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ABSTRACTS

CHARLOTTE M. CHIONG, M.D.
ABSTRACTS EDITOR

This issue of the PJO-HNS feature published articles by fellows of the PSO-HNS as main author or co-author in international journals for 1994-1995. These articles were all subjected to a rigorous peer review. Although the researches resulted from collaboration with international peers during fellowships, it is quite realistic to assume that it will not be long before research done locally will be published in such reputable journals. The residents might benefit from knowing the research experience of their consultants that have been published not only in the PJO-HNS but in other journals as well. These are possible sources of research questions and methods. We therefore invite authors to send in copies of their publications for review in this section.

Margaret C. Lim, Robert M. Taylor, and Robert M. Naclerio. Histology of allergic rhinitis and its comparison to cellular changes in nasal lavage. Am J Respir Crit Care Med 1995; 151:136-44.

To better understand how changes in cells in nasal secretions reflect changes in the nasal mucosa occurring during allergic reactions, we obtained nasal lavage and biopsy specimens from normal (n=11) asymptomatic, seasonally allergic (n=18), and perennially allergic (n=18) subjects. Initial baseline lavages showed that perennially and seasonally allergic subjects, out of their allergy seasons, had significantly higher numbers of eosinophils ($p<0.01$) and neutrophils ($p<0.01$) and total cell counts ($p<0.05$) than normal subjects. Biopsy results showed that at baseline, seasonally allergic subjects had thicker mucosa ($p<0.01$), greater numbers of intraepithelial mononuclear cells and total cell ($p<0.01$), and greater numbers of subepithelial neutrophils ($p<0.001$) than perennially allergic subjects. Twenty-four hours after antigen provocation, nasal lavage of allergic subjects showed an increase in the number of eosinophils ($p<0.05$). Seasonally allergic subjects also had significant increases in numbers of intraepithelial mononuclear cells ($p<0.05$) and total cells ($p<0.01$), and in subepithelial eosinophils ($p<0.001$) and mononuclear cells ($p<0.05$), which were localized to the side challenged. Despite an influx in eosinophils, the epithelial layer was not changed from baseline. The data provide evidence that nasal secretions and the nasal mucosa represent two distinct cellular compartments.

Editor's comment:

The question of whether nasal cytology is representative of tissue histology has fascinated Dr. Margaret Lim even when she was my senior resident at the UP-PGH Medical Center. We had pondered this question and started basic work at that time. She expanded and carried on with this work under the guidance of Dr. Bob Naclerio at Johns Hopkins during a two year fellowship in that institution. This study mainly demonstrated that nasal secretion and nasal mucosa represent distinct compartments with the differing leukocyte populations. In addition, response to antigenic challenge differs in that the predominant cell in nasal lavage is the neutrophil whereas that in the nasal mucosa is the mononuclear cell. As expected, there were significant increases in tissue eosinophils, mononuclear cells and total cell counts at the site of challenge. In seasonally allergic patients the epithelium was thicker with increased intraepithelial mononuclear cells and total cells than either normal subjects or perennially allergic patients. However in contrast to findings in bronchial asthma, there was no epithelial destruction, thickening of basement membrane or subepithelial collagen following antigen exposure.

FM Baroody, BJ Lee, MC Lim, BS Bochner. Implicating Adhesion Molecules in Nasal Allergic Inflammation. Eur Arch Otorhinolaryngol (1995) 252 (Suppl. 1) : S50-S58.

Allergic rhinitis is now considered an inflammatory disorder where many leukocyte types, including eosinophils and T-lymphocytes, accumulate in increased numbers. Along with mast cells and other cells, they release a wide variety of mediators, cytokines, and granule constituents that can directly cause inflammation or activate the local vascular endothelium to further enhance the recruitment of leukocytes through the expression and function of adhesion molecules. While the understanding of the importance of leukocyte and endothelial adhesion molecules is still at a very early stage, recent evidence has already begun to implicate these cell surface molecules in the pathogenesis of allergic diseases such as rhinitis

FUSION, FISSION, FRICTION: THE SOCIETY MUST CARRY ON

An organism can multiply either by fusion or by fission. Such is also true of any organization that would like to achieve growth. The society survived in its initial years when it was mothered by the PAOO which handled all scientific and instructional activities for and in behalf of the specialty. This was, in effect, a fusion with our ophthalmologist brothers. However, when there was already a sufficient number of ENT specialists, the society realized that it could already stand on its own 2 feet and started to handle the affairs of the specialty on its own and dissociating itself from the activities of the academy. With this fission, the society grew by leaps and bounds such that not only was there a growth in members but also an expansion of scope as well. Maxillofacial surgery and head and neck surgery were the natural extensions of the specialty. And this brought friction with other surgical specialties.

Growth brings with it pain & adjustments. There were a lot of ruffled feathers when the society decided to strike out on its own. But organism do adopt to changes in the environment, and so does organizations and strengthened by it after making the proper adjustments. But growth, like progress, is an unstoppable phenomenon that knows no limits until the point of maximal tolerance. That is when it starts to disintegrate and fragment into different parts. And so the cycle continues.

There are many pressure points in the society at present. One is the clamor for the formation of study groups delineated along the different subspecialties of the discipline. This will enhance greater interest in their respective areas of endeavor as well as promote research and greater exchange of information among the members. How would the members of the society consider this – as fusion that further strengths the mother organization, or as fragmentation as it would appear for those with a narrow vision of things?

Another point of concerns is the definite separation of ORL from Ophthalmology in all DOH institutions. If the present rules and regulations of the society and its specialty board will honored. These newly created ORL departments will be orphans not under the wings of any national organization. In the near future they may not qualify as members of the society since they cannot meet present accreditation standards. Will they adopt the necessary changes in order to earn accreditation? Or is the board willing to grant them concessions as that they can be the accommodated under the wings of the society? What will be the predominant process that will govern the specialties' decision on this matter? Will it be fusion or fission? Definitely, there will be friction whatever the society and the board decides on this matter.

Accommodation has been defined by Webster as an adjustment of differences, a reconciliation of parties in dispute. On both issues under consideration, accommodation is the logical conclusion that should be arrived at. In that way, fusion and/or fission would not necessarily be accompanied by friction.

JOSELITO C. JAMIR
Editor-in-Chief

and asthma. Additional studies, including the use of adhesion molecule antagonists when available, will clarify the importance of these structures in the pathophysiology of these disorders.

Editor's comment:

This is an excellent review article that summarizes the current understanding of the pathophysiology of allergic rhinitis in general and focuses on the " potential significance of adhesion molecules in the development and maintenance of allergic inflammatory changes in the upper airways.

Felix P. Nolasco, MD and Robert H. Mathog, MD. Medial orbital wall fractures: Classification and clinical profile. Otolaryngol Head Neck Surg 1995; 112:549-556.

This article reports our experience and proposes a clinical classification regarding medial orbital wall fractures. After a retrospective analysis of 2741 patients with facial fractures, we were able to evaluate 273 patients with 304 medial orbital wall fractures. The male-to-female ratio was 5:1, and most injuries involved the left orbit. Most fractures were caused by personal altercations, but more complex injuries were noted with automobile accidents and falls. Fractures were divided into types based on location and severity of injury: type I (confined to the medial orbital wall), type II (medial orbital wall continuous with floor), type III (medial orbital wall with floor-malar fractures), and type IV (medial orbital wall and complex midfacial injuries). Although visual loss (2%), diplopia (41%), and enophthalmos (12%) were seen, diplopia and enophthalmos were commonly observed with type II injuries. Imaging studies showed that about 52% of the fractures were associated with prolapse of orbital fat, but only 43% could be diagnosed with plain x-rays. Type I fractures were generally explored through a frontoethmoid incision; other types were treated with subcilliary or transconjunctival approaches. The usual treatment consisted of repositioning the fragments and repair of the wall with polyethylene mesh or cranial bone graft. Type I and type II fractures seemed best explained by the hydraulic mechanism of injury, whereas the type III and type IV fractures best fitted the buckling theory.

Editor's Comment :

This study proposes a radiographic classification of medial orbital wall fractures based on CT Scan findings. Interestingly plain x-rays did not yield evidence of prolapse in 57% of cases. Those with Type II fractures (medial wall and orbital floor involvement) were most common and most common and most often resulted in diplopia and enophthalmos. The experience at Wayne State University regarding Medial orbital wall fractures is summarized in this retrospective review. The entity which comprised about 10% of all fracture cases was diagnosed using CT Scan. The use of plain x-rays that detect only 43% of CT-proven medial orbital wall fractures can explain the seemingly low number of cases diagnosed in the local setting. A classification scheme proposed in the study proves to be rationale in terms of the proposed mechanism of injury. Type II fractures were most common and had most symptoms, and were least diagnosed by plain x-rays.

Charlotte M. Chiong, MD, Julian M. Nedzelski, MD, FRCSC, Lynne D. McIlmoyl, and David B. Shipp, MA, Aud(C). Electro-oculographic Findings Pre- and Post-Cochlear Implantation. Journal of Otolaryngology 1994, Vol. 23:447-49.

Vestibular symptoms following cochlear implantation are relatively rare, in spite of well-documented evidence of a significant surviving vestibular neuron population in profoundly deaf individuals. This report details the electro-oculographic (EOG) findings before and after insertion of the Nucleus 22-channel cochlear implant in 25 adults. These findings are correlated with the clinical course of these patients.

Editor's comment:

The effect of cochlear implantation on the vestibular system is an interesting subject. As a fellow at the Massachusetts Eye and Ear Infirmary I investigated the survival of vestibular neurons in the profoundly deaf subjects (Annals of Otol Rhinol Laryngol, June 1993). It was found that there remains a substantial number of the neuronal population which stands at risk of further injury by cochlear implantation. This study however revealed that the vestibular function as reflected in electro-oculographic studies was not significantly affected.

EC Yap-Legaspi, M. Nozaki, M Takeuchi. The contribution of perivascular tissue to the neovascularization of full thickness skin grafts (prefabricated flaps): an experimental study. British Journal of Plastic Surgery 1995, 48:89-92.

The effect of varying amounts of perivascular tissue on the neovascularization of full thickness skin grafts (prefabricated flaps) in rats was investigated. The femoral vasculature of adult Wistar rats (n=48) was dissected to varying degrees: Group I, perivascular areolar tissue and periadventitial tissue preserved; Group 2, perivascular areolar tissue removed, periadventitial tissue preserved; Group 3, femoral artery and vein skeletonized. Full thickness skin grafts harvested from the abdomen were

laid on the femoral vessels. Silicone sheets were used to isolate the graft and its vascular supply from the surrounding tissue bed. At set time, from 24 h to 7 days, grafts from each group were harvested and the amount of neovascularization was evaluated histologically. None of the grafts developed necrosis and all of them showed a progressive degree of neovascularization. Using chi-square analysis, our study found no evidence that varying the amount of perivascular tissue significantly improved over time (p=0.002).
Editor's Comment :

This is an experimental study that looks at the contribution of perivascular tissue to neovascularization of full thickness skin graft. This study done on rats assessed neovascularization by the amount of carbon seen in the graft at 24, 48, and 72 hours and at 7 days seen in the graft at 24, 48, and 72 hours respectively mild neovascularization was seen where carbon was limited to the lower half of the dermis; moderate where carbon is seen through the entire thickness of the dermis above the femoral vessels; and profuse where carbon even beyond the area above the vessels. The best results were obtained when periareolar tissue was removed and periadventitial tissue preserved. While this did not reach statistical significance there was no advantage to either of the three groups mentioned.

Julian M. Nedzelski, MD, FRCS (C), Charlotte M. Chiong, MD, Marlene Z. Cashman, MD, Susan G. Stanton, MS and David W. Rowed, MD, FRCS (C). Hearing Preservation in Acoustic Neuroma Surgery. Otolaryngol Head Neck Surg 1994, 111:703-9.

This study reviews the hearing results in 80 consecutive patients who underwent complete removal of histologically proven acoustic neuromas by use of the suboccipital approach. Of these, 56 patients had successful monitoring of cochlear compound action potentials; 20 were not monitored because their surgery predated monitoring; and 4 had unsuccessful monitoring. A significant difference was found in hearing preservation rates between the group in whom compound action potential monitoring was performed and those in whom monitoring was either unavailable or failed (p=0.02). Overall, 38% (30 of 80) had preserved hearing. There were 51 patients in whom the click threshold for the cochlear compound action potential was measured during surgery. Twenty-one patients had a threshold shift of 20 dB or less, 15 (71%) of these retained serviceable hearing (speech reception threshold < 50 db; speech discrimination score 60%). Of 12 patients in whom the threshold shift was 30 to 60 dB, none had serviceable hearing after surgery. The click threshold shift was predictive of a significant postoperative hearing change (p<0.001).

Editor's comment:

This reflects the experience in hearing preservation surgery at the University of Toronto Sunnybrook Health Science Center and proves the benefits of intraoperative monitoring of hearing . It is interesting to note that this study provides a significant parameter by which success at hearing preservation can be predicted. The click threshold shift has heretofore not been looked at as a predictive parameter in previous studies on intraoperative cochlear nerve monitoring. There are other factors that impact on successful hearing preservation such as preoperative hearing status, age , sex and tumor characteristics such as size, vascularity and lateral extent into the fundus of the internal auditory canal. Microsurgical removal of acoustic neuroma or even vestibular neurectomy have been aided by the real time information provided for by intraoperative monitoring of cochlear compound action potentials.

ANATOMICAL DIMENSIONS OF THE ADULT FILIPINO LARYNX: A STUDY BASED ON CADAVER DISSECTIONS

ROMEO D. ASA, M.D.**
EMMANUEL S. SAMSON, M.D.***
EDGARDO C. RODRIGUEZ, M.D.***

ABSTRACT

This report is an investigation of the different dimensions of the adult Filipino larynx based on dissection of fresh cadaver specimens done at the time autopsy. This study included actual measurements of the different parts of 35 fresh cadaver larynges (20 males, 15 females) aided by caliper and loupe lens. Data gathered was compared with Caucasian figures found in standard anatomy textbooks and journal articles. This study gives baseline anatomic values for Filipinos and showed that Caucasian values do not reflect those of Filipinos. This study proves that a separate and more applicable set of standards of measurements for Filipinos is needed for future references in research studies and for surgeons performing laryngeal surgery and endoscopy.

INTRODUCTION

So much has been written about the anatomy of the larynx that every student of laryngology can find volumes of literature on one subject with detailed precision. The majority of them however, are authored by westerm researchers, so that data on record is of foreign standards.

In any type of surgery, precision and detailed planning is paramount, and knowledge of anatomy is foremost. Surgical innovations and modifications as well as instrument designs are largely based on this principles. Although laryngeal anatomy has been documented in great detail, actual dimensions of its diffe-rent parts are seldom available. This information is based on caucasian standards and may not be applicable to a large extent on Filipino subjects. Since Filipino are considered to be anthropometrically smaller than their Caucasian counterparts, differences dimensions are too be expected. It is on this premise that a separate set of standards on the dimensions of the larynx based on Filipino specimens should be made. The authors believe that the results of this study, how-ever limited, will be an invaluable guide for future research studies and surgical innovations in the field of laryngology.

OBJECTIVE OF THE STUDY

To establish baseline ana-tomical values in Filipinos as possible guide in future research studies and laryngeal surgeries.

RESEARCH MATERIALS & METHODOLOGY

Thirty five fresh adult Filipinos cadaverr, both male and female, age range from 25-52 yrs (36.2), from a government hospital were used in the study. Medical records were reviewed and revealed no diseases involving the larynx. Actual measurements were done during autopsy using a caliper and aided with loupe lens. Resulting data was duly recorded.

Parameters used in the study:

1. **Total length** - from the tip of the epiglottis to the inferior border of the cricoid cartilage.
2. **Supraglottis (SpG)** - from the tip of the epiglottis to the free border of the true vocal cords
3. **Glottis (Glo)** - from the free border of the true vocal cords to about five millimeters below
4. **Subglottis (SbG)** - from the horizontal plane five millimeters below the superior margin of the true vocal cords to the inferior border of the cricoid cartilage
5. **Length of the Rima glottidis (RG)** - from the anterior commisure to the posterior commisure
6. **Thyroid Cartilage**
   a. **Height (HTA)** - from the superior thyroid notch to the anteroinferior border
   b. **Anteroposterior diameter (DTU)** - diameter of the thyroid lamina at the level of the superior thyroid notch

2ND PRIZE, PSO-HNS CONTEST
** RESIDENTS, DEPT. OF ENT, OSPITAL NG MAYNILA
*** CONSULTANTS, DEPT. OF ENT, OSPITAL NG MAYNILA

(DTM) - diameter of the thyroid lamina at level of the midpoint between the superior thyroid notch and the antero-inferior border

(DTI) - diameter of the thyroid lamina at the level of the anteroinferior border

7. Cricoid Cartilage

a. Height (HA) - anterior height of the cricoid cartilage
(HP) - height of the cricoid lamina
(DAP) - anteroposterior diameter
(DT) - transverse diameter

8. Arytenoid Cartilage

a. (AV) - distance from the apex to the vocal process
b. (AM) - distance from the apex to the muscular process
c. (VMS) - distance from the vocal process to the muscular process

RESULTS

I. LARYNX

	total length	SpG	SbG	RG
MALE				
MEAN	59.80	38.8	15.6	18.55
SD	4.149	3.94	1.14	1.60
sample size	20	20	20	20
FEMALE				
Mean	54.47	34.47	13.6	12.73
SD	1.81	1.36	0.99	1.065
sample size	15	15	15	15

note: all figures appearing below are measured in millimeters except for sample size
Glottic measurement was fixed at five millimeters

DISCUSSION

Fresh adult Filipino lar-ynges were grouped according to their sex distribution and the corresponding parameters were measured. Comparisons with the existing values from standard textbooks and journal reports were done against the dimensions obtained based on actual cadaver dissections. Results of this study revealed data on local specimens were significantly lower, confirming the contention of the authors that established measurements of the larynx known thru the years does not necessarily apply to Filipino subjects.

A. THYROID CARTILAGE

Examination of the thyroid cartilage showed obvious sex differences in all parameters measured. Male specimens clearly exceed female specimens and show greater variability. Anterior height of the thyroid lamina averaged 19.6 mm in males, while female specimen averaged 15.67 mm. Of all the parameters measured, the anteroposterior diameter (HTM) of the lamina showed the greatest variability.

Comparison with existing Caucasian figures revealed local measurements to be relatively smaller in both sexes. Maue and Dickson (1971) reported averages of 37.17mm and 26.04mm for male and females respectively. Variation in samples were similar in this studies. Other parameters exhibited higher figures than these findings but to a lesser degree. The comparative values of the parameters were subjected to tests which indicate that there is significant difference in the re-sults tested.

B. CRICOID CARTILAGE

Four dimensions were mea-sured in the cricoid cartilage, namely: anterior height (HA), height if the lamina (HP), anteroposterior diameter (DAP), and transverse diameter (DT). Sex differences were again noted with male specimens showing higher values in all parameters mea-sured. Measurements for the height of the cricoid lamina showed the greatest difference in size as well as variability of the result.

Caucasian dimensions of the cartilage exhibited slightly higher figures. The greatest dif-ference in measurement were noted in the male transverse diameter (DT) with a mean average of 22.40mm which is about 22% greater. Statistical analysis (test) of the parameters indicate a significant difference.

C. ARYTENOID CARTILAGE

Results of the measurement done on the arytenoid cartilage showed a slightly higher value in male specimens. The distances between the apex to the vocal process and from the apex to the muscular process appear similar and tended to be slightly greater than the distance from the vocal process to the muscular process. Variations for both sexes are similar and are minimal.

Data collected by Maue and Dickson (1971) gave similar results with respect to the parameters measured. Differences in dimensions were less than 1mm and variability are similar. There is no significant dif-ference found on testing the comparative figures.

D. LARYNX

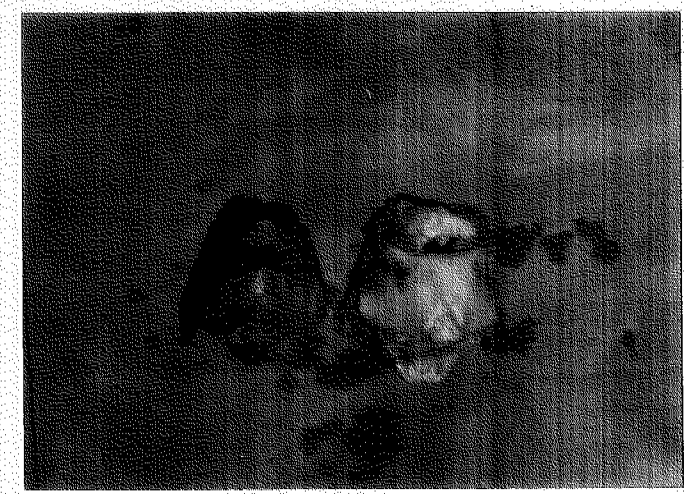
The distance from the tip of the epiglottis to the inferior border of the cricoid cartilage (TL) has an average of 59.8mm for males and 54.47mm for female specimens. Variations in actual measurements were greater in the male population (SD+/-4.149). Supraglottic and subglottic areas were also measured. Glottic measurements were fixed at 5mm for males and 4 mm for females. Data collected showed a greater male supraglottic length with an average of 38.8 mm and much more variable than the female popu-lation. Subglottic measurements for both sexes were much closer as well as their corresponding variability. Measurements for the length of the rima glottidis were made and revealed a significantly higher value for the male group. Female figures were 30%-32% smaller in length.

Laryngeal textbooks pre-sented average measurements of these parameters which showed greater values. The total length of the larynx in this study were about 25% shorter compared to published standards. Supraglottic length was likewise smaller representing only about 70% of the average of the Caucasian figures. Other measurements inc-lude distance from the superior border of the rue vocal cords to the inferior border of the cricoid cartilage and average values for the rima glottidis in Caucasians listed as an average of 23 mm for males and 16 mm in females is about 20% longer on the average. Variations in sizes were noted to be minimal. There was a great difference in the measurements as shown by the statistical analysis result on all parameters.

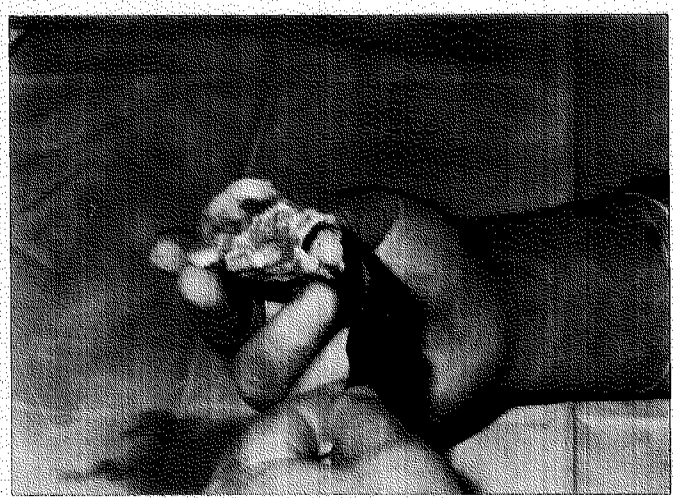
CONCLUSION

The development of whole-organ serial sectioning technique by Tucker in 1961 paved the way for accurate information on the ligamentous, cartilaginous and mucosal relationships within the larynx as well as connective tissue compartment on which much of modern conservation laryngeal surgery are based on. Accuracy in the real sense implies precision and carries with it a sense of applicability. With this concept in mind the authors believe a set of standards based on actual local specimens should be estab-lished if only to provide a more accurate and, therefore, appli-cable laryngeal dimensions for the Filipino patient.

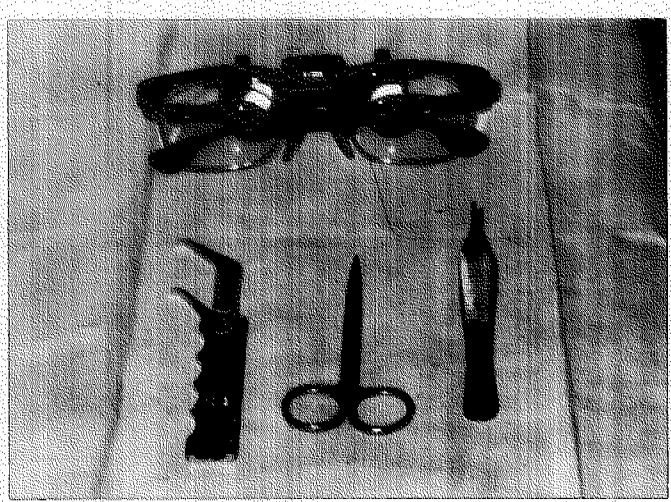
Results of this local study prove that there actually exists a significant variation on the dimensions of the Filipino larynx against established reports based on Caucasian standards. Such observations may prove clinically significant particulary with designing and shaping of prosthesis in thryroplasty and as a possible preoperative guide for the anesthetist in selecting the proper tube size during rigid bronchoscopy procedures.



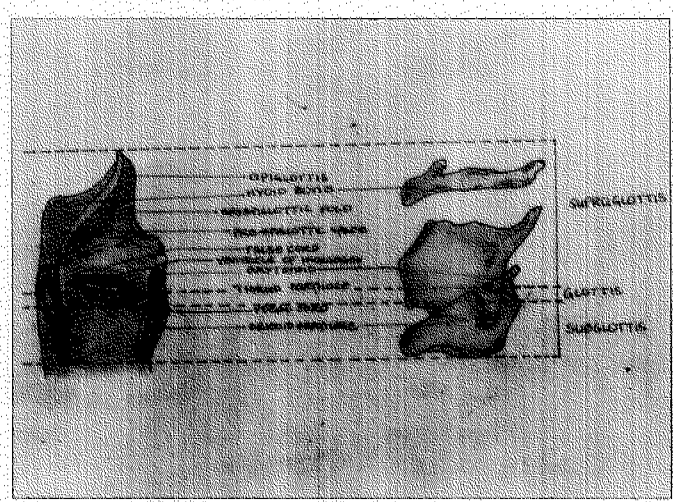
SAMPLE OF ADULT CADAVER



MEASUREMENT OF THE TOTAL LENGTH OF THE LARYNX

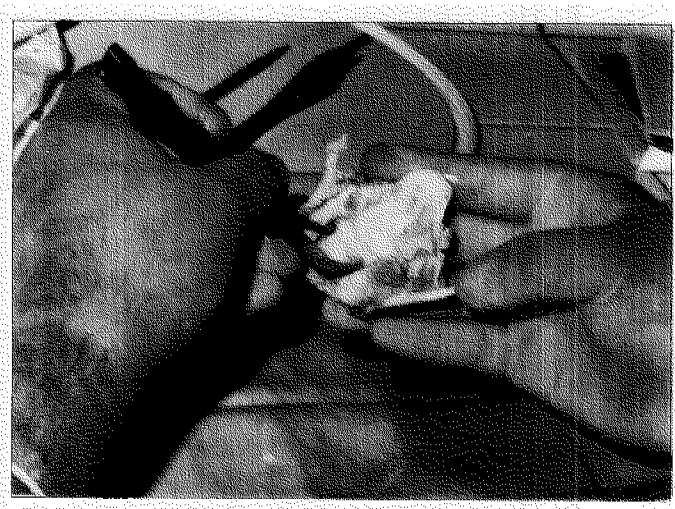


INSTRUMENTS USED IN THE STUDY

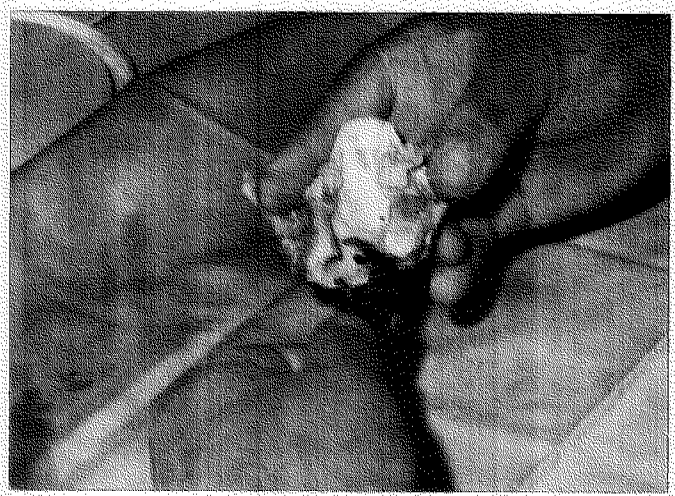


MEASUREMENT OF THE SUPRAGLOTTIC REGION

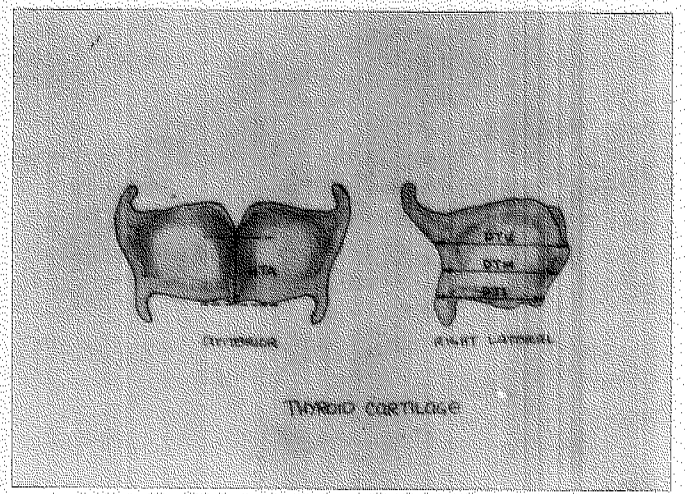
DETERMINATION OF THE GLOTTIC REGION



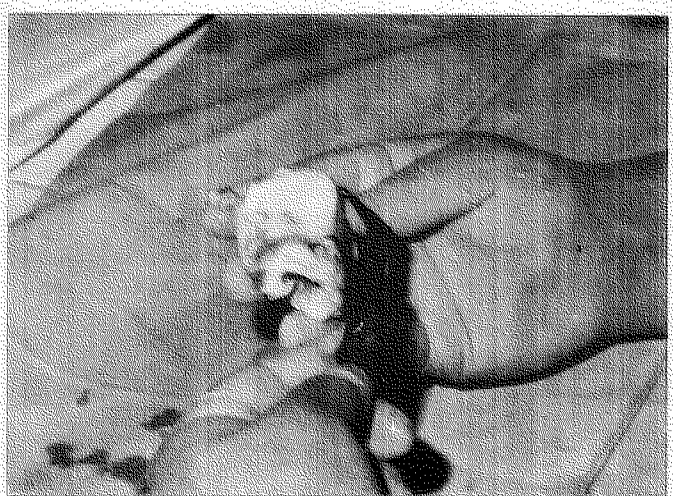
MEASUREMENT OF THE RIMA GLOTTIDIS



MEASUREMENT OF THE SUBGLOTTIC REGION

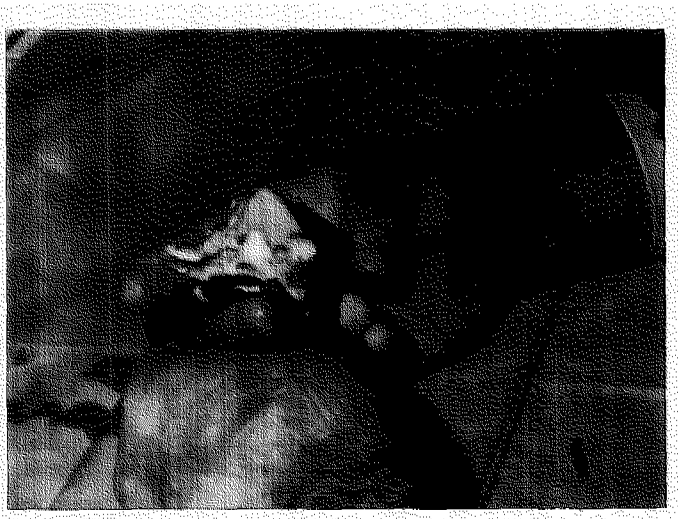


THYROID CARTILAGE



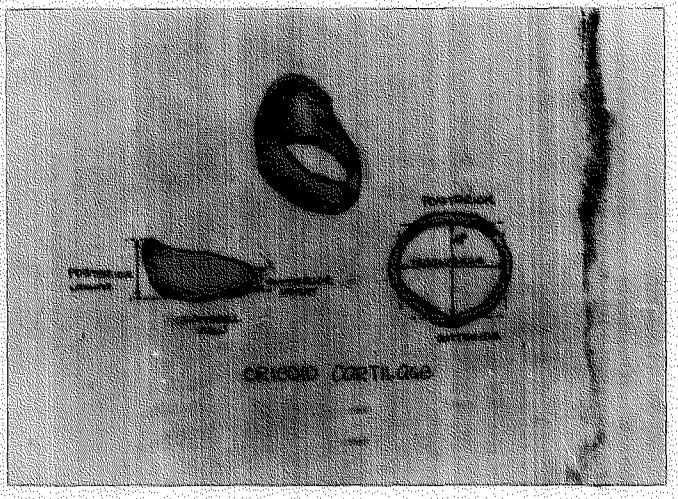
RIMA GLOTTIDIS

MEASUREMENT OF THE ANTERIOR HEIGHT OF THYROID LAMINA



MEASUREMENT OF THE ANTEROPOSTERIOR DIAMETER OF LAMINA

MEASUREMENT OF THE CRICOID LAMINA

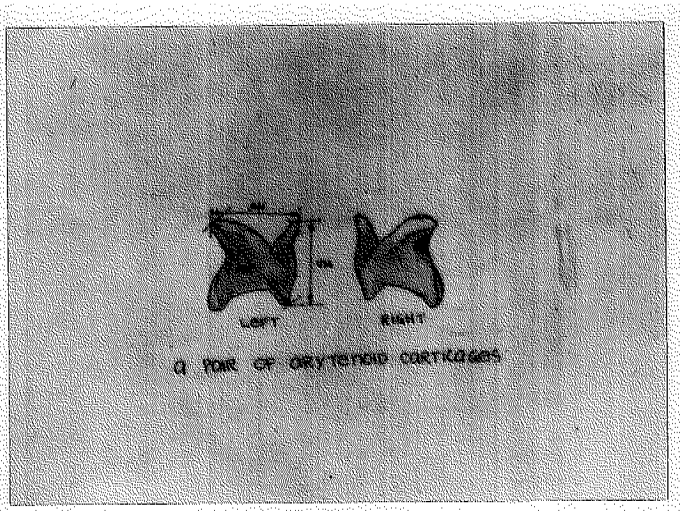


CRICOID CARTILAGE

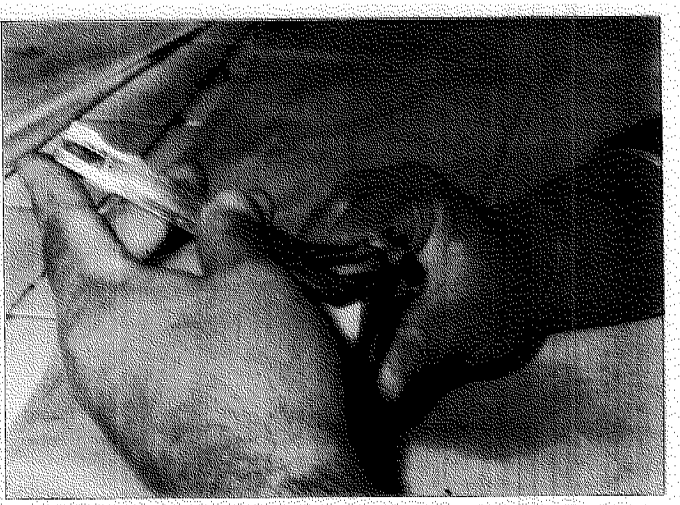
MEASUREMENT OF THE ANTEROPOSTERIOR DIAMETER

MEASUREMENT OF ANTERIOR HEAIGHT OF THE CRICOID

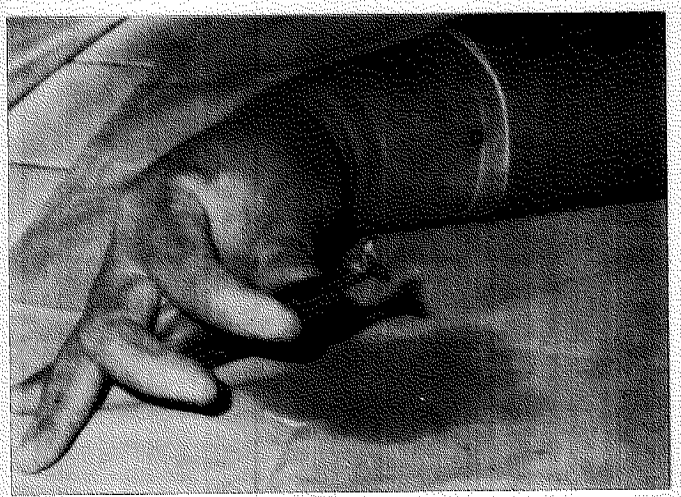
MEASUREMENT OF THE TRANSVERSE DIAMETER



A PAIR OF ARYTENOID CARTILAGES



DISTANCE BETWEEN THE APEX AND THE MUSCULAR PROCESS



SAMPLE OF THE ARYTENOID CARTILAGE

DISTANCE BETWEEN VOCAL PROCESS TO MUSCULAR PROCESS

DISTANCE BETWEEN THE APEX AND THE VOCAL PROCESS

ANATOMICAL DIMENSIONS...

II. THYROID CARTILAGE

	HTA	HTI	DTU	DTM	DTI
MALE					
Mean	19.6	29.92	37.3	33.75	31.50
SD	1.536	2.186	2.408	2.446	2.438
sample size	20	20	20	20	20
FEMALE					
Mean	15.67	21.07	32.8	29.13	27.87
SD	0.989	1.330	1.146	1.061	1.969
sample size	15	15	15	15	15

note: all figures appearing above are measured in millimeters except for sample size

III. CRICOID CARTILAGE

	HA	HP	DAP	DT
MALE				
Mean	6.5			
SD		1.190		
sample size	20	20	20	20
FEMALE				
Mean				
SD				
sample size				

note: all figures appearing above are measured in millimeters except for sample size

IV. ARYTENOID CARTILAGE

	AV	AM	VM
MALE			
Mean	17.60	18.05	14.24
SD	0.924	0.899	0.969
sample size	20	20	20

note: all figures appearing above are measured in millimeters except for sample size

V.	Foreign Data	Local Study	t test (0.01)
1. total length	80 mm	60 mm	21.77
2. supraglottic area	50 mm	38-40 mm	11.38
3. glottic-subglottic area	30 mm	20-22 mm	10.42
5. thyroid cartilage			
a. anterior height (HA)			
male	37.5 mm	19. mm	6.576
female	26.04 mm	15.67 mm	3.108
b. anteroposterior length			
male	36.99 mm	33.75 mm	3.094
female	29.11 mm	29.13 mm	0.011
6. Cricoid cartilage			
a. anterior height (HA)	5-7 mm	4-6 mm	38.99
b. height of cricoid lamina	30 mm	17-20 mm	11.55
c. anteroposterior diameter	16 mm	14.5 mm	3.694
d. transverse diameter	16-22.5	15-17.35mm	3.00
7. Arytenoid cartilage			
a. apex to vocal process (AV)	8 mm	17.60 mm	NS
b. apex to muscular process (AM)	8.5 mm	18 mm	NS
c. vocal process to muscular process (VM)	14 mm	14.24 mm	NS

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TUBED PECTORALIS MAJOR MYOCUTANEOUS FLAP FOR RECONSTRUCTION OF CIRCUMFERENTIAL DEFECTS OF THE PHARYNGOESOPHAGUS: REVISITED

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ABSTRACT

The historical perspective of the use of the pectoralis major myocutaneous flap for reconstruction after resection of the pharyngolarynx and cervical esophagus for cancer is discussed and reasons for the preferred use of this flap over cervical skin flaps and visceral grafts is given. Problems like stenosis and fistula formation which are quite common in this type of reconstruction are addressed by som e modification in the technique and design of the flap in the proximal and idstal anastomotic site. An ongoing study to determine the adequate width of the skin paddle to be harvested in order to have an adequate lumen postoperatively after wound healing and radiotherapy is likewise presented.

INTRODUCTION

Reconstruction of defects of the pharyngoesophagus after resection for cancer has been one of the most difficult challenges for the head and neck surgeon. The defects include those following resection for cancer of the pharynglarynx including advanced laryngeal lesions involving the pyriform sinus. The defect may be partially or totally circumferential without the larynx. As a result, various methods have been used to reconstruct the cervical esophagus and hypopharynx. Methods of reconstruction of these defects have included the tubed pectoralis major myocutaneous flap, deltopectoral flap, cervical skin flpas, jejunal free flaps, stomach and colon, each having its own advantages and disadvantages.

Ariyan proposed the use of the pectoralis major myocutaneous flap for major head and neck reconstruction. ***Mathes*** and ***Nafiai*** noted that identification of the vascular pedicle to muscle and overlying skin territories allowed the myocutaneous flaps to expand the ability of the head and neck surgeon to reconstruct immediately defects such as the pharyngoesophagus. The pectoralis major myocutaneous flap has become the most common regional flap for this type of reconstruction done by the E.N.T.-Head and Neck Surgeon.

This paper aims to present a surgical procedure totally dependent on the skill of the E.N.T. - Head and Neck Surgeon; to present an immediate reconstruction of pharyngoesophageal defects without violation of the thorax and abdomen ; tp present a safe, less time consuming and less technically demanding alternative surgical procedure to visceral transfer; to present a method of reconstruction when visceral transfer is contraindicated; and to present a technique for decreasing the incidence of stenosis.

CASE

A 60 year old male presented in a January 1994 with a four month history of dysphagia to solif foods which eventually progressed to liquids. The patient developed hoarseness 3 months PTA and a firm, non tender thumbsized left lateral neck mass. Two months PTA, there was difficulty of breathing not related to physical exertion, weight loss and body weakness. Due to the progession of the above symptoms, the patient was brought to this institution and was admitted.

Upon admission, the patient was severely dyspneic necessitating an emergency tracheostomy was done. While at the O.R., triple endoscopy with biopsy was also performed which revealed a fungating mass occupying the entire left false vocal cords, left true vocal cords, left aryepiglottic fold and the left arytenoids with extension to the entire circumference of the left pyriform sinus. The post cricoid area and posterior pharyngeal wall was also involved (fig. 1). A 3x3 cm. left lateral neck mass was likewise noted. Biopsy done revelaed findings consistent with squamous cell carcinoma. Chest X-ray showed hyperaerated ling foelds with fibrotic densities on upper both lobes. Pulmonary service gave a diagnosis of COPD Emphysema. CBC, EKG, FBS, BUN, CREA determinations done were within normal limits. An impression of hypopharygeal carcinoma stage III (T3N1Mx) was given and the surgical plan was to do a RND opn the left, total laryngopharyngectomy with cervical esophagectomy. Immediate reconstruction was planned with the use of the tubed pectoralis major myocutaneous flap.

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OPERATIVE TECHNIQUE:

Following surgical resection of tumor with adequate margins, the length of the defect was measured. The course of the pectoral branch of the thoracoacromial artery was also delineated by drawing a line from the shoulder tip to the xiphoid process and a second line from the midportion of the clavicle at right angles to the first line (fig. 2). The width of the paddle to be harvested was determined based on the projected end stage diameter and percentage allownce for a decrease in the circumference after wound healing and radiotherapy. Below is a table showing the projected end stage tube diameter and percentage allowances.

FIG.1 FIG.2

	Projected End stage diameter	Projected End stage circum.	% allowance in circum.	Paddle width to be harvested
A.	**2 cms.**	**6.28 cms**	**20%**	**7.5 cms.**
	30%	8.0 cms		
	40%	9.0 cms.		
	50%	9.5 cms.		
B.	**2.5 cms.**	**7.85 cms**	**20%**	**9.5 cms.**
	30%	10.0 cms.		
	40%	11.0 cms		
	50%	12.0 cms.		

By using the formula C=2Πd wherein C is the projected end stage circumference, and Π=3.14, the paddle width to be harvested allowing for 30% decrease in the circumference to 6.28 or a diameter of 2, the projected end stage diameter which will produce adequate passage of food could be determined with this formula:

Paddle Width
= Projected End Stage Circum. X (1 + .3)

Paddle Width
= 6.8 X (1 + .3)
= 8.1 cms. or 8.0 cms.

Therefore the width of the skin paddle should be at least 8.0 cms. in order to have a 30% allowance for a reduction in the circumference to 2 cms. After drawing the porpesed skin island, a scalloped incision was made at the inferior edge of the flap. A skin incision was then made around the skin island up to the pectoralis facia. The skin edges were tucked to the immediate underlying muscle to prevent separation, retraction of the skin and avulsion of vessels from the muscle. Careful undermining of the subcutaneous tissues medially and laterally was done. The pectoralis major muscle was now lifted from the underlying pectoralis minor muscle after identifying the pectoral branch of the thoracoacromial artery and transposed (fig.3). The inferior pole of the skin paddle was sutured supreriorly around the pharynx except anteriorly at the tongue base. Closure anteriorly was modified with the use of the tongue flap to further increase the diameter of the inlet and reduce stricture formation (fig.4). The scalloped incision done previously served the same purpose. The inferior anastomosis of the tube with the esophagus was done by fashioning a 4 cm. long S shape inncision 1.5 cms. from the superior border of the skin paddle (fig.5). The 4 cm. long incision gave a circumference of 8 cms., the same as the tube circumference. The S configuration was done to minimize formation of stenosis. The esophagus was anastomosed in an end to side anastomosis. After suturing the esophagus with simple interrupted suture to the S shaped incision, longitudinal suturing of the tube is done with a ***Connel*** type of stich. The inferior border of the tube was left open over the skin inferior and lateral to the tracheostomy site as a controled fistula to prevent soiling the tracheostome. The longitudinal suture line was anchored to the side where a RND was not done to prevent fistula formation. After 16 days, the controlled fistula was closed in layers.

Four weeks post operatively, patient was subjected to radiotherapy.

RESULTS

Feeding per os was started on the 28th post-op day initially with liquids, then gradually shifted within a week to solides. There was no evidence of fistula formation, regurgitation of food or dysphagia. After 2,400 Rads, a barium swallow under video fluoroscopy was done. This revealed a good unobstructed passage of dye (see video). A flexible esophagoscopy with video and CT scan were also done and a lumen of adequate size without stenosis nor flap necrosis was seen. The patient was discharged on the 34th post-op day.

DISCUSSION

The physiologic requirement for reconstruction of circumferential defects resulting from surgery of pharyngoesophageal cancer is to establish a conduit for the passage of food from the pharynx with gravity as the principal driving force into the remaining portion of the upper gastrointestinal tract. The tubed pectoralis major myocutaneous flap fulfills the above requirement which solely relies on the skill of the ENT-Head and Neck Surgeon. It uses tissue taken outside the metastatic area in the neck and outside the radiation fields. An incidental value concerns the protection that its muscle elements provides for the carotids if post-op radiotherapy is planned. Viability is superior because of its storng blood supply. One stage reconstruction or a two stage reconstruction is possible and the controlled fistula can be placed lower and lateral from the tracheostomy,

avoiding soiling of the tracheostome. The only limitation is related to bulk but this problem could be solved by incorporation of random dsegments of skin with the pectoralis muscle and skin grafting of the pectoralis muscle.

Visceral tabsfer is also one of the popular methods for reconstruction of circumferential defects of the pharyngoesophagus. However, this requires a multi-team approach: ENT-Head and Neck surgeon and General Surgeon. There is a need for a team with expertise inharvesting visceral grafts from the abdomen. Often, this may not at all be possible in the rural areas and some centers. The visceral harvest requires a more extensive surgical procedure which involves invasion of the abdomen or abdomen and thorax in cases of pharyngogastric anastomosis.

In many patients with carcinoma of the hypopharynx, some degree of nutritional, pulmonary and cardiovascular compromise is expected and they may not be fit for this procedure. This must be considered in the light of reported rates of postoperative complications in the chest and abdomen (table 1&2). Visceral transfer is contraindicated in patients with chronic bowel disease like Crohn's disease, patients with perforated peptic ulcers and patients who have undergone extensive bowel surgery. Patients with this type of rconstruction are also predisposed to gastrointestinal complications such as dumping syndrome and regurgiatation of gastric contents into the mouth. Likewise, the tubed pectoralis major myocutaneous flap has a lower mortality rate than visceral grafts and flap survival is superior owing to its strong vascular supply (table 3&4). Swallowing function with tubed pectoralis major myocutaneous flap is also comparable to that achieved by the visceral grafts (table 5&6). However, the hospittal stay is shorter and swallowing function is achieved earlier by visceral grafts.

CONCLUSION

In a setting where expertise in harvesting visceral grafts is not available, or when an ENT-Head and Neck Surgeon is left alone to do reconstruction of the pharyngoesophagus, the tubed pectoralis major myocutaneous flap is one good alternative method of immediate reconstruction. Morbi-dity and mortality rate is lower compared to the more invasive and extensive surgical procedure like visceral transfer. It satisfactorily fulfills the basic requirement ofp pharyngoesophageal reconstruction to adequately deliver food to the rest of the gastrointestinal tract. It seems that the keystone to the success of pharygnocervical reconstruction depends on the design of suturing the anastomosis (Scaloped and S-shaped), positioning of the longitudinal suture line to the side where a RND was not done, proper positioning of the controlled fistula and the type, reliability and viability of the flap used. For the ENT-Head and Neck Surgeon, this type of reconstruction should always be part of one's armamentarium.

TABLE 1
Hospital Deaths After Gastric "Pull-up"

Operative death (aortic stenosis)	1
Pulmonary cause	
Embolism	1
Bronchopneumonia	1
Respiratory distress syn.	2
Cardiovascular	
Myocardial infarction	3
Hypotension	2
Acute pancreatitis	1
Mesenteric thrombosis	1
Diabetic gangrene	1
Graft necrosis	1
	14/134(10.4%)

*From **Harrison D.** Use of Stomach and Colon for reconstruction of Pharyngoesophageal region.Head and NeckCancer 1990*

TABLE 2
Abdominal Complications After Free Jejunal Transfer

Abdominal wound dehiscence	10
Bowel obstruction	7
Gastrointestinal hemorrhage	5
G-Tube leak	2
Prolonged ileus	2
Intussusception	1
Abscess	1
Acute gastric dilation	1
Mallary-Weiss syndrome	1
Superior mesenteric syndrome	1
Abdominal wall hematoma	1
	32/555(5.8%)

TABLE 3
Immediate Postoperative Problems

	Tubed Pectoralis Major Flap	**Pharyngogastric** Anastomosis
No. of pts. in group	18	43
Salivary fistula	7	3
Flap necrosis	0	0
Wound infection	5	2
Hospitalmorality	0	3

From ***Lam KH, Ha CM, Wei WI, Wong J.*** Immediate reconstruction of pharyngeal defects-preference or reference. Arch Otolaryngology Head & Neck Surgery 1989. May:608-612. Copyright 1989 American Medical Association.

TABLE 4
Review of Literature:
Complications with Free Jejunal Autograft

No.oc cases	Mortality	Fistula	Stricture	Graft Loss
347	3.5%	10.6%	5.5%	11.5%

TABLE 5.
Postoperative Function

	Tubed Pectoralis Major Flap	Pharyngogastric Anastomosis
No.of patients (including hosp. mortality)	17	4
Swallowing functionable to take		
Solid diet	12(71%)	25(63%)
Soft diet	4(24%)	13(33%)
Liquid only	1	2

From ***Lam KH, Ha CM, Wei WI Wong J.*** Immediate reconstruction of pharyngeal defects preference or reference.Arch Otolaryngology Head & Neck & Surgery.1989 May:608-612. Copyright 1989 American Medical Association.

TABLE 6.
Review of the Literature:
Functional Results After Jejunal Transplantation

Author	no. of pts. grafts	no.circumferential grafts	no. patch able to swallow	no.pts.
Shusterman et al.	48	50	0	42
Fisher et al.	47	51	0	32
Coleman et al.	101	111	0	83
Flyn et al.	35	35	0	26
Shumrick & Savoury	65	65	0	58
Ferguson & De Santo	18	18	0	17
Salamoun et al.	32	32	0	26
Deane et al.	17	17	0	13
Biel & Maisel	17	18	0	12
Theil et al.	72	74	0	-
Wang et al.	10	10	0	-
Nozaki et al.	29	29	0	-
Chang et al.	20	18	2	-
Berger et al.	40	11	29	-
Reuther et al.	30	0	30	-
Kato et al.	11	11	0	11
Robinson & Mac Lead	37	21	16	-
Mckee & Peters	11	11	0	9
Nakamura et al.	13	13	0	-
TOTALS	653	595	77	329/402=81.8%

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MODIFIED NASOLABIAL FLAP TO THE ANTERIOR FLOOR OF THE MOUTH

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ABSTRACT

The use of the nasolabial flap to reconstruct defects in the floor of the mouth has been previously described as an axial flap and done in a two-stage procedure.

This paper focuses on a modification of the usual procedure using the nasolabial flap as a random flap done in a one-stage procedure.

The advantages of this modification are discussed.

INTRODUCTION

Human beings are possessed with a compelling drive to reconstruct and cover defects in the body. This desire has been the prime impetus in the development and continuing progress in the filed of flap reconstruction. The wondrous qualities of human skin have not ceased to yield to the intellect and imagination of surgeons throughout the years up to the present.

The focus of this paper is the use of nasolabial flaps to the anterior floor of the mouth. It is recognized that the functional integrity of the anterior floor of the mouth is very important in maintaining tongue mobility-vital for normality of articulation, deglutition, and disposal of saliva.

For small defects in the said area, the nasolabial flap has been shown to be an effective method of reconstruction. This involves an inferiorly0based nasolabial flap to cover the defect in the anterior floor of the mouth. This technique has traditionally been described as a two-stage one. It is the aim of this paper to present a modification of this nasolabial island flap done as a one-stage random flap reconstruction.

MATERIALS

The nasolabial flap has been used in eight cases. As represented by the following case report.

A 65 year old male, farmer from Roxas City who consulting for limitation of tongue mobility was diagnosed to have squamous cell carcinoma, moderately-differentiated, floor of the mouth, Stage IV (T4, N2c, Mx). He underwent en bloc tumor resection in a combined wide excision of the floor of themouth, partial glossectomy and anterior marginal mandibulectomy (Fig. 1).Radicalneck dissection on the left and modified neck dissection on the right were also done. A left pectoralis major myocutaneous flap was used to reconstruct the surgical defect.

The post-operative course was unremarkable until the 13th post-op day when wound dehiscence was noted. Followed by formation of an oro-cutaneous fistula from the anterior floor of the mouth measuring 2x2 1/2 cms. The patient was thus assessed to be a good candidate for closure of the fistula using the modified nasolabial island flap reconstruction technique.

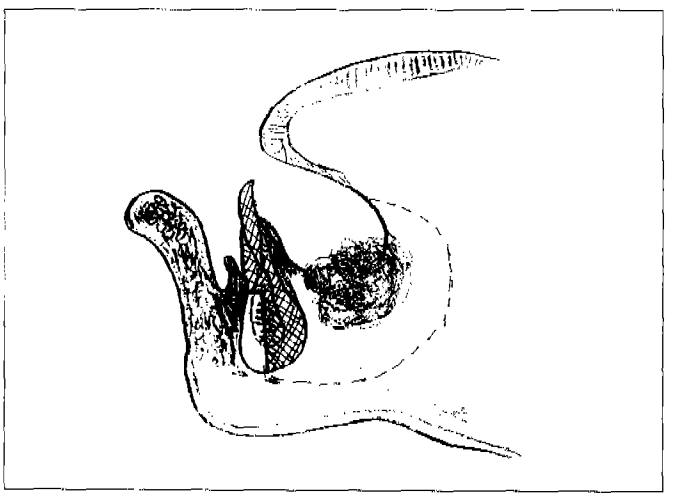

FIG. 1 - SAGITTAL VIEW OF FLOOR OF THE MOUTH WITH THE TUMOR. CROSS-HATCHED AREA REPRESENTING THE MARGINAL RESECTION OF THE MANDIBLE

METHODS OF REPAIR

In its underlying concept, the previously axial nasolabial flap relying on the facial vessels as its main blood supply has now been modified to become a random flap relying on the vascula cutaneous dermal layer.

With regards to the technique, the usual procedure entails closure of the defect using a nasolabial with its skin pedicle infolded along its base and left unsutured to avoid stangulation of the flap. This makes it a two-

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stage procedure because the skin-lined pedicle flap has to be amputated two later for complete closure of the flap donor defect (fig. 2). Previous authors have claimed that amputation of the skin pedicle has to be delayed because thisflap is used mostly in patients with cancer of the anterior floor of the mouth undergoing neck dissection. Most of the time, the main blood supply of the nasolabial flap, the facial vessels are disrupted during neck dissection. It has been proven that the survival flap can survive by relying on its dermal subcutaneous pedicled flap used as one-stage random flap.

In this modification, undermining is done both dermally and subcutaneously. Proper care should be

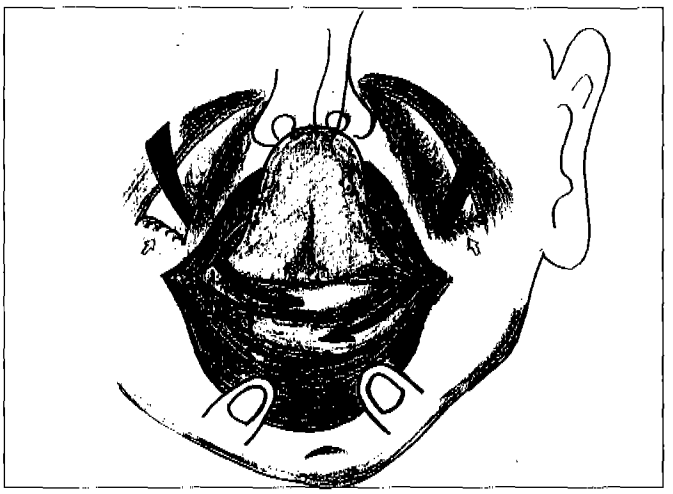

FIG. 2 - TWO-STAGE BILATERAL NASOLABIAL FLAP
(SMALL ARROW POINTS TO SKIN-LINED PEDICLE FLAP TO BE AMPUTATED 2 WEEKS LATER)

observed in the dermal layer level extending laterally towards the parotid to give the flap a horizontal pedicle. The flap is then brought into the mouth through the a cheek tunnel incision along the buccal mucosa to cover the defect in the anterior floor of the mouth. This way, even if the base is closed immediately, strangulation is not a threat. OneOlayer closure suturing is done along the skin in the area of the dermal-subcutaneous pedicle and two-layer suturing is done to the rest going up to the alar region. (superior part of the donor defect). A triangular skin exicision is done from the base of the flap for easy and complete closure of the cheek defect (Fig. 3-7). One can also use a bilateral nasolabial island flap for bigger anterior floor of the mouth defects partially involving the tongue (Fig.8).

DISCUSSION

It is indeed very important to maintain the functional integrity of the anterior floor of the mouth to assure normality of tongue mobility. For small defects in this area, a suitably matching small flap reconstruction should be employed. Usual flaps in the repair of the anterior

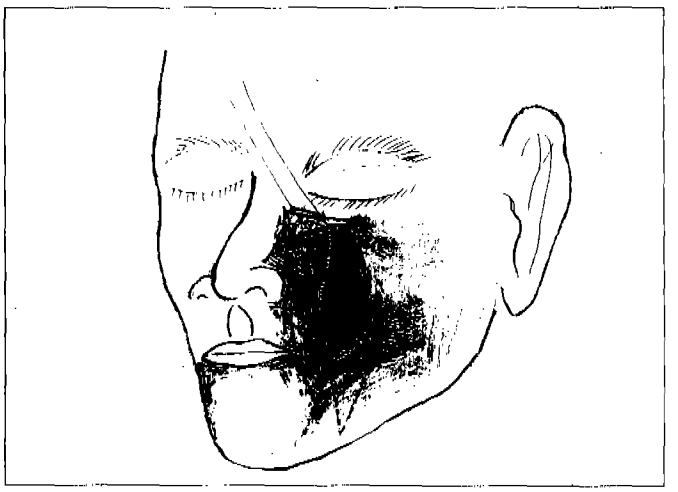

FIG. 3 - THE PRINCIPLE OF INFERIORLY BASED MODIFIED NASOLABIAL FLAP BROUGHT INTO THE MOUTH THROUGH A CHEEK TUNNEL AS A RANDOM FLAP

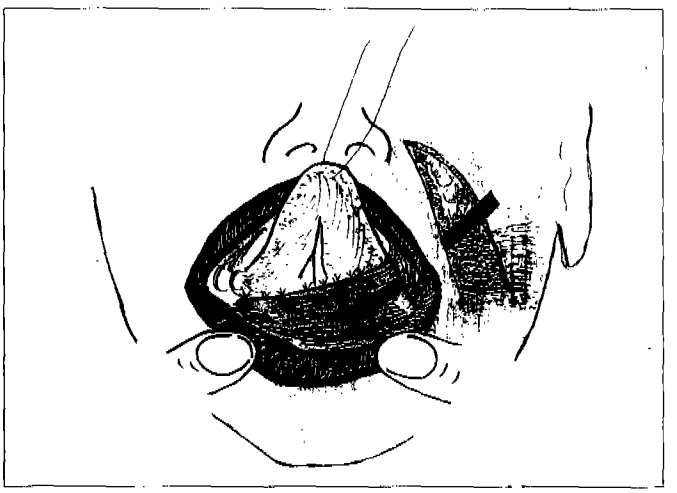

FIG. 4 - ONE STAGE UNILATERAL NASOLABIAL FLAP

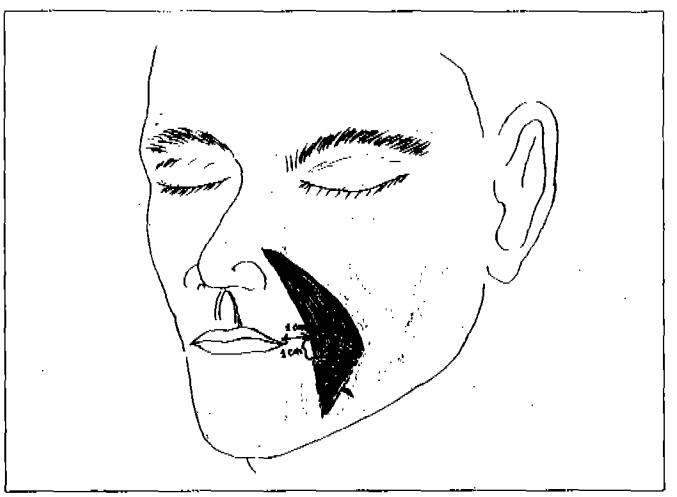

FIG. 5 - OUTLINE OF THE NASOLABIAL FLAP WITH A SMALL TRIANGULAR AREA PLACED INFERIORLY

FIG. 6 - OUTLINE OF THE NASOLABIAL FLAP

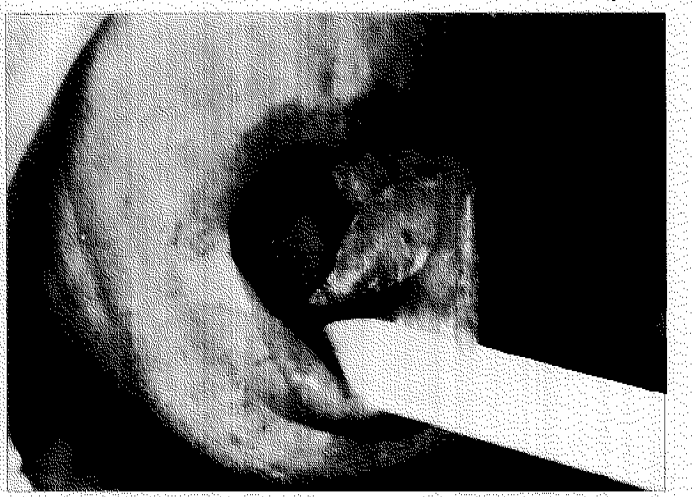

FIG. 7 - NASOLABIAL FLAP COVERING THE DEFECT IN THE ANTERIOR FLOOR OF THE MOUTH

floor of the mouth are the following, with their respective disadvantages:

1. Tongue Flap: These flaps are thin with high incidence of deniscence because of tongue movement;
2. Temporalis Muscle Fascia Flap: Technique involved is too complicated for the procedure to be done.
3. Deltopectoral Flap: This requires a two-stage procedure with the added disadvantage of being a distant flap.
4. Island Pectoralis Major Myocutaneous Flap: This is too much of a radical flap procedure to cover a small defect in the anterior floor of the mouth.
5. Microvascular Free Flap (e.g. Radial Flap): This requires formidable technical expertise and set-up to assure a successful take.

The sixth option is the nasolabial flap. This technique has been shown to provide a simple, safe, and effective method of reconstruction.

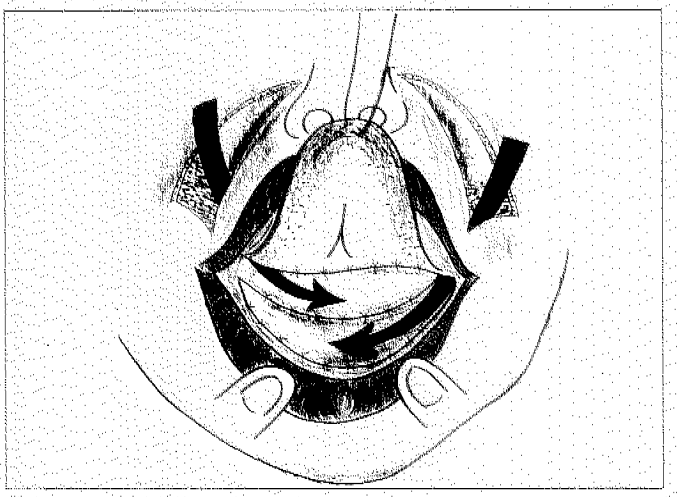

FIG. 8 - ONE STAGE NASOLABIAL FLAP (BILATERAL)

The advantages of this modification are :

1. One-stage procedure for convenience and practicality;
2. Less operation time;
3. Less expense;
4. Simple, not distant flap;
5. Incision line closure and scar is along the nasolabial fold which is cosmetically acceptable (Fig. 9).

Its advantages, however, are minimal. It cannot be used to reconstruct extensive floor of them outh defects especially those that occupy the entire floor and invade the tongue. One should use the other flap for this purpose, as mentioned previously. It is also not recommended for patients younger than 35 years old. The tightness of a young person's skin lends difficulty to the technique and poor cosmetic result. It is also noted that there is post-op formation of a facies like that of the "Joker" (as in the "Batman" film), especially in the elderly (Fig. 10). This, however, is a temporary condition, resolving in six weeks time.

CONCLUSION

This report describes a modified execution of nasolabial flap reconstruction of appropriately-sized defects in the anterior floor of the mouth. It is believed that practical modifications in this flap's basic concept and usual technique are made. In this series, this modification has been tried and has been successful in all eight cases. Five of these were cases of floor of the mouth malignancies with segmental or marginal resection ofthe mandible, two were benign conditions and one was a repair of an unsuccessful initial flap reconstruction. Because of the modifications, the usual two-stage procedure of the nasolabial flap have been converted into a more convenient one-stage flap procedure.

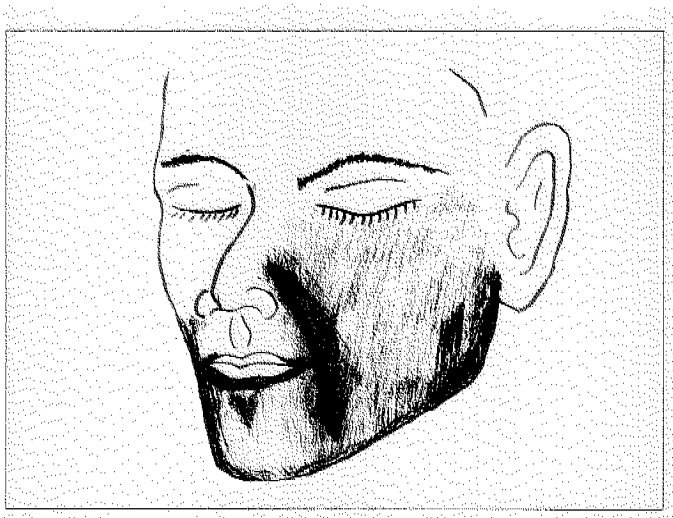

FIG. 9 - CLOSURE OF THE CHEEK DEFECT ALONG THE NASOLABIAL FOLD

FIG. 10 - "THE JOKER FACIES"

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THE TEFLON INTRAVENOUS CANNULA: A PRACTICAL ALTERNATIVE TO OSSICULAR REPLACEMENT PROSTHESIS

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ABSTRACT

Among the characteristics of an ideal material for ossicular reconstruction, biocompatability is foremost and the most complex. In a general sense, this is the ability of an impalnt to fool the host immune system into recognizing the graft as part of the whole itself. Likewise, the material should be reproducible. This actually encompasses two different issues; individual surgical expense and general ease of use. While technological advances have provided us with better and more effective alternatives, ear surgery has become very expensive.

This a review of the first ten patients who have received the Abbocath (Teflon) intravenous cannula as an latrnative to alloplastic ossicular replacement prosthesis currently available in the market. Extrusion has never been a problem, because of the bioinert characteristics of this material. Post-operative audiometric follow-ups revelaed stable hearing improvements.

With the advantages of relative biocompatibility, stable post-operative hearing improvements, relative ease of use, ready availability and affordability, the Teflon intravenous cannula has earned its recognition as a practical alternative to high-priced ossicular replacement prosthesis.

INTRODUCTION

Before the advent of antibiotics,ear surgery was concerned almost entirely with the relief of middle ear infections by operations aimed at draining pus ot removing diseased tissue. Middle ear infection was rightly feared as a great danger tothe patient. Surgical interventions were, of necessity, hurried and, before introduction of the operating microscope, were performed with the precision afforded only by the naked eye with ot without magnifying spectacles. It is not so very long since ear surgery was widely regarded as being within the ream of any general surgeon gifted with certain manual dexterity using hammer and gouge. Today all major ear surgery is governed by a prevailing interest in function. that is not to say operations are not needed to save lives but that operations are now never performed without due regard being paid to the effect upon the hearing. Developments within the last 30 years has transformed ear surgery into one of the most precise, delicate, and satisfying disciplines in the whole of medicine.

Reconstruction of the eardrum and the sound conducting mechanism of the middle ear is the contribution of tympanoplasty to the original efforts to eradicate infection in the surgery of chronic otitis media. Numerous combination of graft position, ossicular interposition, cartilage and bone struts, and various types of solid plastic, metal, and lately, glass ceramic had been used. Each technique is plagued with its own particular problems, including graft failures, implants extrusions, and persistent and recurrent conductive hearing loss.

The locally availabel ABBOCATH-brand disposable (Teflon) intravenous cannula has been used as an alternative to the currently marketed drum-to-footpalte Total Ossicular Replacement prosthesis (Plastipore-TORP; Richards Medical Co.) commercially available. This alloplastic material has the advantages of being relatively biocompatible, provide stable hearing improvement, easy to handle, readily available, and most affordable.

MATERIALS

To be successful. a material used for tympanoplasty must possess several characteristics. It is important to establish the standard by which it is judged.

Towards the last half of the 20th century, a burgeoning number of materials were used in tympanoplasty. These are classified into three broad subgroups: autografts, homografts, and allografts.

The first and most complex criterion concerns relative biocompability. In a general sense, biocompatibility refers to the ability of an implant to fool the host immune system into recognizing the graft as part of he host itself. The second criterion is that he,aterial must resist and tolerate infectious process. The middle ear cavity is susceptible to infection because of its connection to the outside by way of the eustachian tube. Any material implanted in young people must last for decades. The implants used must perform their function without, defect

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caused by scar retraction fibrosed or ankylosed. Finally, the material obtained must be readily reproducible becoming dislodged. This actually encompasses two slightly different issues: individual surgical expense and general ease of use.

Autografts are obtained from the patient and returned to him. These are almost always the most favorable grafts to use for reconstruction. They are certainly immunocompatible, but requires the additional step of harvesting tissue, often from an inconvenient site as in cases of revision surgery.

Homografts are taken from cadavers and then processed. They are readily available from any "ear banks". Disadvantages include the need for several sizes of grafts on the shelf in the operating room. Some grafts are of differing dimensions, and therefore, the surgeon may need to select different sizes of different patients, not to mention the cost to procure them. In addition, homograft cartilage carries the potential risk of transmittal of disease.

Alloplastic materials are man-made and are most convenient to obtain. They are available from a number of well-known manufacturers of these prosthesis, in a number of sizes, shapes and styles of implantation. Alloplasts must display some characteristics of biocompatibility. This may be achieved by being nearly bioinert and minimally interacting with the immune system. Examples of alloplastic materials readily available in the market include polyethylene (Plastipore), polytetrafluoroethylene (Teflon), bioactive glass ceramics and porous (Coralline) hydroxylapatite, each claiming biocompatibility with reliable sound conducting potential supported by extensive research studies.

METHODOLOGY

Preparation of the Prosthesis.

Having a shaft that most approximates that of the conventional ossicular replacement prosthesis (Plastipore-TORP; Richards Medical Co.), the Abbocath G22 intravenous cannula was chosen as the raw material. One end was heated, flattening it to create a platform" with 3 mm. diameter for the tympanic membrane graft to sit on. Trimming the stem to an appropriate length requires judgment at the time of the operation. The finished TORP-pattened Abbocath IV cannula was gas-autoclaved for sterilization.

Tragal Cartilage Removal.

After injection of a local anesthetic containing epinephrine, an incision is made just posterior to the dome of the tragus. This incision reduces the cosmetic. A large piece of cartilage is excised and the perichondrium is removed. The cartilage is then placed on a moistened tongue blade, trimmed to the appropriate size, and thinned with a No.11 surgical blade. This thinning process particulary on the edges, results in cartilage with a slightly dome shape. Having this shape, the cartilage will conform to the contours of the tympanic membrane when the prosthesis and cartilage are placed under slight tension.

Prosthesis Placement.

The middle ear is filled lightly with pieces of Gelfoam. This moistened Gelfoam is used to facilitate placement of the prothesis and cartilage, stabilizing them temporarily and providing counterpressure for the Gelfoam packing that will be placed in the ear canal after replacement of the tympanomeatal flap.

THE STUDY

Records of the first 10 patients who received the Abbocath (Teflon) IV cannula as ossicular replacement prosthesis were retrieved. The very first patient to undergo such a procedure was a 24 year-old female who consulted at the out-patient clinic because of decrease hearing on the right, having a history of recurrent right ear infection for the last 4 years. The air-bone gap was closed from pre-operative audiometric reading of 50 dB to about 25 dB recorded 2 months after surgery. Another audiometric reading done after 4 months later and the last follow-up made 2 years post-operatively showedstable hearing improvement with 15-20 dB residual conductive deficit on both occasions.

Success with the first operation provided us with the initiative to continue using IV cannula for the less fortunate patients who cannot afford the conventional ossicular replacement prosthesis currently available in the market.

The charts of the 10 patients were reviewed particular attention to closure of the air-bone gap and correlating it with the criteria for hearing improvement based at a 25 dB residual conductive deficit or less. This has been the basis for labelling the procedure a success or a failure.

Chronic otitis media was the principal diagnosis on most of the cases, all of which had dry ears at the time of the operation. One patient underwent two-stage procedure, the others just single stage. Eight patients underwent wall-up mastoidectomy, two underwent wall-down technique.

As a rule, the ear to be operated upon should follow the guidelines required for an ideal candidate for tympanoplasty: a dry middle ear mucosa with a patent eustachain tube and an audiometric reading of a conductive hearing default. The third criterion requires that the only remaining ossicular remnant be the stapes footplate (the superstructure excluded) or totally absent ossicular chain including the footplate. This latter criterion actually encompasses the limitation upon which this type of implant material is applicable and obviously needs intraoperative judgment for its utility.

CASE NO. 1

Chief complaint:

Decreased hearing, right. four years history of recurrent right ear infection.]

Pre-operative Evaluation:

Total tympanic membrane perforation
Ossicles present: none
Middle ear mucosa: dry
X-ray: mastoiditis, right

Diagnosis:

Chronic otitis media, AD: inactive

Pre-operative Audiometry:

Moderate conductive hearing loss, AD
(45-50 dB air-bone gap)

Intraoperative findings:

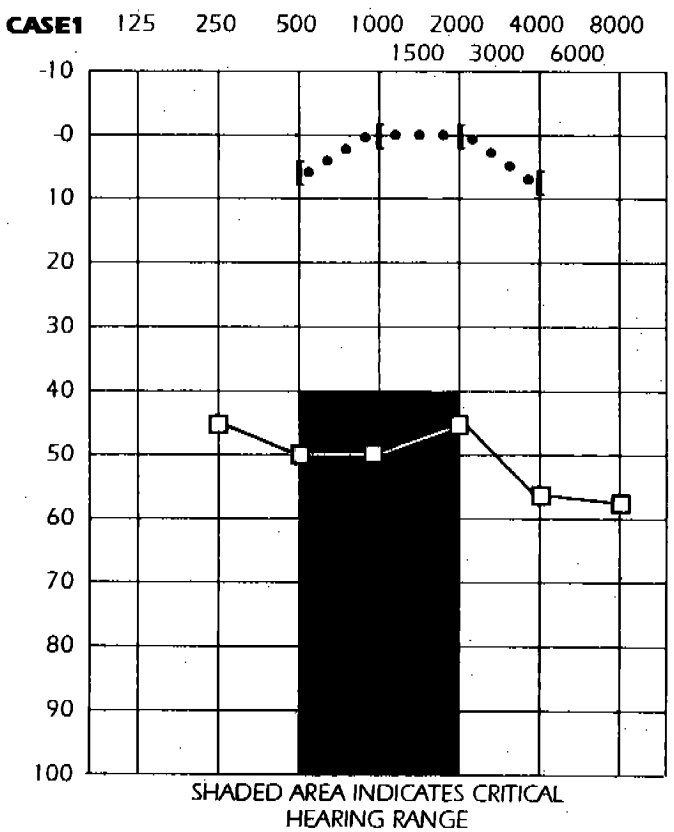
Minimal granulation tissues noted on the epitympanum and aditus. Rest of the M.E. mucosa smooth. E.T. patent. Ossicles absent except for stapes footplate.

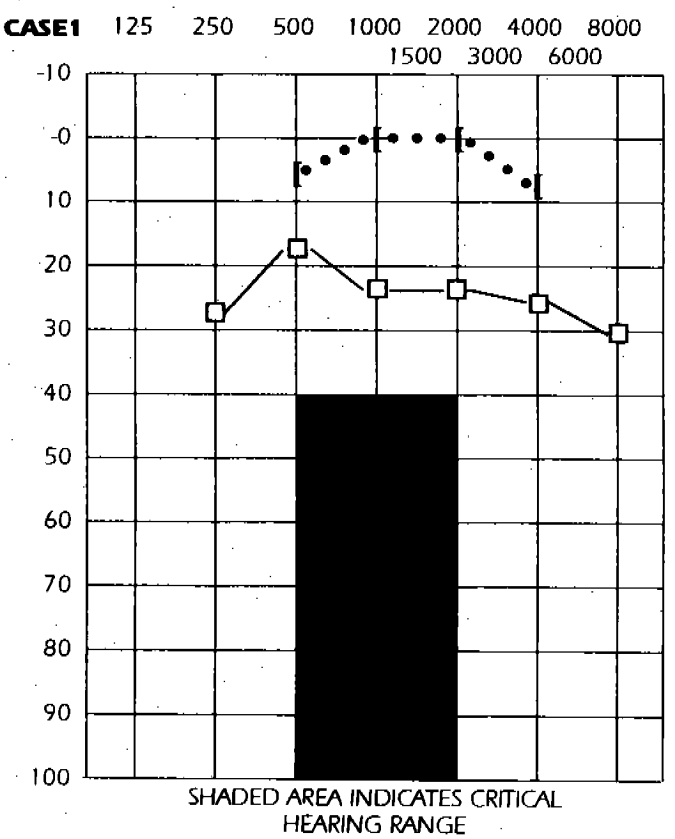
Technique:

Canal wall-up mastoidectomy with tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis.

Post-operative follow-up:

At 2 months post-op:
20-25 dB residual conductive deficit
At 6 months post-op:
15-20 dB residual conductive deficit
At 2 year post-op:
15-20 dB residual conductive deficit





CASE NO. 2

Chief Complaint:

Recurrent infection of the left ear. History of recurrent ear discharge noted since 8 years prior to consultation.

Pre-operative Evaluation:

Total TM perforation; Ossicles:none; Dry ME mucosa; X-ray:mastoiditis, left

Diagnosis:

Chronic otitis media, AS inactive S/P Canal wall-up mastoidectomy

Pre-operative Audiometry:

Moderate conductive heairng loss, AS (40-50 dB air-bone gap)

Intraoperative findings:

ME mucosa with minimal granulation tissue ossicles absent, except for the stapes footplate. Eustachian tube patent.

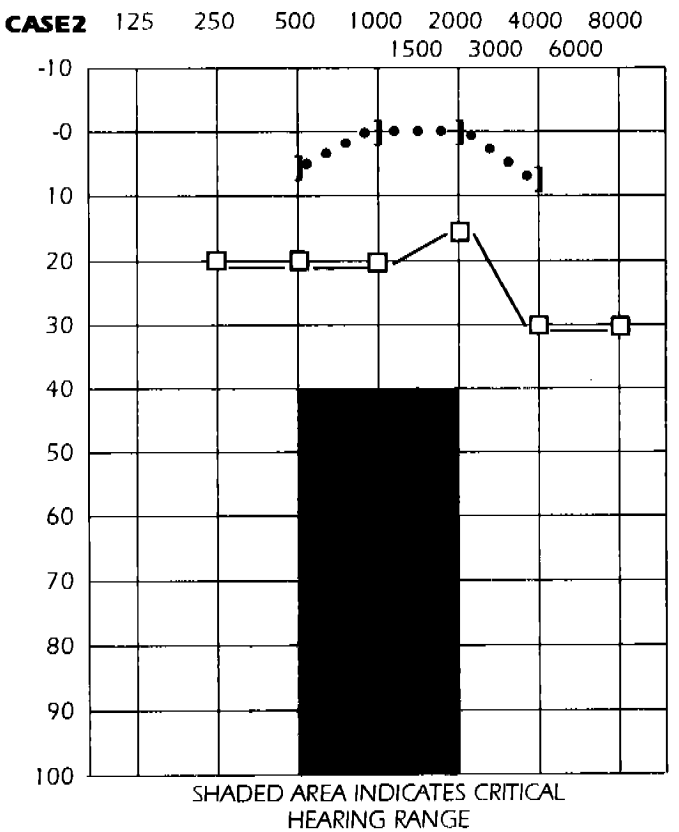
Technique:

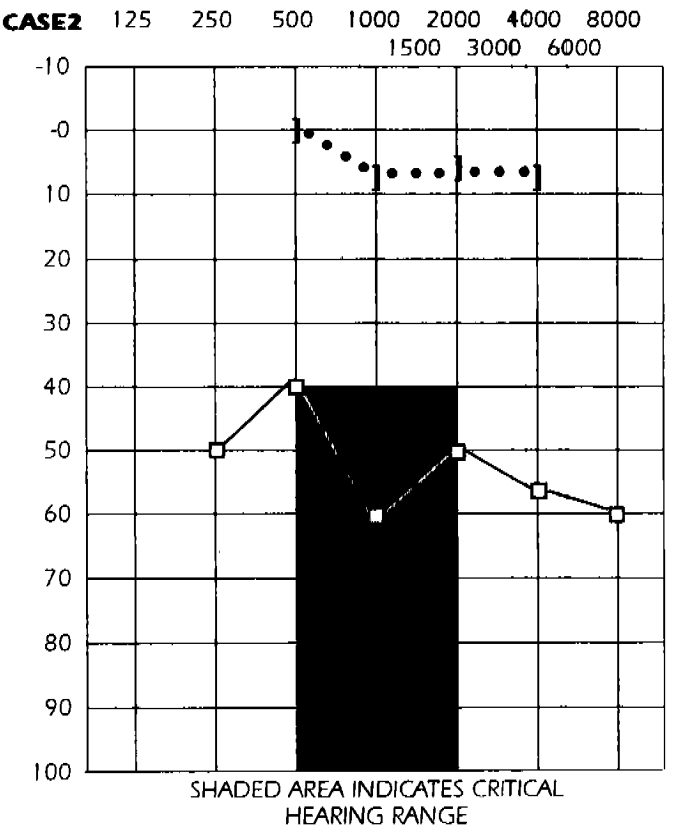
Tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis.

Post-operative Follow-up:

At 2 months post-op: 15-25 dB residual conductive deficit

At 10 months post-op: 15-20 dB residual conductive deficit





CASE NO. 3

C.B., 23,F

Chief Complaint:

Decreased hearing, left. History of hearing deficit for more than 5 years prior to consultation.

Pre-operative Evaluation:

Near total perforation; Handle of the malleus still visible; Dry middle ear mucosa; X-ray: mastoiditis, AS

Diagnosis:

Chronic Otitis Media, AS; inactive

Pre-operative Audiometry:

Moderate conductive hearing loss, AS (45-55 dB air-bone gap)

Intraoperative Findings:

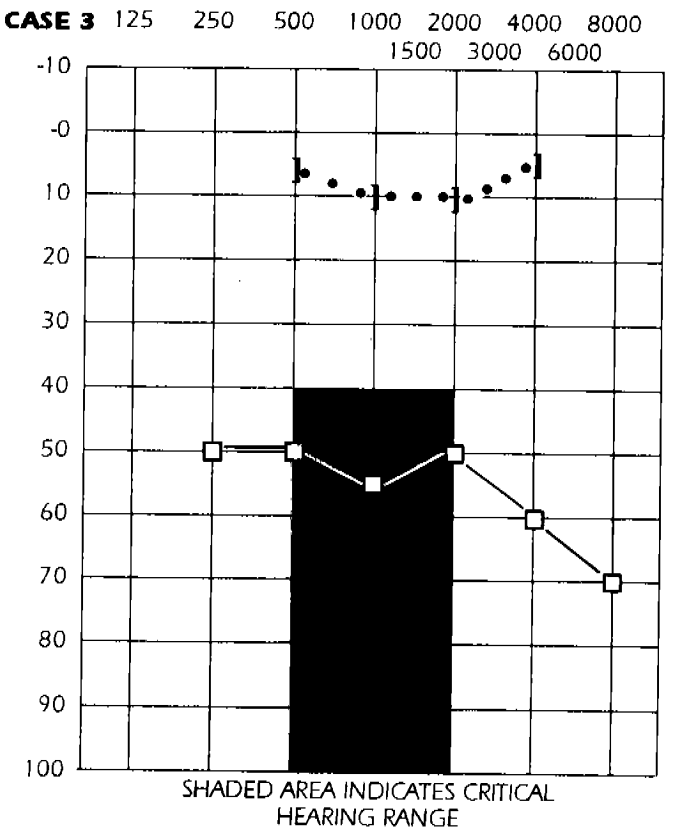
Granulation tissues invade the entire mastoid antrum, aditus and epitympanum; rest of the ME cavity with smooth mucosa. ET patent. Ossicles absent except the stapes footplate.

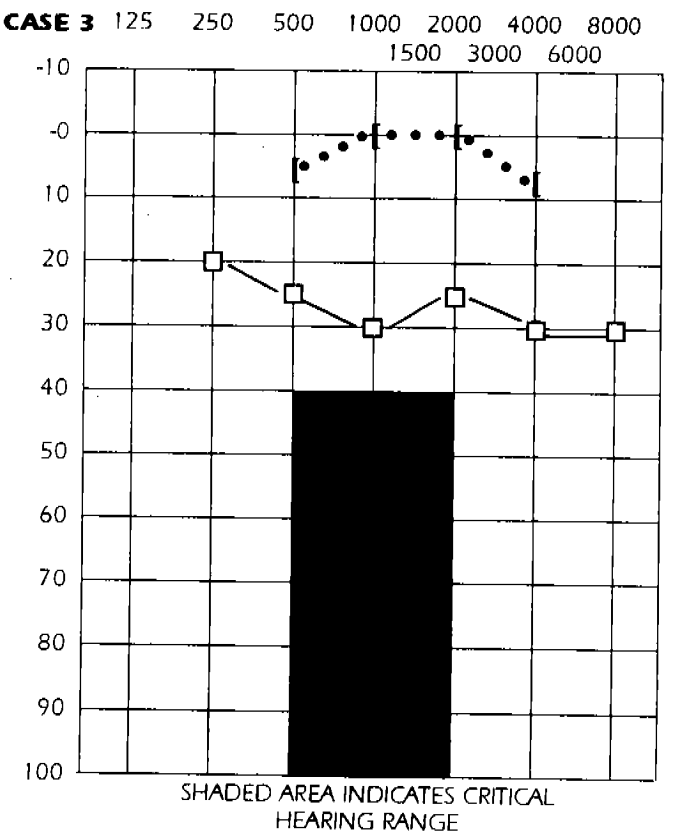
Technique:

Canal wall-up mastoidectomy with tympanoplasty using Teflon IV cannula as ossicular replacment prosthesis.

Post-operative Follow-up:

At 2 months post-op: 15-25 dB residual conductive deficit
At 6 months post-op: 20-25 dB residual conductive deficit
At 1 year post-op: 15-25 dB residual conductive deficit





CASE NO. 4

F.D.C., 30 M

Chief Complaint:

Recurrent ear infection, bilateral. History of recurrent bilateral ear discharge since childhood.

Pre-operative Evaluation:

Total TM perforation, bilateral; No ossicules visible; Granulation tissue over ME mucosa; X-ray: mastoiditis, bilateral.

Diagnosis:

Chronic Otitis media, AU, inactive, AD active, AS

Pre-operative Audiometry:

Moderate conductive hearing loss,AU (30-40 dB air-bone gap, AD; 40-50 dB air-bone gap, AS)

Intra-operative Findings:

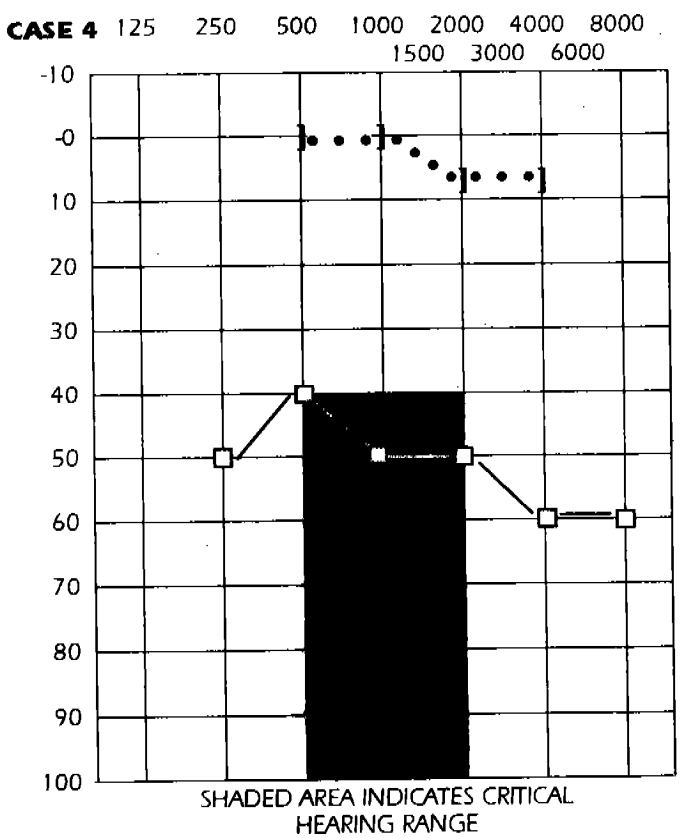
Granulation tissues noted over the mastoid antrum, aditus and rest of the ME cavity. ET noted patent. Ossicles absent, including the stapes foot-plate.

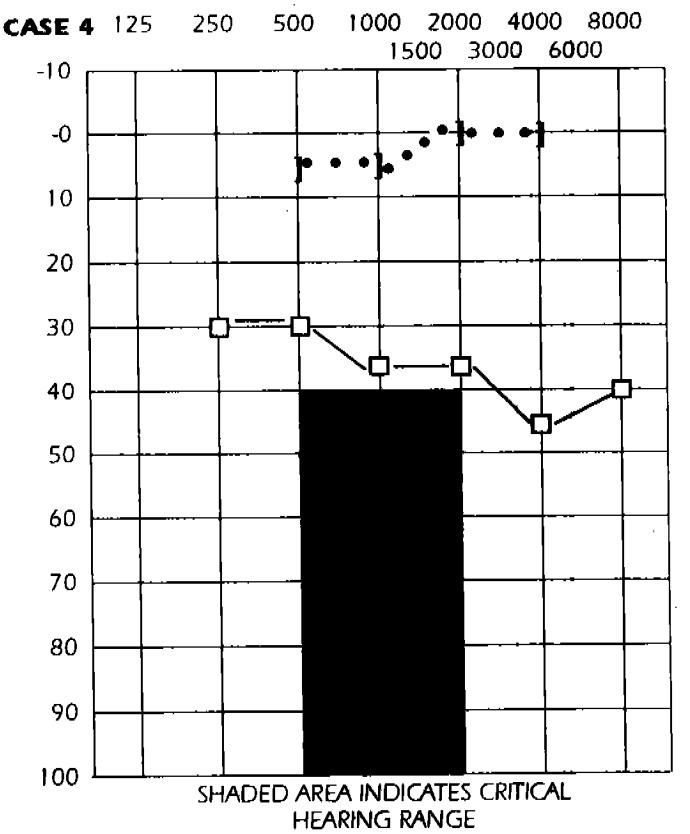
Technique:

Canal wall-up mastoidectomy with tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis.

Postoperative Follow-up:

At 2 months post-op: 30-40 dB resi-dual conductive deficit





CASE NO. 5

J.R., 39 F

Chief Complaint:

Recurrent ear discharge, left. On and off aural discharge noted since childhood.

Preoperative Evaluation:

Total TM perforation, No ossicles noted, moist mucosa, Granulation tissue on ME cavity, X-ray: cholesteatoma, left.

Diagnosis:

Chronic tympanomastoiditis with cholesteatoma AS; Chronic otitis media, AD

Pre-operative Audiometry:

Moderate to severe mixed hearing loss, AS (50-60 dB air-bone gap at 25-30 dB bone conduction threshold

Intra-operative Findings:

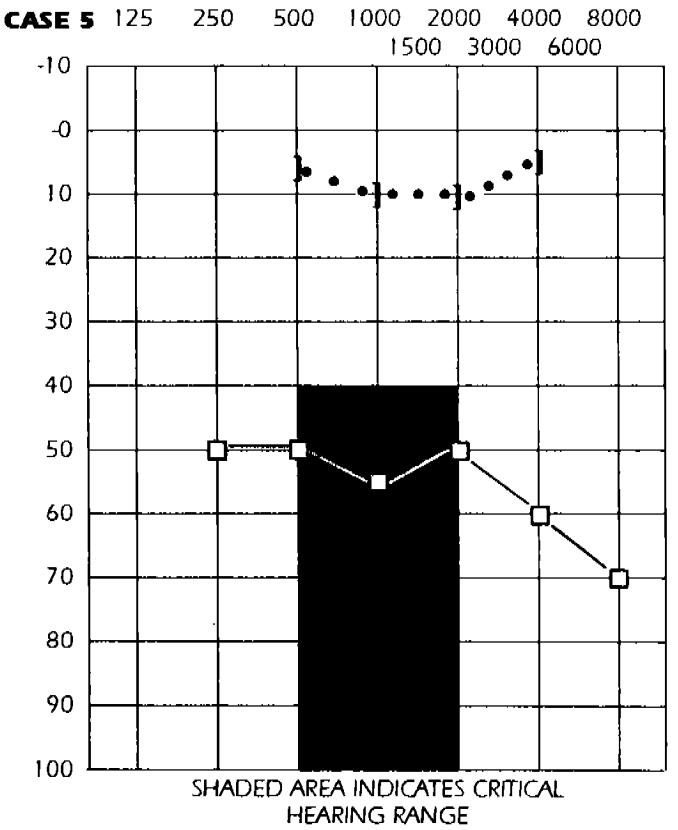
Cholesteatoma filled the mastoid cavity. Moderate amount of granulation tissue over the aditus and epitympanum including most of the ME cavity. ET noted patent. Ossicles absent including the stapes footplate.

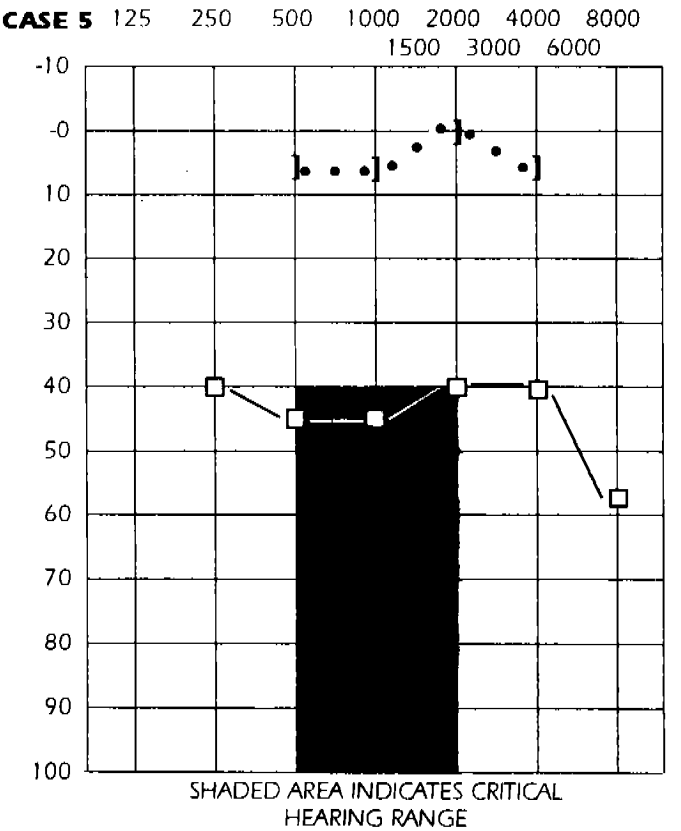
Technique:

Canal wall-down mastoidectomy with tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis.

Post-operative Follow-up:

At 2 months post-op: 40-50 dB residual conductive deficit





CASE NO. 6

R.A., 29 M

Chief Complaint:

Decreased hearing, right. History of on and off ear infection during childhood.

Pre-operative Evaluation:

Total TM perforation; Ossicles absent; Dry ME mucosa; X-ray: mastoiditis, right

Diagnosis:

Chronic Otitis media, AD; inactive

Pre-operative Audiometry:

Moderately severe conductive hearing loss, AD(50-60 dB air-bone gap).

Intra-operative Findings:

Moderate amount of granulation tissue noted on the aditus, epi- and mesi- tympanum; rest of the ME mucosa with smooth mucosa. ET patent. Ossicles absent except for footplate of stapes.

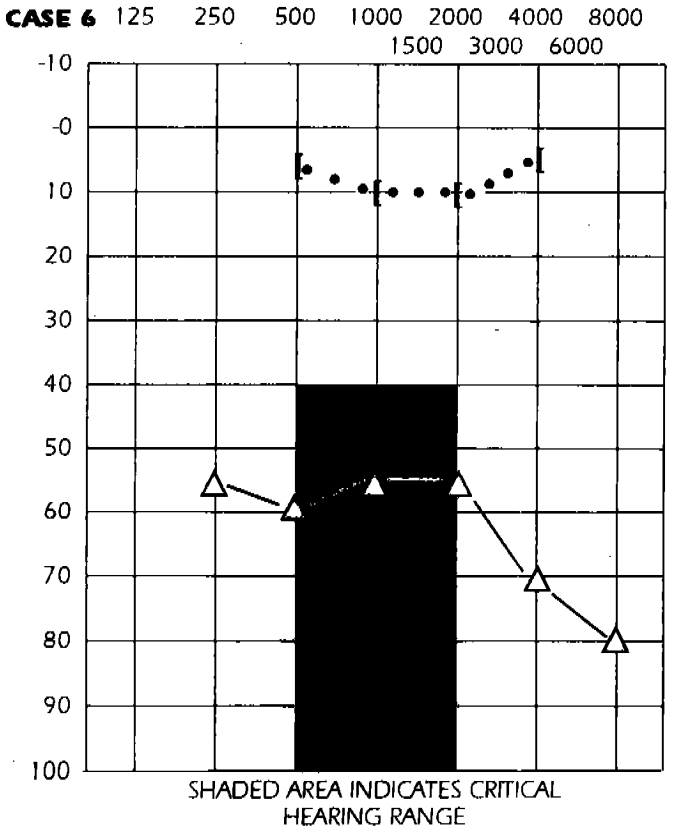
Technique:

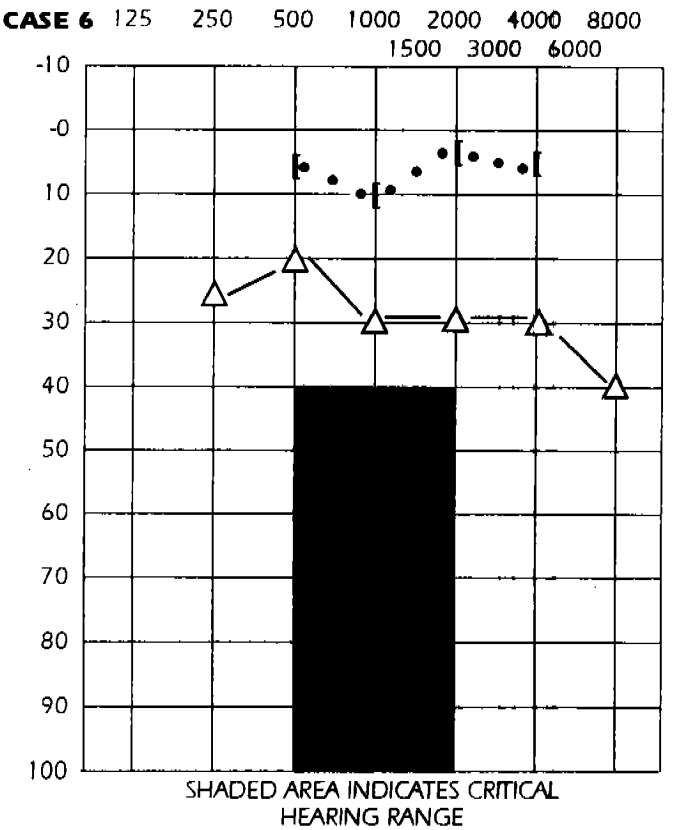
Canal wall-up mastoidectomy with tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis.

Post-operative Follow-up:

At 2 months post-op: 20-50 dB residual conductive deficit

At 1 year post-op: 15-25 dB resi-dual conductive deficit





CASE NO. 7

M.C., 24 M

Chief Complaint:

Ear discharge, right; 1 year history of recurrent foul-smelling right ear discharge.

Pre-operative Evaluation:

Near total TM perforation; Minimal granulation tissue; Dry ME mucosa; No ossicles visible

Diagnosis:

Chronic otitis media, AD; inactive

Intra-operative Findings:

Granulation tisssues noted on the aditus and middle ear cavity; ET patent; stapes footplate present, malleus and incus missing.

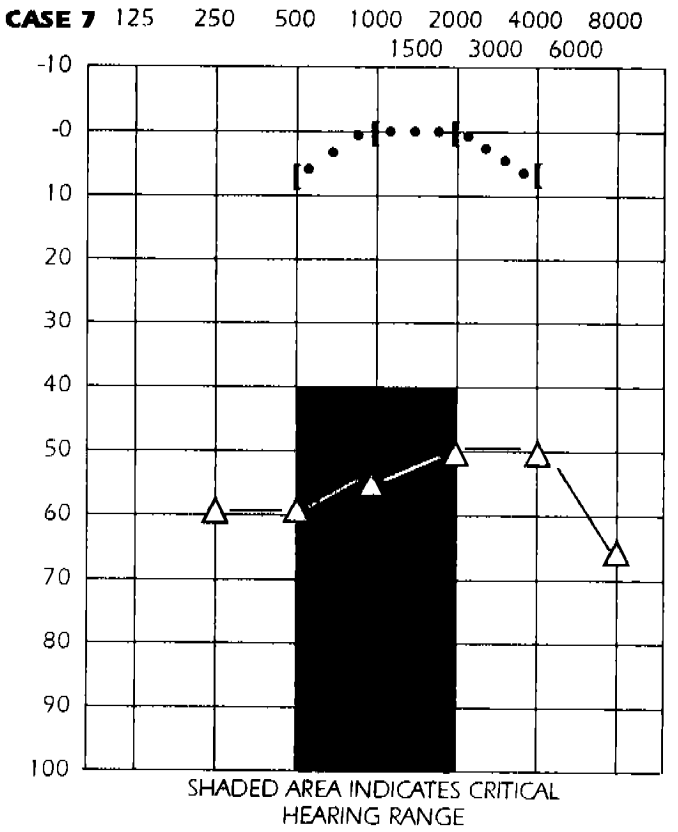
Technique:

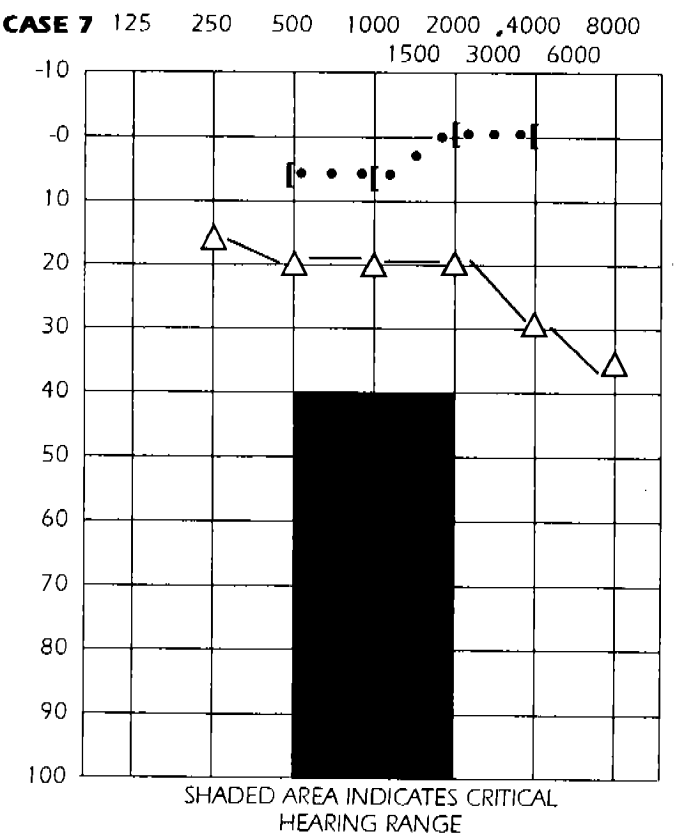
Canal wall-up mastoid-ectomy with tympanoplasty using Teflon IV cannula as ossicular replacement prosthesis

Post-operative Follow-up:

At 2 months post-op 15-25 dB residual conductive deficit

At 8 months post-op: 20-25 dB resi-dual conductive deficit





CASE NO. 8

R.D.C., 28 M

Chief Complaint:

Ear discharge, right. On and off ear discharge noted since 6 months prior to consultation.

Pre-operative Evaluation:

Total TM perforation; Ossicles absent; Granulation tissues all over middle ear mucosa; Yellowish foul-smelling discharge; X-ray: choleteatoma, right

Diagnosis:

Chronic tympanomastoiditis with cholesteatoma, AD Preoperative Audiometry:

Moderate to severe mixed hearing loss, AD (55-60 dB air-bone gap, at 20-30 bone conduction threshold)

Intra-operative Findings:

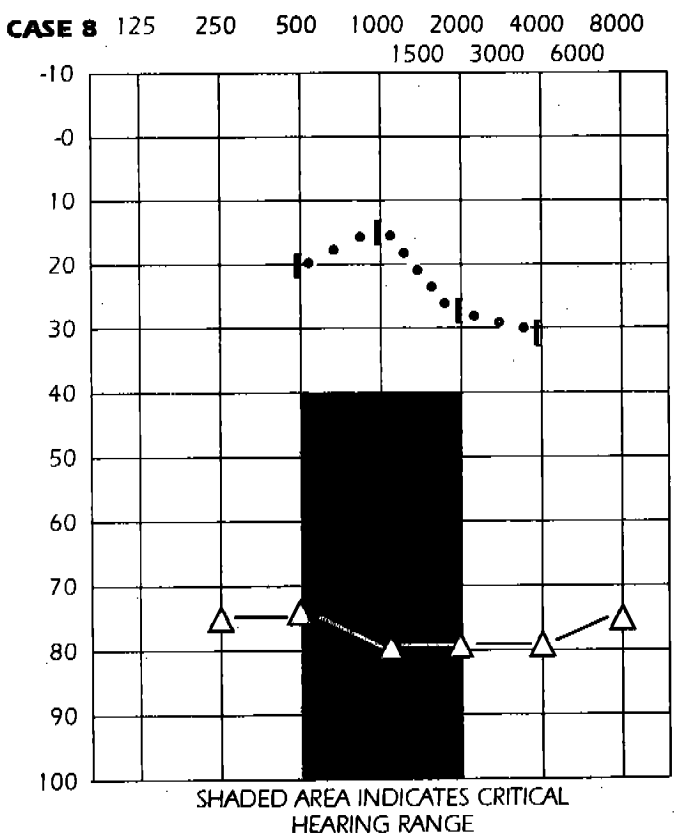
Cholesteatoma completely filled the mastoid antrum including the aditus; other areas of the middle ear space covered by granulation tisue. ET noted patent. Ossicles absent including the stapes footplate.

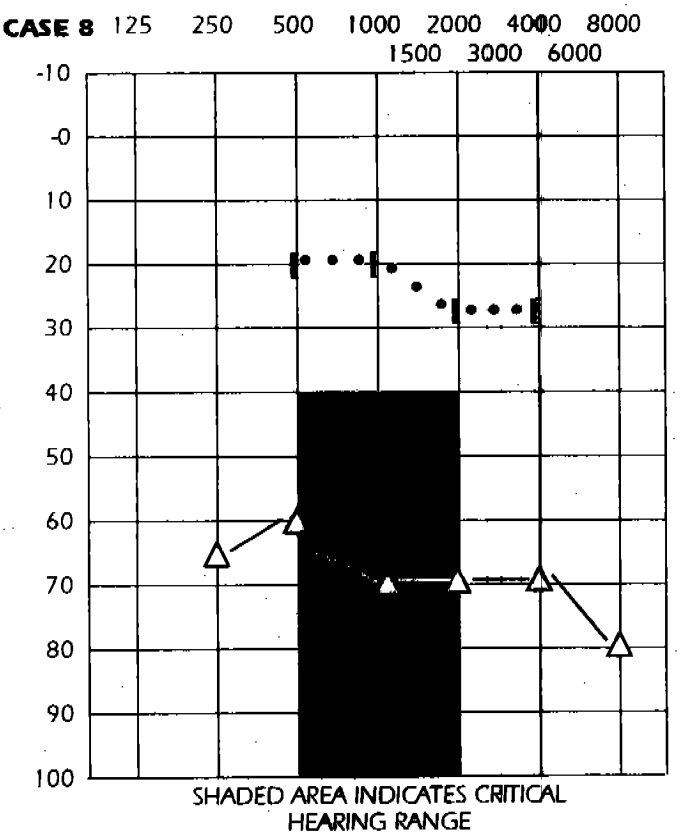
Technique:

Canal wall-down mastoidectomy with tympanoplasty using Teflon Iv cannula as ossicular replacement prosthesis

Post-operative Follow-up:

At 2 months post-op: 40-50 dB resi-dual conductive deficit





CASE NO. 9

J.C., 47 M

Chief Complaint:

Decreased hearing, right ear; On and off hostory of recurrent ear infection since 1 year prior to consultation

Pre-operative Evaluation:

Near total TM perforation; No ossicles visible; Pale ME mucosa, dry; X-ray: mastoiditis, AD

Diagnosis:

Chronic otitis media, AD; inactive

Pre-operative Audiometry:

Moderately severe conductive hearing loss (50-60 dB air-bone gap), AD

Intra-operative Findings:

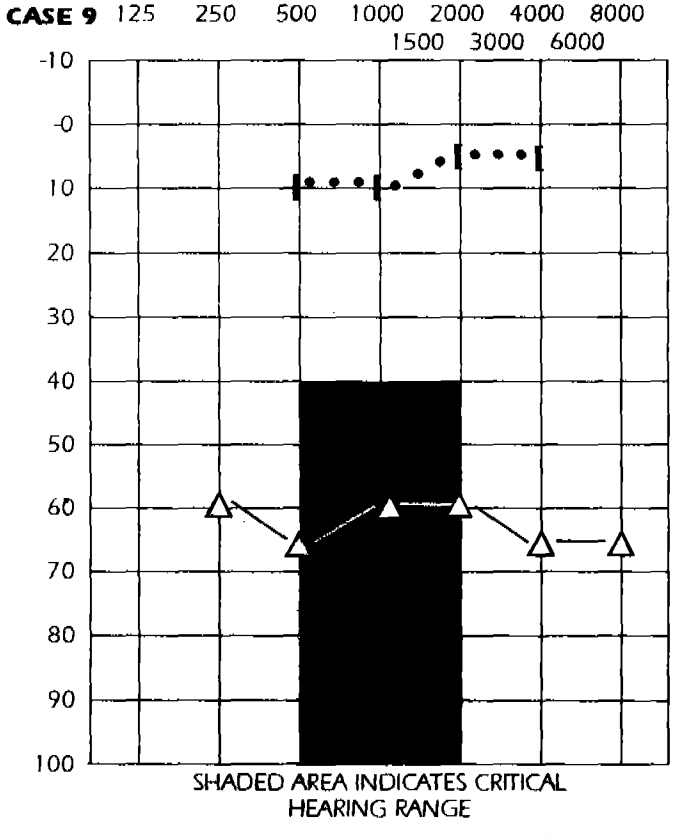
Minimal granulation tissues noted over the mastoid antrum, epitympanum; rest of the ME mucosa with smooth mucosa; ET patent; footplate of the stapes intact.

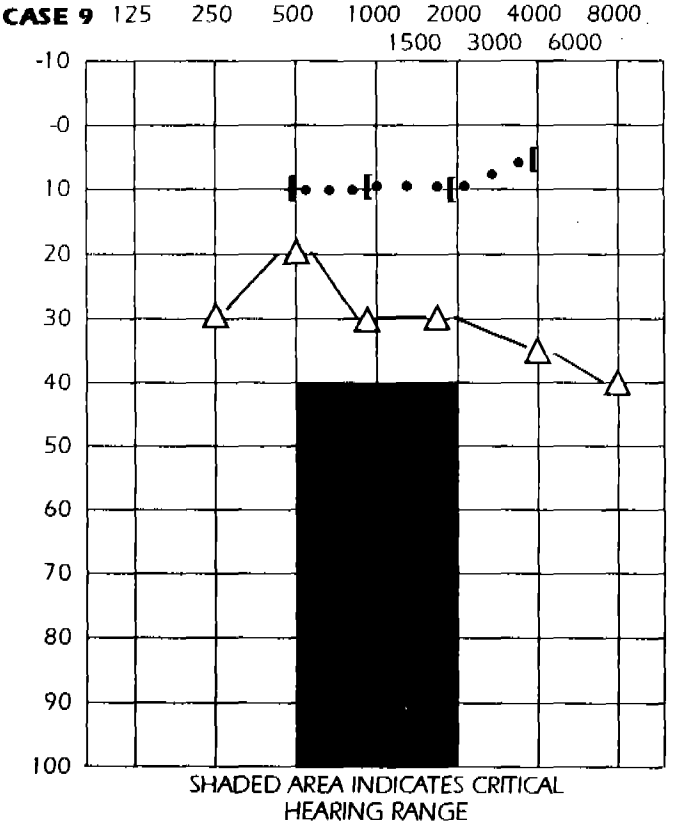
Technique:

Canal wall-up mastoidec-tomy with tympanoplsty using Teflon IV cannula as ossicular replacement prosthesis

Post-operative Follow-up:

At 2 months post-op: 20-25 dB resi-dual conductive deficit





CASE NO. 10

W.M., 24 M

Chief Complaint:

Decreased hearing, right; Ear discharge, on and off noted since childhood

Pre-operative Evaluation:

Total TM perforation; No ossicles visible; Granulation tissue over the ME cavity; X-ray: mastoiditis, right

Diagnosis:

Chronic otitis media, AD, inactive

Pre-operative Audiometry:

Moderate conductive hearing loss, AD (45-50 dB air-bone gap)

Intra-operative Findings:

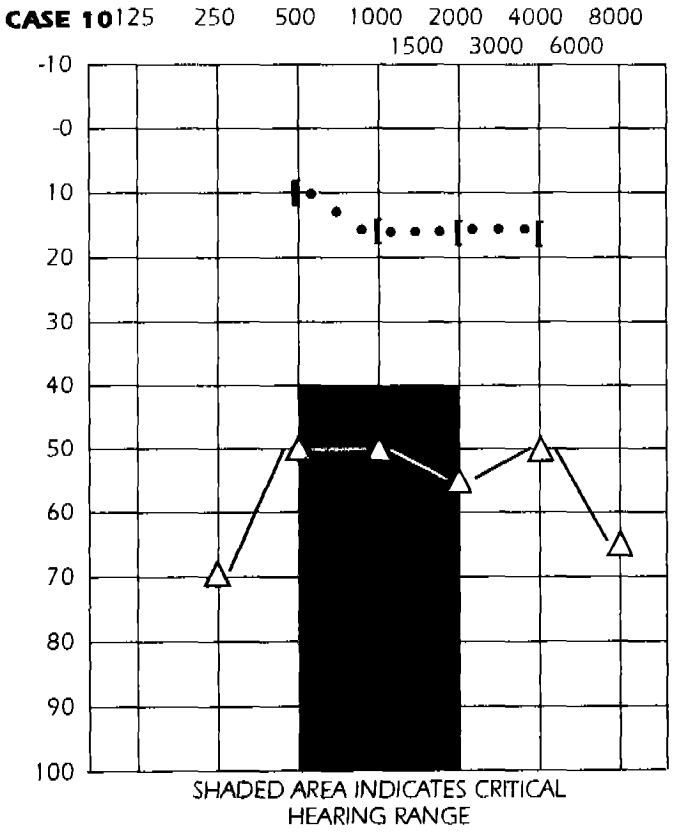
Granulation tissues noted over the mastoid antrum, aditus and all over the middle ear cavity; ET noted patent; ossicles absent including the stapes

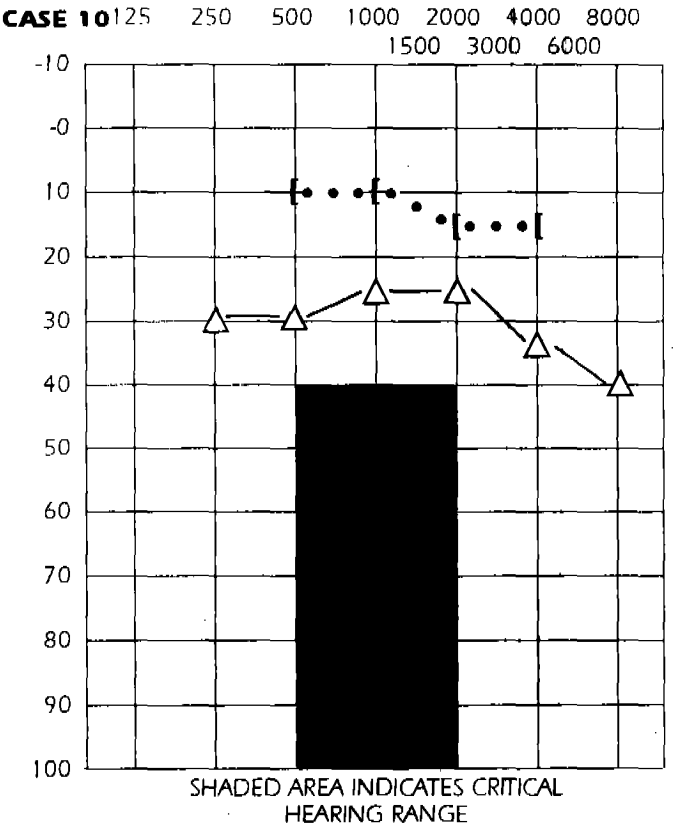
Technique:

Canal wall-up mastoidec-tomy with tympanoplsty using IV cannula as ossicular replacement prosthesis

Post-operative Follow-up:

At 2 months post-op: 15-25v dB residual conductive deficit.





The following are clinical data of the ten patients with follow-ups ranging from 2 months to two years post-operativley, pre-operativley clinical evaluation, pre-operatively and post-operative audiometric studies, intraoperative findings and technique used.

RESULTS

The hearing results are reported as the residual conductive deficit. This deficit is determined by analyzing the post-operative audiometry results using the averages of 500, 1000 and 2000 Hz. Hearing deficit was determined by identifying the average "residual" (post-operative) air-bone gap in these frequencies. The result is designated as the RESIDUAL CONDUCTIVE DEFICIT.

The criteria used to consider an operation succussful with regard to hearing loss is a residual conductive deficit of 25 dB or less.

The following table is a suummary of the ten patients with their coresponding audiometric results pre- and post-operatively:

AUDIOMETRIC RESULTS

		PRE-OPERATIVE Air-bone gap	POST-OPERATIVE Residual Conduc. Deficit*
1.	M.V.S., 24F	45-50 dB	20-25 dB
2.	G.S., 29M	40-50 dB	15-25 dB
3.	C.B., 23F	45-55 dB	15-25 dB
4.	F.D.C., 30M	40-50 dB	30-40 dB
5.	J.R., 39F	50-60 dB	40-50 dB
6.	R.A., 29M	50-60 dB	15-25 dB
7.	M.C., 24M	45-55 dB	20-25 dB
8.	R.D.C., 28M	55-60 dB	40-50 dB
9.	J.C., 47M	50-60 dB	20-25 dB
10.	W.M., 24M	45-50 dB	15-25 dB

*Average post-operative audioometric readings taken during follow-up periods ranging from 2 months to 2 years (average: 1 year).

Post-operative follow-ups ranged from 2 months to 2 years with an average of one year. Of the ten patients evaluated, 8 had pre-operative diagnosis of chronic otitis media. All, except for one, had dry ears at thetime of the operation, both had cholesteatoma on x-ray. Both underwent single-stage wall-down technique with tympanoplasty using the IV cannula as ossicular replacement prosthesis.

Of the eight patients with chronic otitis media, six patients underwent one-stage wall-up mastoiddectomy, one patient underwent two-stage procedure while the lone case with active infection underwent waal-down technique.

The decision to use the IV cannula as prosthesis were decided upon intraoperatively on most of the cases. Although tympanoplasty was primarily advocated, the type of ossicular discontinuity revealed during surgery influenced the utility of the IV cannula for the obvious reason that this type of prosthesis is only applicable for chronically infected ears with the footplate of the stapes being the only remnant of the ossicular chain or for totally absent ossicles including footplate.

Three of the ten cases only showed slight improvement on post-operative audiogram. A 10 dB hearing improvement was noted on all three occassions, taken 2 months post-op after which no other follow-up had been on record. These three cases failed to reach the audiometric criteria of 25 dB residaul conductive deficit, although prosthesis extrusion was not a problem.

Of the three failed cases, two had cholesteatoma while the other patient had granulation tissue invasion of the mastoid cavity. All three had total loss ofthe ossicular chain, inclusing the stapes footplate. Canal wallp-down technique was done on all occasions.

An average of 50 dB pre-operatively audiometric air-bone gap was noted between the seven improved cases. The average residual conductive deficit was recorded at 22 dB, showing average hearing improvement of 28 dB.

DISCUSSION

By collecting the sound energy with a freely mobile large membrane and then concentrating it upon a small piston-like entrance to the inner ear, nature has provided a well-engineered system, the middle ear transformer mechanism, to bridge the impedance mismatch and allow maximum transfer of energy.

The loos of energy as a result of energy transfer from gaseous to liquid medium is expressed as 30 dB, about the level at which a person begins to complain that one has a hearing problem. However, with the combined functions of the tympanic membrane, the ossicular chain and footplate of the stapes, a mechanical advantage corresponding to about 25 to 26 dB could be derived from the leverage & hydraulic systems. Thus, the transformer action of the middle ear recovers most (25-26 dB), but not all of the 30 dB lost when sound waves pass from air to liquid. The remaining 4 to 5 dB are forever lost.

Keeping these figures in mind, one should be able to clse whatever preoperative air-bone gap Is present to about the 25 dB level or beter. The 25 dB (or less) residual conductive ddeficit is the designated criteria forlabeling the operation, with regard to hearing improvement, a success or failure. A successful operation therefore, should be able to bridge any 50 dB preoperative air-bone gap to at least a 25 dB residual conductive deficit or better.

The choice of the Abbocath intravenous cannula as a prosthesis stems from the fact that the bioinert characteristics of Teflon (polytetrafluoroethylene) is comparable with plastipore which is the type of material

used in the manufacture of the most popularly ised ossicular replacement prosthesis in the market. Published studies using Teflon support the bioinert characteristics of this material. **Schuknecht** in a report(on surgicak pathology of middle ear implants)revealed tissue accepatance of thid alloplast without evidence of distrubance with the host's immune system. Combined with its relative ease of use, availability and affordability make it a practical, cost-effective alternative to these high-proced imported alloplastic materials.

While technological advances had provided better and more effective alternatives, ear surgerry has, for most of our indigent patients, become painfully expensive. Although it is quite impossible to match what nature has to offer notwithstanding the intricacies of how normal ossicular chain actually works, at least the otologist must try and hope to augment whtever is presentlly, and affordably available. This has been the guiding force behind every case deemed to benefit most from this particular technique.

At this point, however, one must emphasize thst this type of implant material could only be utilized to a particular ossicular disruption, that of a missing ossicular chain with the only remnant being the stapes footplate or even with the footplate itself missing.

A 28 dB average hearing improvement from a 50 dB deficit maybe a samll consolation on our efforts to provide quality auditory function among the less fortunate patients.

CONCLUSION

The choice of a material for ossicular reconstruction is just one factor that determines the success or failure of surgery. The biocompatibility of a material is one major criterion one can not ignore. The criteria encompasses more than this particular factor alone. Just as crucial are the surgeon's expertise as well as the condition of the middle ear mucosa and function of the eustachian tube at the time of operation.

The advantages of this type of prosthesis are (1) relative biocompati-bility; (2) stable hearing improvement; (3) easy to use; (4) readily available; and (5) most affordable.

When one begins using a new technique, the initial results frequently are not as good as with previously used techniques. This is certainly true with the initial results. Undoubtedly the most affordable and readily available alloplastic implant material for osssicu-lar reconstruction, the Teflon intravenous cannula prosthesis has earned the recognition as a practical alternative to high-priced conventional prosthesis.

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LOCAL EXPERIENCE WITH THE MYOMUCOSAL TRACHEOESOPHAGEAL SHUNT: THE LARYNGECTOMIZED PATIENT SPEAKS OUT!

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ABSTRACT

For years the postoperative voice rehabilitation of the laryngectomized patient has been a neglected issue. The sad reality is that even unnder the best supervision only about 30% acheive a functional esophageal voice. In the past surgical procedures for speech rehabilitiation following laryngectomy lacked wide support because of tumor recurrence, aspiration, stenosis of the fistula, and multiple surgical stages. The recent prosthesis and their modifications have achieved an approximately 70% success rate in experienced hands. The application of these in our setting, however, has not gained acceptance because of the high cost, unavailability of these devices and limited experience in their use. Furthermore,even inm properly attached prosthesis, soilage is unavoidable and maintenance is difficult. Described herein id the first locally reported experience with the use of "Myomucosal Tracheosophageal Shunt" - a mucosa-lined tracheosophageal fistula with a functioning proximal muscle sphincter, created at one stage at laryngectony.

INTRODUCTION

The patient who has just undergone a Total Laryngectomy is indeed a pitiful sight. There the patient lies silent and dejected, stripped of dignity, for he loss of faculty that sets man apart from the lower species, the ability for a meaningful communication with human beings. What alternative does the lary-ngectomee have?

The sad reality is that only about 30% of laryngectomees, the more motivated ones perhaps, achieve functional esophageal voice. Surgical procedures for speech rehabilitation follwoing laryngectomy lack wide support because of tumor recurrence, aspiration, stenosis of the fistula, and multiple surgical stage of limited usefulness in irradiated patients. The recent prosthesis and their modifications have has around 70% success rate in experienced hands. The application in the local setting, however, is limited because of the high cost, unavailability of these devices and limited experience in their use. Furthermore, even with a properly attached prosthesis, soilage is unavoidable and maintenance is difficult.

For years, estblishing quality phonation after laryngectomy has been the dream of many otolrayngologists. It requires the creation of an air channel from the trachea to the esophagus. This may be easier said than done. The challenge is to do so with a technique that eliminates soiling of the trachea with pharyngeal contents. More importantly, survival must not be compromised by an ill-advised narrow field procedure for the sake of reconstruction.

The objective of this paper therefore is to describe an apply a one-stage surgical technique that:

A. Would follow wide field ablationa an is not limited by the amount of trachea resected.
B. Could be done just before closure and, therefore, does not significantly increase operative time.
C. Reduces soilage to an absolute minimum.
D. Does not interfere with but rather compliments the possible development of an esophageal voice.
E. Results in voice quality comparable with, if not superior to, esophageal voice attained with other techniques without their drawbacks.

PATIENTS AND METHODS

Two patients, a 65 year old male with stage III glottic cancer with subglottic extension, and 64 year old male with initial Stage II T2N0M0 cancer who failed to respond to primary irradiation, underwent total laryngectomy. In both cases a myomucosal shunt described by ***Strome*** et al using an indferiorly based muscle falp with a superiorly derived tubed mucosal flap, pulled through a muscle sling were done. The muscle sling is thought to reduce the probability of mediastinal contamination as well as provide better constriction to keep the tube collapsed reducing the possibilty of leakage into the tracheostoma during swallowing.

A T-shaped closure was done to repair the pharyngoesophageal defect after total laryngectomy. The vertical limb was accomplished first. A 7.5 mm endotracheal tube was introduced into the horizontal

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limb prior to completion of the pharyngoesophageal repair. The tracheal stump was sutured to the inferior limb of the skin flap. The endotracheal tube was inflated just posterior to the trachea at the angle produced by the junction of the esophagus and the anterioly displaced trachea. An inferiorly based muscle flap measuring about 2.5 x 1.5 cm was developed at the anterior esophageal wall over the inflated cuff.(Fig.1) A superiorly based mucosal flap was subsequently developed.The endotracheal tube was deflated and withdrawn and the pharyngoesophageal repair was completed.A mucosal tube was constructed with interrupted 3-0 Vicryl around a no. 10 catheter. (Fig 2) The superior muscle sling was separated bluntly from the underlying mucosa. A 5 to 8 mm incision is made across the anterior muscle wall 5 to 6 mm above the muscle flap defect and the mucosal tube was delivered beneath and through the muscular sling.(Fig3) The esophageal muscle flap was replaced and close with interrupted 3-0 vicryl sutures. A 4mm dermal punch was used to fenestrate the posterior tracheal wall about 1-1.5 cm. posterior to the lip of the tracheostoma. The mucosal tube was anastomosed to trachea with 4-0 Vicryl sutures and closure was done in layers (fig. 4).

RESULTS

The first patient had a T lesion, whereas the second patient failed to respond to primary full course irridiation. In both patients a superiorly based mucosal flap was used. Both patients had an unremarkable recovery.The first patient regained functional speech after one month of practice.There were no reported significant aspiration problems other than an occasional drop of liquid at the stomal verge and none at all when swallowing solids.This patient was followed up for three months with progressive improvement in voice use and no evolving aspiration problems.The patient can now modulate the voice through different ranges of intensity and can sustain this voice through sentences and short phrases.

The second patient underwent total laryngectomy and myomucosal shunt recontruction barely three weeks prior to this report. The patient was evaluated for tube patency on the tenth day.The patient was able to vocalize monosyllabic words on the thirteenth day and could sustain the voice through two to three word sentences as of this writing. Further improvement of this ability to vocalize is expected, although it is certainly too eraly to tell whether the success will maintained indefinitely. No aspiraton problems have been noted even when drinking. A slightly narrower muscle sling was created in this patient through which the shunt was pulled through.

The first patient was lost to follow up after the third month and is now on the sevevnth postoperative month. The second patient comes for weekly visits and the speech development described above is being monitored.

DICUSSION

There are several options in the rehabilitation of the laryngectomized patient, each with its own inherent advantages and limitations.Traditionally esophageal voice is the preferred method of laryngeal speech. Even the more motivated patients, however do not always acquire it. Reports of acquisition rates have been varied but recent studies suggest the good esophageal speech can be achieved inas few as 30% to 40%. The disadvantages of this mode of speech is limited volume, esophageal voice trianing is often time consuming, frustrating, not always available especially in the local setting,and frequently does not meet the needs of patients.

Some patients prefer mechanical artificial larynges. The most common type is a portable electric device held againt the neck to transmit electrically generated sounds to the pharynx which are transformed to speech by articulation. Artificial larynges are often effective and may satisfy communication requirements rapidly. These, however are not readily available and may be quite expensive and their conspicous, artificial, robot-like sound and appearance limits acceptability.

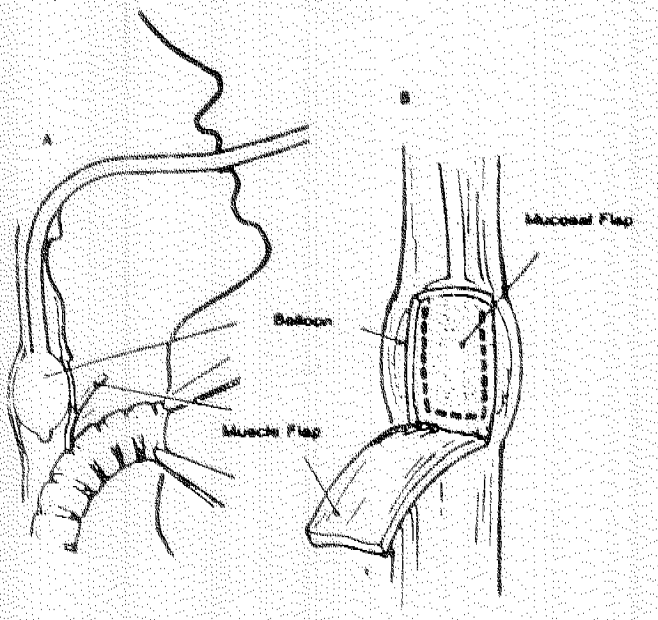
For most patients perhaps, nothing could be more satisfying than to reacquire a self-generated, contraption-free,near normal sounding voice.

The search for an ideal solution,therefore, focused on a surgical alternative that could meet the following criteria: good voice quality, adequate surgical margins,no aspiration, and a one stage reconstruction that does not require a prosthesis.The fundamental principle behind all surgical efforts to develop laryngeal speech is the creation of an air channel from the trachea to esophagus, a tracheosophageal shunt. **Conley** was among the first to describe a technique that applied this concept but was later to abandon this technique because of the "technical problem to overcome consisted of creating a passageway that would permit free flow of air from the trachea to the esophagus without passage of food or saliva from the gullet into the trachea".

Asai developed a shunt method where he superior trachea was incorporated in a skin-lined shunt extending to the hypopharynx and a side tracheostomy formed inferior to the shunt. The technique, how-ever, was staged and used in non-irradiated patients; furthermore, excellent speech was observed in not more than 20% with a high incidence of salivary soiling.

Amatsu proposed a method where laryngectomy was performed such that the anterior two thirds of the cartilage from the first through fourth tracheal rings were removed with the membranous trachea preserved. A side to side tracheosphageal anastomosis was established with the membranous flap tube forming a shunt from the trachea to the esophagus.The inherent limitations of this techniques are: the need to preserve the membranous trachea from the first to forth trachea rings

Diagramatic and Photographic Illustration of the Operation for Myomucosal Tracheoesophageal Shunt Construction



A.

B.

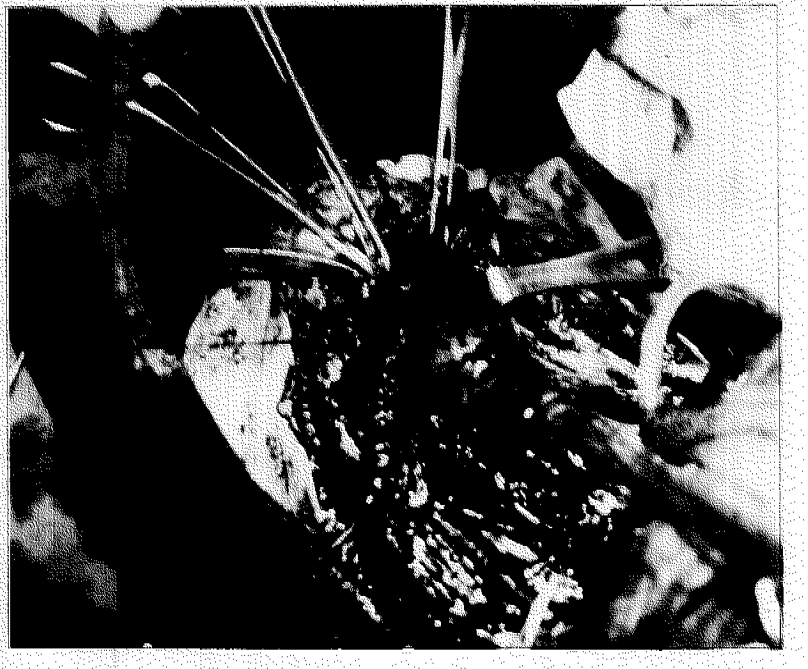
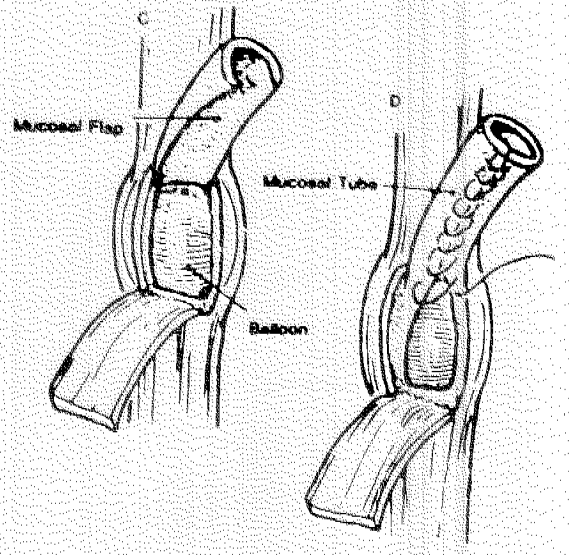


Fig. 1
A. Endotracheal tube cuff is inflated (arrow in photo)
B. Inferiorly based muscle flap is developed (arrow in photo
Superiorly based mucosal flap is outlined (diagram)

C.



D.

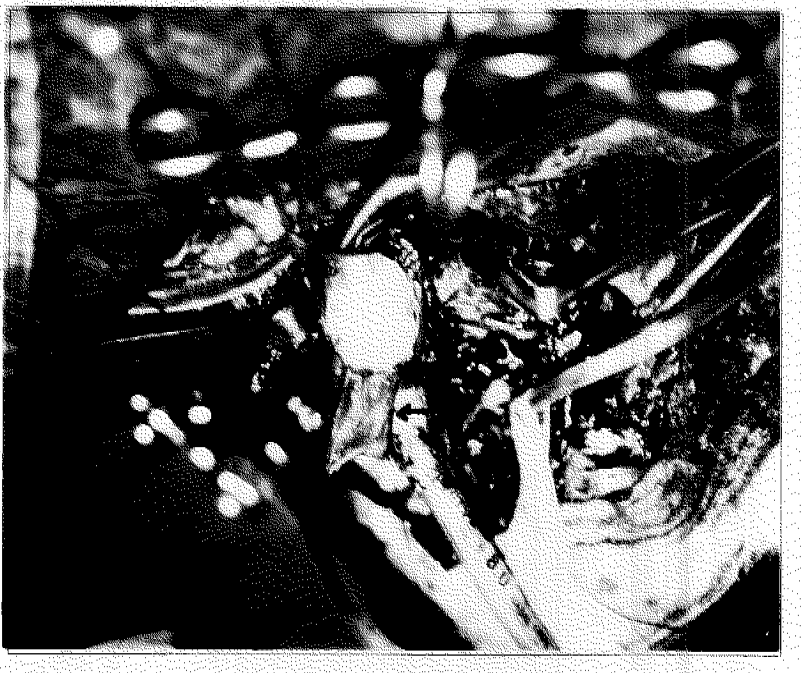
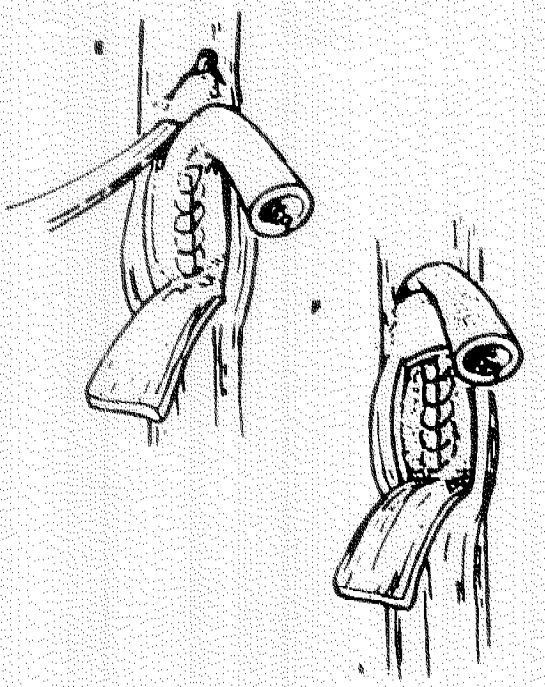


Fig. 2
C. Superiorly based mucosal flap is cut (arrow in photo)
D. 3-0 Vicryl™ interrupted sutures also close esophageal window.



E.

F.

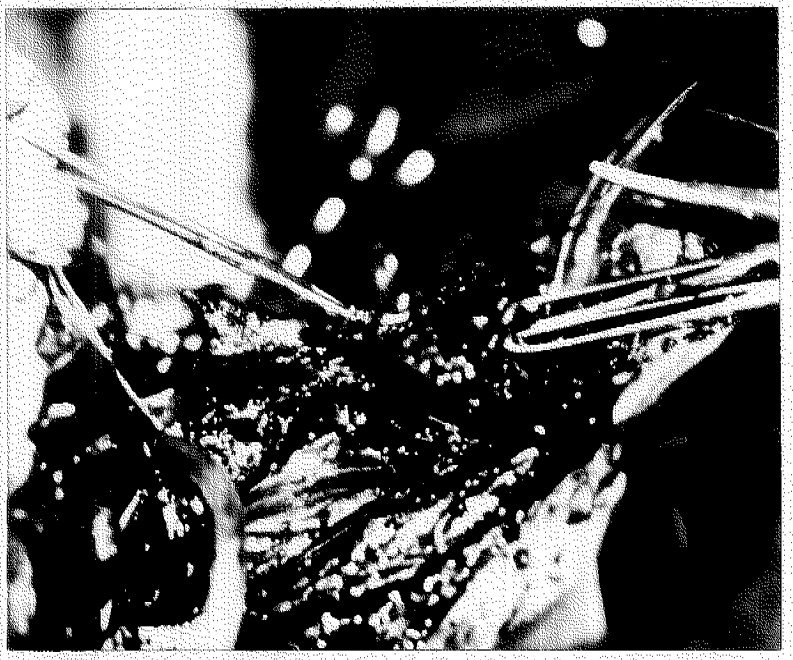
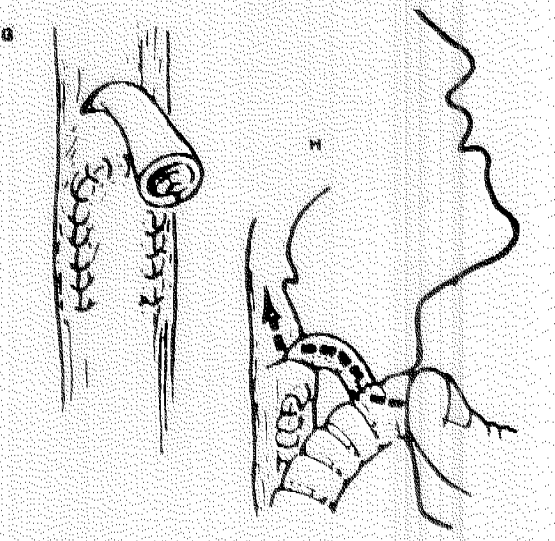


Fig. 3

E. Superior muscle sling is separated from underlying mucosa bluntly (arrow in photo)

F. Mucosal tube is brought under the muscle sling and through the superior fenestra in the muscle (arrow in photo)

G.



H.

Fig. 4
G. Esophageal muscle flap is closed
H. A posterior tracheal fenestra is created with 4mm dermal punch. Mucosal tube is sutured to the tracheal fenestra (arrow show point of shunt anastomosis to the posterior tracheal wall in photo)

1. (photo only) showing a stoma (shunt opening) within the tracheal stoma.

which may compromise the surgeons ability to clear adequate margins of resectio especially in advanced tumors with significant subglottic extension.Although satisfactory speech were reported in 76%, salivary leakage was observed in 30%.

The "neoglottis fonatoria" proposed by ***Staffieri*** and **Serafini** is liwise a conservative procedure requiring the transection of thr trachea and the first tracheal ring and preservation of the anterior hypopharyngeal and retrocricoid mucosa in order to establish a shunt by exteriorization of mocosa through a 5 to 8 mm buttonhole in the anterior pharyngoesophangeal wall. The limitations described for advanced tumors with subglottic extension likewise apply to their procedure.Indeed many later completion laryngectomy. Likewise, the high incidence of delayed incontinence and chronic aspiration hindered its long term effectiveness and acceptance.

The endoscopic shunt developed by ***Singer*** and **Blom** and the use of a silicone bivalve prosthesis used to fit into the shunt or a stent and to eliminate reflux into the airway is a rational alternative. These techniques address critical issue of no limitation of effective cancer treatment with adequate surgical margins, normal deglutition unaffected by voice restoration, avoidance of prolonged hospitalization and no dependence on complicated valves, cannulas and external devices. Success rate of around 70% is achieved with this prosthesis and voice quality was often better than with esophangeal speech. The technique gained popuarity continues to be the one of the more acceptable alternatives. Further modifications were also made by Panje and others. The necessity for a second procedure and training of daily care of the prosthesis have been its main drawbacks,the prosthesis is quite expensive and it is not locally available.In spite of its technical simplicity, tracheo-esophangeal puncture is not complication free. ***Silver*** et al detailed complications in 15% of patients which included mediastinitis and cellulitis of the trachea and root of the neck.Only a modest 50% rate of compliance has been reported.Leakage,poor tissue tolerance, discomfort from a long prosthesis,spontaneous extrusion and fistula closure are partly responsible.

Reported herein is the first local experience with this technique consisting of the creation of a valved trache-esophangeal shunt developed from esophageal mocusa, not full thickness esophagus.The eso-phageal muscle sling acts as a protective sphincter during the act of deglutition enabling a superiorly directed fistula to be constructed without the problem of aspiration.Perhaps one of the outstanding features of this technique is its technical simplicity. Reconstruction can be perform primarily in any patient adding only about 2 hours more of operating time. There is no second stage and the constructed shunt does not preclude the acquisition of esophageal speech. In this limited exeprience using a superiorly based tubed mucosal flap pulled through a superior muscle sling, tube patency was a constant feature in both patients, voice reacquisition was achieved in less than 1 month postoperatively with minimal leakeage during deglutition.

CONCLUSION

This report outlines the first local experience using a new refinement of an earlier concept. The principle behind it as well as he technique of its construction has been described. A brief discussion of earlier surgical techniques for voice rehabilitation was also under-taken for thje purpose of comparison. The necouraging aspects of this technique include the ease of construction, the absence of breakdown or signifi-cant aspiration and the total lack of surgical constraints to preserve tissue when a total laryngectomy is warranted. Although the number of patients is small and the follow-up period is short, this technique definitely shows promise. In dealing with the patient who has undergone a total laryngectomy, very little has been done to address the patient's post-operative needs. In reality, many of us underestimate the value os speech. Surgery may have saved the patient's life bvut created a social cripple. The look of frustration in every laryngec-tomee's face is mute testimony to the difficulaty they endure each day owing to the loss of their ability to vocalize their thoughts and needs. Herein lies the opportunity that offers so much to gain at such small price.

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EAR CHECK: A SCORING SYSTEM TO SCREEN AND GRADE OTITIS MEDIA IN PEDIATRIC PATIENTS

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NORBERTO V. MARTINEZ, M.D. ***

ABSTRACT

An Ear Check Scoring System (ECSS)to screen and grade otitis media has been developed. Thge ECSS was divided into two parts: the Patient's/Relative Protocol (PRP) made up of a combination of signs and symptoms of otitis media and the Examiner's Protocol (EP), composed of objective findings from otoscopy and ancillary procedures. Eighty-five pediatric patients from a local hospital were included in the study. A high correlation coefficient of 0.96934 was obtained between the PRP and EP total scores. The duration (0.78), odor (0.76), and color of discharge (0.72) had the best correlation with the examiner's total score. The PRO total scores and the corresponding cut-off value of 8 was significant, sensitive (81.25), and specific (86.49) in predicting the presence of chronic otitis media, while a cut-off value of 6 in predicting the presence of acute otitis media had a poor to fair sensitivity (71.43) ans specificity (55.96). Computed relative risk ratio of incidence of having the illness, were 2.66 and 4.04 in AOM and COM respectively.

INTRODUCTION

Otitis media is one of the common diseases that afflict children worlwide. Moreover, in a developing country like the Phil-ippines, it ranks as one of the common causes of morbidity in children. Despite the advent of broad spectrum of antibiotics, complications still abound and develop. This is agrravated by thr fact that dissemination of medical information is so poor an lacking that medical assistance and treatment is hardly sought for and for by these patients.

Based on a previous study by Campomanes, et.al., aptly entitled *"Akala ko luga lang"* it was discovered that most mothers regarded otitis media as a naturally-occuring "mild" ear infection that would resolve spontaneously. This was confirmed in the same study which revealed that s staggering 42 per cent of mothers would not seel medical advice even when the afflicted child develops purulent, foul-smelling ear discharge, locally known as "luga". It is a wide-spread belief that such 'mild' infection is part of childhood and will just disappear. Sometimes it does, but not without the risk of developing complications. In a local study by Rama, 40 per cent of brain abscesses in the past decade were found to be otogenic in origin.

There are no national statistics available but the prevelance of otitis media is unfortunately high and is consi-dered one of the common problems seen byt otolaryngologists, pediatricians, and general prac-titioners alike. However, because of the paucity of medical personnel and health workers in the rural areas coupled with misconceptions on its course, many cases of otitis media are not diagnosed, and worse, not treated.

OBJECTIVES

This study aims:

1. To devise and develop a scoring system, using a set of parameters composed of signs and symptoms to screen patients with otitis media and, if possible, grade its severity.

2. To determine the sensitivity, specificity, positve and negative predictive values of this scoring system in screening for and grading otitis media according to severity (well, ill, seriously ill).

3. To determine which parameter has the best correlation with the presence of otitis media.

4. To determine the acceptability and applicability of the scoring system among the target po-pulation - mothers/guardians, ba-ranggay health workers (midwives, nurses, health volunteers) and primary health care physicians.

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METHODOLOGY

PHASE I

PART I: DEVELOPMENT OF THE EAR CHECK SCORING SYSTEM

The scoring system used a combination of signs and syptoms which more or less represent common manifestations of otitis media and its complications,

The Ear Check Scoring System (ECSS) protocol was divided into two parts.

A. **Parent's/Relative's Protocol (PRP)** - composed of 12 questions describing two symptoms (otalgia, and hearing acuity) and 10 signs (presence of otorrhea, duration of discharge, presence of upper respiratory tract infection, color of ear discharge, odor of ear discharge, fever, facial nerve involvement (i.e. paraly-sis), level of consciousness, subperiosteaal abscess, and vomi-ting. (See appendix A)

B. **Examiner's Protocol (EP)** - composed of 12 items, all objective findings: presence of upper respiratory tract infec-tion; presence of otorrhea: color, and odor of discharge, and positive growth in cultures; tympanic membrane: color, integ-rity (i.e. perforation), mobility (pneumatic otoscopy), air-fluid level in the middle ear; granula-tion tissue/cholesteatoma;fever, mastoid x-ray; tympanogram; Audi-tory Maturation Response (AMR) Index in children below 4 years old and screening pure tone audiometry (500hz, 1khz, 2khz) in patients 5 years old and above; facial nerve involvement; level of consciousness; subperiosteal abscess; and presence/absence of vomiting. (See appendix B)

Each item has an equivalent score and correspindinng grades from 0, 1, 2, and 3. The total score was then calculated for both protocols (EP/PRP). By using appropriate statistical methods, each item in the Parent's/Rela-tive's Protocol (PRP) and its to-tal score were correlated with the total score of the examiner's (EP).

PART II THE PARENTS'/GUARDIANS' PERCEPTION OF THE EAR EAR PROTOCOL

Part II comprised seven questions which investigated the potential usefulness and applicability of the scoring system to the primary health care system (See appendix A-II)

PHASE II-FIELD TRIALS OF THE EAR CHECK SCORING SYSTEM

1. PATIENT POPULATION. Pediatric pateints aged 7 to 19 years old who sought or were brought for consultation because of otorrhea and/or otalgia, from December 1993 to September 1994 at the Outpatient Sections of the Divisions of Pediatrics and Otolaryngology, were included in the study.

The following were excluded from the study:

a. Patients with history of trauma to or manipulation of the ear.
b. Patients previously diagnosed with otitis media and currently on antibiotic therapy for the past one month.
c. Patients with congenital ab-normalities of the ear.
d. Patients who underwent ear surgery.

2. ADMINISTRATION OF THE PROTOCOL An Ear Check questionnaire, the Patients'/Relative's Protocol (PRP) was provided to parents or guardians of the subjects and was filled up prior to the examination. (appendix A)

The subjects were examined by one ENT resident (ETSC) who carefully filled up the corres-ponding Examiner's Protocol (EP). (appendix B)

3. GRADING THE SEVERITY OF THE ILLNESS. As there is no definite grading system which serves as 'gold standard' for grading the severity of otitis media, it was classified into those who have otitis medida (acute or chronic) and those who did not have (impacted cerumen, normal fin-dings, etc.) according to scores accumulated from the objective findings and diagnosis based on the examiner's assessment.

4. STATISTICAL ANALYSIS. The scoring system was designed to screen and, if possible, grade the severity of otitis media, with increasing scores identi-fying more severe illness. The specificity (the accuracy with which normal cases are identified as without disease) and sensit-ivity (the accuracy with which the score identifies those wih otitis media) were calculated for each score group to determine the accuracy of the scoring system. Predictive values (the chance of a case with a given score having a given grade of illness) were also calculated using the appropriate statistical method.

Linear regression analysis of the data was used to construct standard curves and to calculate correlation coefficients for the total scores from the Patient's/-Relative's Assessment(PRP) and its different parameters with the total score of the examiner's (EP).

For the purpose of validity testing, the subjects were dichotomized into those with or without ilness based on: 1) presence or absence acute otitis media (AOM); and 2) presence or absence of chronic otitis media (COM). The patient's score (based on the PRP) were analyzed using the Chi-square and Mantel-Haenzel test to determine their signifi-cance (p value) and relative risk in predicting disease. Cut-off values (PRP total score of 4 to 10) were

arbitrarily set and the sensitivity, specificity, posi-tive, and negative predictive values, accuracy and prevalence were computed accordingly.

The sensitivity, specifi-city, positve, and negative predictive values were calculated between the total scores as given by the patients/parents/guardians correctly identified those with illness as assessed by the examiners were calculated. A p-value of less than 0.05 was considered statistically signi-ficant.

RESULTS

Eighty-five pediatric pati-ents who consulted or were brought to the Outpatient Section of the Divisions of Otolary-ngology and Pediatrics were inclu-ded in the study. Age of the patients ranged from 9 months to 19 years old with a mean age of 6.16 years. There were 48 male (56.4%) and 37 female (43.5%) subjects. Sixty-one patients (71.7%) presented with an ear discharge and 24 (28.2%) with otalgia. In case of bilateral ear involvement, the poorer ear was graded and entered in the protocol.

All the patients were examined by one ENT resident (ETSC) who filled up the Exami-ner's Protocol (EP) while either the patients themselves or their relatives filled up the PRP. The results (TOTAL SCORES) are enumerated in Table I. (See appendix C)

As seen Table II (Appendix D), more that 50% of the patients were diagnosed to have chronic otits media (COM) with 6 (7%) patients having subperiosteal abscess, 2 (2.3%) with facial nerve paralysis, 2 (2.3%) with brain abscess of which one patient expired and upon autopsy revealed massive cerebral abs-cess. This was followed by acute otits media (AOM/OME) 23.5%, impacted cerumen (15.2%) and 2 patients (2.3%) were found to have foreign body in the ear presenting with otorrhea.

Associated diseases among the patients were urinary incontinence (1), cerebral palsy (1), non-Hodgkin's lymphoma (1), benign febrile convulsion (1), and two with primary complex infection confirmed by chest x-ray. More than half of the sample population were noted to have posterior neck lymphadenopathy.

A precedent history of upper respiratory tract infection was present in 64 (75%) patients with otitis media. Nine (10.5%) subjects had fever ranging from 37.8 C - 38.9 C and 5 (5.8%) above 39 C in the course of the disease.

In patients with impacted cerumen, the ear was cleansed to assess the integrity of the tympanic membranes. Pneumatic otoscopy was done on intact tym-panic membranes but not without any difficulty especially among infants and toddlers.

Of the 85 subjects examined by otoscopy, 23 (27%) had bila-teral tympanic membrane perforation, 9 (10.5%) had a right-sided perforation and 15 (17.6%) had it on the left. Among the patients diagnosed of otits media (N-60), 21 (30.4%) had either hyperemic or bullous tympanic membrane, 48 (69.5%) had a marginal or central perforation, 2 (2.3%) had perforation in the attic area. On pneumatic otoscopy, 19 (27.5%) had fair to poor tympanic membrane mobility and 49 (71%) had perforated ear drums where the procedure could not be done.

Two patients had air-fluid level in the mivddle ear (OME). Fourteen (20.2%) patients had granulation tissues in the middle ear or external auditory canal & 4 (5.7%) had cholesteatoma on otoscopy. Two patients had peripheral facial nerve paralysis ipsilateral to the diseased ear.

The ear discharge was purulent (yellowish or greenish) in 42 (60.8%) children, followed by whitish mucoid discharge in 15 (21.7&), and bloody discharge in 3 (4.3%) subjects. The discharge had a foul odor in 43.4% and the rest were non-foul smelling.

Culture & sensitivity was done after sterilizing the external auditory canal with alcohol. Afterwards a suction irrigation system for collecting discharge was used. In cases where otorrhea was readily accesible, a sterile cotton applicator was used. Of the 69 patients with otits media, only 52 (75.3%) had otorrhea on examination. Of these 44 (84.6&) were able to undergo culture and sensitivity studies where 41 (93.1%) yielded positive growths while 3 (6.6%) had none. Proteus sp. was isolated in 13 (30.9%), followed by Enterobacter sp. 7(16.6%), and Pseudomonas sp. in 6 (14.2%). The rest of the pathogens are listed in Table III (See appendix D). Mixed bacteria were noted in 8(19.5%).

Among the ancillary procedures, 11 (12.9%) patients underwent mastoid x-ray which revelaed mastoiditis in 6 (7.0%) and a radiolucent density suspicious of cholesteeatoma in 4 patients. CT scan was requested in a patient with cerebellar adscess and in two cases of meningitis.

Regarding audiometric eval-uation, 34 (40%) children below 4 years old were able to recognize & localize the sound stimulus in all angles when presented to them. The normal Auditory Matura-tion Response (AMR)(see Appendix E) served as a guidleine in grading their responses. On screening audiometry (500 hz, 1khz, 2khz), 8(9.4%) had mild hearing loss, 10 (11.7%) with moderate hearing loss, and 2 (2.3%) with severe to profound hearing impairement. Patients with subperiosteal abscess were not able to undergo audiometry because of the pain brought about by the copression of the headphones. One patient with cerebral palsy failed to comply with gthe simple instructions. Those with intracranial complications were not able to tolerate the procedure.

Alteration in the level of consciousness was observed in three cases: one patient with meningitis and two with brain abscess. Vomiting accompanied these cases as well as a patient with labyrinthitis. Sub-periosteal abscess was present in 6(7.0%)cases.

Of the 69 patients with itotis media, 8(9.4%)underwent mastoidectomy. In the patient with

cerebellar abscess, cranio-tomy was done. The intraoperative findings including the total scores are listed accordingnly. (See appendix F)

The mean of the **Patient's-/Relative Protocol (PRP)** and the **Examiner's Protocol (EP)** total scores were 7.40 & 7.89, respec-ively. The correlation coeffi-cient between the two were computed to be 0.86934 (See appendix G).

By means of linear regre-ssion analysis (MICROSTAT soft-ware progam), a correlation coefficient matrix was generated to relate the correlation of the different parameters enumerated in the PRP with both the PRP and EP total scores. (See appendix G)

As seen in Table IV, the duration (0.7889), odor(0.76122) and color of discharge(0.72597), respectively, have the best correlation with the Examiner's totoal score. On the other hand, the presence/abscence of otlagia (0.08969), facial nerve palsy (0.13999), and fever(0.16160) have the poorest correlation with the sverity of the disease. (See appendix G,H)

From the values in Table V, (Total Patient's Score Against Positive Acute Otitis Media), a cut-off value of 6 had the highest sensitivity (71.43%)and specificity(55.96%) in predicting the presence of acute otitis media. Significant cut-off values ($p<0.05$) were noted for total scores 4 to 8 (Appendix I)

On the other hand, Table V, (Total Patient's Score Against Positive Chronic Otitis Media) revealed that a cut-off valuec of 8 had the highest sensitivity (81.25% and specificity (86.49%) in predicting chronic otitis media. It is worthwhile to note that a wide range of cut-off values (from 6 to 10) were significant(p value<>0.05) in predicting COM from the PRP scores. (Appendix I)

PART II - PARENTS'/GUARDIANS' PERCEPTION OF THE EAR CHECK PROTOCOL

Of the 85 respondents, 30 (35.2%)reached or graduted col-lege, 36(42.3%) reached or fini-shed high school, 8(9.4%)reached or graduated in elementary, and 11% were vocational graduates.

The response to the questions in part two of the Parents'/Relative's Protocol (PRP) are summarized as follows:

1. **Was the Ear Check easy to use?**
   (Madali bang gamitin and checklist na ito?)
   97% of the respondents found the checklist easy to use, while 3% thought otherwise.

2. **Are you bothered with the knowledge of the severity of the illness of your child?**
   (Lalo ka bang natakot o napapayapa and iyong kalooban dahil nalalaman mo ang kalagayan ng iyong anak?)
   Some 20% were bothered, while 66% reported they were at ease with the knowledge of their child's illness. The rest, 14% had no answer.

3. **Do you think this checklist will be of benefit to ther mothers/parents?**
   (Sa iyong pala-ay, malaki ba ang pakinabang at magagamit o makakatulong ba ang checklist na ito sakaling ito ay gagamitin ng ibang nanay?)

   Ninety-eight per ent of the respondents believed that the Ear Check would be of benefit to other parents of children with ear pain or ear discharge.

4. **Will you recommend this checklist to parents whose chil-dren have either ear pain or ear discharge?**
   (Ito ba ay irere-komenda mo sa mga magulang ng mga batang may luga?)

   Some 97 per cent would recommend it while 3 percent would not..

5. **Will you use this checklist as basis for bringing your child to the doctor?**
   (Pagkakatiwalaan mo ba ang checklist na ito sa iyong paggawa ng desisyon kung dapat dalhin sa doktor and iyong anak?)

   Ninety-four percent would use this checklist as a basis for deciding if medical consultation or treatment is called for by the present illness. The rest did not reply.

6. **Which question/s were diffi-cult to understand or answer? Why?**
   (Ano sa mga tanong ang mahirap lagyan ng check o mahirap maintindihan? Bakit?)

   More that 70 per cent responded that no question was difficult to answer and under-stand. Six respondents indicated that *Question No.4 (absence or presence of otalgia)* was diffi-cult to determine because their children were still young and could not verbalize if there were pain. Some five relatives regar-ded that the *duration of dis-charge (Question No.2)* was difficult to determine since they cannot recall specifically when the discharge started. One mother was unable to differentiate a pustule over the post-auricular area from subperiosteal abscess. Facial nerve paralysis was misconstrued In 3 instances but was positively identified in two cases of seventh nerve palsy. Clarifications were asked by some mothers regarding *Question No.10(level of consciousness)*, but after some explanations they were able to understand. Clearly, language barrier was a factor in one patient (See Table I - EP27) who only knows the Visayan language. The latter got the widest discrepancy in scores between the EP and PRP.

DISCUSSION

Otitis media describes an "inflammation of the middle ear" and implies not only the middle ear cavity but also the eustachian tube and mastoid antrum"

In children, it has been reported that by age 6, 76% to 95% of children will have at least one episode of this disease. This can be partly explained by the anatomical predis-position of the eustachian tube in children which is more horizontal, shorter and wider in diameter. Otitis media incidence and prevalence peak in the pre-school years and decrease as age increases. In this series, the mean age was 6.16 years. Foreign literature has reported the following age-specific OM prevalence rates: neonates - 0 to 12 per cent; age 1: 12 per cent; age 2: 7 to 12 per cent; age 3 to 4: 12 to 18 per cent; age 5:4 to 17 per cent; age 6 to 8: 3 to 9 per cent; and age 9:0 to 6 per cent. The inverse relation between OM occurrence and age may be related to increased risk of respiratory infections, decreased immunocompetence or eustachian tube angle in infants and young children.

At present, otitis media is one of the most serious health problems in developing countries. Mainly due to inadequate medical treatment, lack of medical education in the acute stages of the disease, climatic conditions, contaminated waters and malnutrition. These conditions prevail in many years of the globe. For instance in Latin America, which has six million inhabitants, there are only eight practicing Otolaryngologists to serve them.

Otitis media is often preceded by an upper respiratory tract infection which is usually viral in origin. This includes any form of nasopharyngitis, tonsillitis, or laryngitis. In this study, more than 95% had a previous history of URTI. Non-infectious causes leading to mechanical obstruction of the eustachian tube orifice such as adenoid hypertrophy in children and nasopharyngeal carcinoma may also cause otitis media. These should be considered in cases of recurrent and non-resolving infection with adequate therapy.

Otitis media is classified into acute or chronic infection based on clinical or histopatho-logic basis. Histopathologically, acute criteria. media (AOM) refers to infiltration of polymorpho-nuclear cells with the classic signs of acute inflammation. Chronic otitis media (COM), on the other hand, implies invasion of the mucoperiosteum by round cells which are common in chronic inflammation. COM oftentimes lead to irreversible sequelae or pathology, such as perforated tympanic membrane, eroded ossicles, atelectasis of the middle ear, tympanosclerosis, cholesterol granuloma, granulation tissue or cholesteatoma. In advanced cases, it may lead to complications which are life threatening especially to the young. These sequelae may be facilitated pathways of infection: 1) extension by thrombophlebitis, 2) extension by bone erosion, and 3) extension by performed pathway.

Clinically, AOM is the initial 3 weeks of infection. It is labeled COM beginning 3 months following the onset and subacute between 3 weeks and 3 months. The classification adapted in the PRP was simplified into: **acute**(within 3 weeks) and **chronic**(more than 3 weeks) to facilitate simpler and easier communication.

Otitis media is associated with the presence of fluid in the middle ear. Basically, three types of effusions are found: (1) serous (serous otitis media - SOM), (2) mucoid (mucoid otitis media -MOM), (3) purulent (purulent otitis suppurative media - POM). Two other types can be added: (4) bloody effusion, and (5) any combination of the previously mentioned fluids (since most effusions are mixed). The classification was adapted In this study with purulent discharge predominating in this series.

Effusions come either from transudation from vessels and secretion from glandular cells in the middle ear.

When infected, it becomes a purulent effluent and the color changes from whitish to yellowish or greenish, and the odor becomes more and more disagreeable. This study showed that foul-smelling aural discharge has a good correlation in foreseeing the presence of otitis media.

The source of this bacteria most probably come from the nasopharynx where the eustachian tube drains. There are studies which show that in children with otitis media, over 50 per cent of cultures of the effusion recorded the same bacteria in the nasopharynx.

In this series, *Prosteus sp.* composed 30.9 per cent of all growths in aural discharge culture followed by *Enterobacter sp.*(16.6%) and *Pseudomonas sp.*(14.2%).

Thus, gram negative bacteria made up almost 80 per cent of all positive aural discharge growth while, gram positive microorganisms (alpha-hemolytic Streptococcus 4.8%, Streptococcus pneumoniae 2.4% and G-Streptococcus 2.4%) represent less than one fourth of all growths.

This finding is consistent with the local study by Alonzo (1988), which has *Pseudomonas* and *Proteus* as the leading pathogens in chronic otitis media patients. Another study by Del Rosario (1989), revealed the same bacteria in the culture of the aural aspirates in chronic cases.

In a local study by Rama (1992), 40% of patient with brain abscess who underwent surgery had otogenic abscesses and cited *Peptostreptococcus* 20% and Microaerophic *Streptococcus* (20%) as the main isolates. A poor third was *Proteus* (12.5%) and the least was *Pseudomonas* (4%). This is in contrast with foreign literature which points to the latter as the main culprit. The overall mortality rate was 15%.

The Parent's/Relative Pro-tocol (PRP) was formulated and written in the vernacular (Filipino) to make the respondents comfortable and acquainted with the questions and has aid them in answering the checklist. Majority of the respondents did not encounter any difficulty

in answering the check list. However, a handful needed guidance in comprehending some of the items. Two adolescent patients were unable to communicate when interviewed by the examiner because they were monolinguists knowing only the Visayan language. One father had to be assisted in answering the questions since he was unable to read.

Some questions needed clarification, such as the inquiry on otolagia. Although the questions described behavioral patterns pertaining to ear pain in patients below two years old such as irritability, ear tugging, and incessant crying, the mothers encountered some difficulty of serving young children especially infants who could not verbalized their complaint. However, majority of the mothers were able to identify such unusual behavior.

With regards to otorrhea, discrepancies in score between the examiner and guardian was observed especially when the ear discharge was present in the past and absent during examination. This discrepancy can be attributed to the patient in the early stage of hyperemia which rarely shows otorrhea and either the mother cleaned the ear prior to consultation or the host immune system was overcoming the infection. Thus, patients could present with otorrhea in the PRP and without otorrhea in the EP. This would somehow affect the correlation of scores of both protocols but despite these factors, the correlation remained significantly high.

Two patients with facial paralysis were identified positively by their parents and relatives. Some problems were encountered regarding the level of consciousness as well as the presence of subperiosteal abscess but once explained by the examiner, the respondent did not have a hard time understanding the query. With regards to vomiting, burping of babies was not misinterpreted as an unusual sign of vomiting.

Auditory Maturation Responses (AMR)(Appendix E) were observed in patients below 4 years old. Although this crude method of evaluation does not quantitatively measure the hearing loss in young patients, this modality at least gives an index of auditory development. This modality is accepted and is an integral part of pediatric audiologic evaluation worldwide. In patients with chronically discharging ear complaining of hearing loss to some extent, a complete audiometry in all frequencies was done.

As much as possible, available modalities currently employed in all the diagnosis of otitis media were initially included in this study such as history, physical examination, pneumatic otoscopy, impedance and pure tone audiometry, x-ray and tympanocentesis. In the absence of a tympanogram, pneumatic otos-copy could very well serve as a comparable method in evaluating tympanic mobility. It is highly suggested that mastoid x-ray be done in advanced and chronic cases.

No laboratory test exist that are specific to the diagnosis otitis media. As always, the clinician utilized a combination of clinical skills, adequate history, otoscopic examination, and ancillary procedures.

Since no single laboratory test could be used to diagnose otitis media, the following parameters were used as 'Gold Standards' of disease for testing the validity of the PRP total scores in screening for otitis media: 1) Acute otitis media or AOM (based on examiner's diagnosis-EP), 2) Chronic otitis media or COM (based on examiner's diagnosis-EP). The presence of AOM or COM was determined by a combination of historical, physical examination, laboratory, and ancillary procedure findings. It is worthwhile to note that patients who garnered a score of 5 and below were diagnosed with impacted cerumen, foreign body, or normal findings etc. while majority of the patients who scored higher than 8, included all patients who underwent surgery and those with complications.

The total scores of the Parent's/Relative's Protocol (PRP) were then correlated with the more objective findings of the ENT resident (ETSC) as reflected in the Examiner's Pro-tocol (EP) total score. The total scores of both protocols correlated very well with a high value of 0.86934 (Appendix G). Thus, because of the high correlation between the subjective findings of the Parent's/Relative Protocol (PRP) with that of the otolarygnologic and laboratory/ancillary findings, the feasibility of a scoring system in screening and possibly grading the severity of otitis media in pediatric patients is not far fetched.

The correlation coefficient of each and every parameter is enumerated in Table IV(Appendix H) and as mentioned, the duration (0.7889), odor (0.76122) and color of discharge (0.72597), respectively, have the best correlation with the Examiner's total score. On the other hand, the presence/absence of otalgia (0.08969), facial nerve palsy (0.13999) and fever (0.16160) have the poorest correlation with the severity of the disease. This findings indicated that the presence of aural discharge is still best diagnostic clue that an infection in the middle ear is on-going.

By using the appropriate statistical method, the p values, relative risk, sensitivity, specificity, positive and negative predictive values (PPV and NPV) accuracy and prevalence were computed using the Recorder-Operator Curve (ROC), the optimal cut-off values with the highest sensitivity and specificity were determined. The significant ranges and optimal cut-off values are summarized in Table VI (Appendix J).

The Relative risk (RR - the amount of risk a subject has in developing a disease, in this case, AOM, COM, if he is exposed, in this case, having a PRP total score or equal to or above the optimal cut-off score) was also calculated for each parameter in Table VII (Appendix J).

Extrapolating the above scores, and considering the cut-off values set for AOM and COM, this will give us a rough scale for a scoring system as seen in Table VII (Appendix J).

Thus, a patient who has a PRP total score of 9 has>4.04 times more risks of having chronic otitis media.

The fairly high levels of sensitivity, specificity, PPV,

and NPV, and relative risks between the PRP total scores in predicting COM, indicate that a scoring system for screening otitis media and probably grading its severity is very much possible. This is the main objective of this pilot study.

CONCLUSION

1. In a serires of 85 patients presenting with otorrhea and otalgia aged 9 months to 19 year old, Chronic Otitis Media (COM)comprised a high 57.6 per cent followed by acute otitis media 23.5 per cent.
2. Forty-one patients (78.8%) out of the 52 patients with otorrhea on examination, had a positive aural discharge culture, most common pathogen of which was *Proteus sp.* 30.9 per cent.
3. The Parent's/Relative's Protocol (PRP total score correlated well with the objective findings of the Examiner's Pro-tocol (EP) with a high cor-relation coefficient of r=0.86934.
4. Among the PRP parameters, the duration(0.7889), odor(0.76122) and color(0.72597) of discharge, respectively, had the best correlation with the Examiner's Protocol (EP)total score.
5. The PRP total scores and their corresponding cut-off scores were significant, sens-itive and specific enough in predicting Chronic Otitis Media (COM). However, PRP total scores was weakly significiant in predicting Acute Otitis Media (AOM) and had poor to fair sensitivity and specificity.
6. A scoring system was derived to roughly predict the presence of otitis medai and its severity(as to no disease, with disease, or severe disease). The following scores were calculated: 0-4(No disease); 5-7(With di-sease); 8 and above(With severe disease).
7. Based on the survey, the Earcheck Scoring System (ECSS) was easy to use and most respondents would recommend it to others.
8. This scoring system is relatively an accrate system for screening otitis media. Although it would be desirable to have a simple check list of a few individuaal symptoms, it would not grade the illness, nor be sensitive of specific as the ECSS which uses a weighted combination of symptoms and signs.

RECOMMENDATION

1. That the Earcheck Scoring System (ECSS) for the Parent's/Relative's Protocol (PRP) be revised with more weight be given (by means of a higher score equivalent) on parameters having high correlation(e.g. discharge odor, color, duration) with the diagnosis of otitis media (AOM, COM) including the life threatening complications.
2. Once formulated, the revised Earcheck Scoring System (ECSS)) be validated in a multi-center trial with more subjects and revisions made accordingly. It is important to find out how the scoring system works in practice and how accurate it is in different situations.
3. That the Earcheck Scoring System (ECSS) be finetuned and further improved to be sensitive and specific in grading the severity of otitis media, if such were present.
4. That visual aids/pict-ures be incoporated alongside the corresponding criterion/parameter in the Parent's/ Relatives Proto-col (PRP) to facilitate better understanding of the symptom or sign described.
5. Given enough funding, anaerobic and TB cultures may be done to cover potential bacteria present in chronic and recurrent cases.
6. Lastly, that a more comprehensive preventive and educational campaign be launched in order to ake thepopulation aware of the high incidence/prevalence of otitis media, its dangers and devastating sequelae. A better understanding of the disease is imperative so that early diagnosis and treatment be the rule among the population rather than the exception.

APPENDIX A
PATIENT'S/PARENT'S/GUARDIAN'S PROTOCOL (PRP)

Patient code number:_____
Patient's relative name:_____
Patient's name: _____
Age:_____ Sex: _____ Date:_____

1. May lumalabas bang sipon o luga sa tainga ng iyong anak?
   _____wala (0)
   _____mayroon (1)

2. Gaano ng katagal ang luga na lumalabas sa tainga ng inyong anak?
   _____kulang sa tatlong linggo (1)
   _____mahigit sa tatlong linggo (2)

3. Siya ba ay may sipon, ubo o pangangati ng lalamunan?
   _____wala (0)
   _____mayroon (1)

4. Masakit ba ang kanyang tainga? (Kung kulang sa isang taon, obserbahan ang kakaibang pagiyak, di mapakali, panay ang tangan sa tainga)
   _____hindi (0)
   _____oo (1)

5. Anong kulay ang luma;labas na luga sa tainga ng inyong anak?
   _____walang lumalabas (0)
   _____maputi na parang sipon (1)
   _____madilaw o berde (2)
   _____mapula na parang dugo (3)

6. Anong amoy ng luga na lumalabas sa tainga ng inyong anak?
   _____walang amoy (0)
   _____mabaho (1)
   _____parang amoy na mababulok (2)

7. Siya ba ay nilalagnat? (Gumamit ng thermometer kung mayroon. Ilagay sa bibig ang thermometer kung mahigit isang taon ang pasyente, ilagay sa puwit kung kulang isang taon ang pasyente)
_____ walang lagnat (0)
_____ may sinat o kaunting lagnat (hanggang 38.5 C) (1)
_____ mataas at inaapoy ng lagnat (mahigit 38.5 C) (2)

8. Humina baang kanyang pandinig?
_____ hindi humina, wlang pagbabago (0)
_____ kailangan sigawan o malakas na boses para marinig ang kausap (1)

9. May pagbabago ba sa kanyang mukha? (Pag-ngiwi sa pagngiti, hindi maisara ang mata)
_____ wala (0)
_____ mayroon (1)

10. May pagbabago ba sa kanyang kamalayan? (mental status or consciosness - kung kulang sa isang taon ang bata: mahina ba ng kanyang pag-iyak , walang ganang dumede o kumain, o tulug na tulog)
_____ wala (0)
_____ mayroon (1)

11.Tinutubuan ba siya ng pigsa o bukol sa likod ng tainga o sa mga parteng malapit sa tainga?
_____ walang pigsa o bukol (0)
_____ tinutubuan ng pigsa o bukol sa likod ng tainga (1)

12.Siya ba ay nagsusuka?
_____ hindi nagsusuka (0)
_____ nagsusuka hanggang tatlong beses sa isang araw (1)
_____ nagsusuka at di makakain o makinom (2)

II. Sagutin ang mga sumusunod na mga tanong:

1. Ano ang iyong natapos?
_____ Elementary _____ high school
_____ College _____ vocational

2. Madali bang gamitin ang check list na ito?
_____ oo _____ hindi

3. Lalo ka bang natatakot o napapayapa sa ckeck list na ito dahil nalalaman mo ang kalagayan ng iyong anak?
_____ natatakot
_____ napapayapa

4. Sa iyong palagay, malaki ba ang pakinabangan ay magagamit o makakatulong ba ang check list na ito sakaling gamitin ng ibang nanay?
_____ oo _____ hindi

5. Ito ba ay irerekomenda mo sa mga magulang ng mga batang may luga?
_____ oo _____ hindi

6. Pagkakatiwalaan mo ba ang check list na ito sa paggawa ng desisyon kung dapat dalhin sa doktor ang iyong anak?
_____ oo _____ hindi

7. Ano sa mga tanong ang mahirap lasgyan ng tsek o mahirap maintindihan? Bakit?
_____ tanong#1 sipon o luga sa tainga
_____ tanong#2 Tagal ng luga sa tainga
_____ tanong#3 Sipon,ubo o pangangati ng lalamunan
_____ tanong#4 Sakit sa tainga
_____ tanong#5 Kulay ng luga
_____ tanong#6 amoy ng luga
_____ tanong#7 Lagnat
_____ tanong#8 paghina ng pandinig
_____ tanong#9 pagbabago sa mukha
_____ tanong#10 pagbabago sa kamalayan
_____ tanong#11 pigsa o bukol sa likod ng tainga
_____ tanong#12 pagsusuka

APPENDIX B
EXAMINER'S PROTOCOL (EP)

Patient code number:_____
Patient's name: _____
Age:_____ Sex: _____ Date:_____

1. Presence of upper respiratory tract infection:
essentially normal (0)
any two of the following findings; Nasal discharge, congested turbinates, hyperemic of congested tonsils, , hyperemic of congested pharyngeal walll, postnasal drip (1)

2. Presence of ear discharge:
none (0)
yes (1)

If yes, Color of discharge
_____ white or clear (1)
_____ yellowish/greenish (2)
_____ red/bloody (3)

Odor of discharge:
_____ non-foul smelling (1)
_____ foul smelling (2)

Positive Growth:
_____ <100,000 CFU/ml (1)
_____ => 100,000 CFU/ml (2)

3. Tympanic membrane:
A. Color
_____ Opaque/white (0)
_____ Reddish/hyperemic/
_____ bullous lesions (1)

B. Perforation
_____ none (0)
_____ central/marginal perforation (1)
_____ attic perforation (2)

C. Mobility
_____ good mobility (0)
_____ fair to poor
_____ mobility (1)

D. Fluid in the Middle Ear
_____ none (0)
_____ with air-fluid level and/or air bubbles (1)

4. Granulation Tissues/Cholesteatoma
_____ none
_____ granulation tissue (1)
_____ cholesteatoma (2)

5. Fever:
_____ none (0)
_____ low to moderate grade (37.8-38.9(C) (1)
_____ high grade (>39(C) (2)

6. Mastoid X-ray:
_____ negative (0)
_____ with mastoiditis (1)
_____ with cholesteatoma (2)

7. Tympanogram
_____ Type A- normal middle ear pressure & mobility (0)
_____ Type B- little or no mobility/fluid in the

8. Pure Tone Audiogram (4 years old & above)
   _____ essentially normal
   _____ mild hearing loss (1)
   _____ moderate hearing loss (2)
   _____ severe to profound hearing loss (3)

9. Changes in facial expression (Facial nerve involvement, shallow nasolabial fold, inability to close the eye/s)
   _____ none (0)
   _____ with alteration (1)

10. Changes in the level of consciousness:
   _____ none (0)
   _____ with alteration (1)

11. Presence of vomiting:
   _____ none (0)
   _____ vomiting more than three times a day (1)
   _____ vomiting with inability to take in fluid (2)

TOTAL SCORE _____

FINAL DIAGNOSIS: _____

MANAGEMENT: _____

_____

ASSESSED BY: _____

APPENDIX C
TABLE I
EARCHECK DATABASE (1)

Code	Age/ Sex	Chief Complaint	PRP score	Examiner score	Culture	Diag-nosis
EP1	10/F	otorrhea	5	6	—	AOM AU
EP2	9/F	otorrhea	14	16	entero-bacter	COM, AD subperiosteal abscess benign febril convulsion
EP3	3.5/M	otorrhea	7	8	strep. pneumonia	AOM, AU
EP4	2/F	otorrhea	6	3	—	AOM, AU
EP5	2.75/M	otorrhea	5	2	—	normal findings
EP6	7/M	otorrhea	8	9	no growth	AOM/ Bullous myringitis
EP7	3/F	otalgia	3	3	—	AOM, AS, Primary complete acute viral illness
EP8	5/M	otalgia	7	7	—	AOM, AS urinary incontinence
EP9	1.5/M	otorrhea	8	6	—	AOM, AD
EP10	1/M	otorrhea	6	6	a hemolytic strep staphylo-coccus a.	AOM, AS
EP11	4/F	otalgia	2	0	—	impacted cerumen AS
EP12	1/M	otorrhea	6	5	proteus	AOM, AD
EP13	7.5/M	otorrhea	6	6	—	COM, AS cerebral palsy
EP14	1.3/M	otorrhea	6	3	—	AOM, AS
EP15	.91/F	otorrhea	9	5	no growth	COM,AS
EP16	4.5/M	otalgia	4	2	—	COM, AS
EP17	2/M	otorrhea	8	4	proteus pseudomonas	COM, AS
EP18	3/M	otorrhea	6	8	—	COM, AS
EP19	1/F	otorrhea	9	12	proteus	COM, AS subperiosteal abscess pre-auricular, AD
EP20	1.9/M	otorrhea	11	11	acinetobacter	AOM, AS
EP 21	5/M	otalgia	3	0	—	impacted cerumen, AS
EP22	2/F	otorrhea	7	5	—	COM, AS
EP23	3/M	otalgia	3	3	—	AOM, AS
EP24	16/M	otorrhea	9	13	proteus	COM, AU, HL,AU
EP25	2.8/M	otorrhea	5	8	proteus	COM,AS
EP26	13/F	otorrhea	8	11	proteus	COM,AS
EP27	6/M	otorrhea	13	5	—	COM, AU
EP28	2/F	otalgia	1	0	—	impacted cerumen
EP29	1,9/M	otorrhea	11	12	staphylo-coccus	COM, AD
EP30	13/M	otorrhea	11	11	—	COM, AU
EP31	1,.2/F	otorrhea	10	11	pseudomonas	COM, AU
EP32	2.25/F	otorrhea	10	11	enterobacter	COM, AD
EP33	6/F	otorrhea	55	—	foreign body, AD	
EP34	11/M	otorrhea	78	—	COM, AU	
EP35	3/M	otorrhea	11	10	enterobacter staphylococcus	COM, AU
EP36	5/M	otorrhea	10	13	a- hemolytic strep candida sp.	COM, AU
EP37	.9/M	otorrhea	9	11	enterobacter	COM, AU
EP38	.8/M	otorrhea	7	7	—	COM, AS
EP39	3/F	otorrhea	6	6	—	COM, AS
EP40	10/F	otorrhea	5	3	—	foreign body, cotton
EP41	12/F	otorrhea	10	7	—	COM ,AD
EP42	7/M	otalgia	6	3	—	AOM, AS
EP43	2/F	otorrhea	8	11	pseudomonas	COM, AD
EP44	2.5/F	otalgia	6	4	—	AOM, AU
EP45	1.6/M	otorrhea	9	12	citrobacter	COM, AS
EP46	14/F	otorrhea	11	12	—	COM, AU
EP47	5/F	otalgia	10	—	impacted cerumen	
EP48	11/M	otorrhea	11	13	pseudomonas	COM, AU
EP49	17/F	otorrhea	9	12	no growth	COM, AU
EP50	2/M	otalgia	1	1	—	impacted cerumen
EP51	10/M	otorrhea	9	12	staphylo-coccus	COM, AU
EP52	16/F	otalgia	12	15	proteus	COM, AD acute labyrinthitis
EP53	7/M	otalgia	7	2	—	impacted cerumen
EP54	2/F	otalgia	6	8	—	COM, AS
EP55	3/F	otalgia	3	4	—	AOM, AS
EP56	13/M	otalgia	1	0	—	impacted cerumen
EP57	8/M	otalgia	1	0	—	impacted cerumen
EP58	7/M	otalgia	2	0	—	impacted cerumen
EP59	5/M	otalgia	1	0	—	impacted cerumen
EP60	3/F	otalgia	1	0	—	impacted cerumen
EP61	5/M	otorrhea	1	0	—	impacted cerumen
EP62	9/M	otorrhea	11	16	klebsiella	COM, AS
EP63	14/F	otorrhea	11	13	no discharge	COM, AU non-Hodgkin's lymphoma
EP64	16/F	otorrhea	10	17	proteus	COM, AU facial nerve paralyisis
EP65	3/M	otorrhea	17	14	pseudomonas staphylo-ccocus	COM, AU subperiosteal abscess primary complex
EP66	3/M	otorrhea	9	11	proteus	COM, AU
EP67	12/F	otorrhea	14	14	—	COM, AS subperiosteal abscess
EP68	11/F	otorrhea	9	6	enterobacter staphylo-ccocus	AOM, AS
EP69	13/M	otorrhea	11	16	proteus	COM, AS facial nerve paralysis
EP70	4/F	otorrhea	6	9	enterobacter	AOM, AS
EP71	3/F	otorrhea	7	7	pseudomonas	COM, AU
EP72	10/M	otorrhea	13	16	proteus e. coli	COM, AD

cerebellar abscess						
EP73	0.8/M	otorrhea	8	10	staphy loccocus	
EP74	9/M	otorrhea	14	16	E. coli enterobacter	COM, AU COM, AD r/o meningitis
EP75	2/M	otorrhea	4	7	staphy-loccocus	AOM, AS
EP76	3/M	otalgia	1	0	—	impacted cerumen
EP77	4/M	otalgia	9	12	gamma-streptococcus	COM, AS subperioseal abscess
EP78	.75/F	otorrhea	8	9	staphy-loccocus A.	COM, AU
EP79	10/M	otorrhea	12	15	bacillus sp.	COM, AU brain abscess +
EP80	10/F	otorrhea	8	12	staphy-loccocus A. candida	COM, AD
EP81	12/M	otorrhea	9	13	proteus sp.	COM, AU subperiosteal abscess
EP82	19/F	otorrhea	12	14	staphy-loccocus A.	COM, AS
EP83	7/F	otalgia	6	5	—	OME, AD
EP84	1/M	otorrhea	8	10	proteus sp.	COM, AU
EP85	13/F	otorrhea	9	13	pseudomonas	COM, AU

+ expired

APPENDIX - D

Table II. Diagnosis of 85 Patients Examined

DIAGNOSIS	NO. (%)
Chronic otitis media	49 (57.6%)
- with subperiosteal abscess	6(7%)
- with facial paralysis	2 (2.3%)
- with brain abscess+	2(2.3%)
- with meningitis	1 (1%)
Acute ottis media/OME	20(23.5%)
Impacted cerumen	13(15.2%)
Foreign body	2(2.3%)
Essentially normal	1(1%)

+ one patient expired

Table III. Distribution of Pathogens in 41 Patients with Positive Culture Results

CULTURE	NO.(%)
proteus sp.	13 (30.9%)
enterobacter sp.	7 (16.6%)
pseudomonas sp.	6 (14.2%)
staphyloccocus sp.	7 (16.6%)
a-hemolytic streptoccocus	2 (4.8%)
g-streptoccocus	1 (2.4%)
streptoccocus pneumonia	1 (2.4%)
acinetobacter sp.	1 (2.4%)
citrobacter sp.	1 (2.4%)
klebsiella sp.	1 (2.4%)
bacillus sp.	1 (2.4%)
mixed bacteria	8 (19.5%)

APPENDIX - E
Normal Auditory Maturation Responses

Birth- 2 mos. -arousal from sleep
3 - 4 mos - rudimentary head turn
4 - 7 mos. - localization to side only
7 - 9 mos. - localizes to side and indirectly below
9 - 13 mos. - localizes to side and below
13-16 mos. - localies to side, below, and indirectly above
16-21 mos. - localizes directly all sginals to side and above
21-24 mos. - locates directly a sound to any angle

Auditory Behaviour Index for Infants: Stimulus and Levle of Response

Age	Noise-makers (Approx. SPL audio-metric zero)	Speech (Re: audio-metric zero)	Expected response	Startle to Speech
0-6w	50-70 dB	40-60 dB	eye-widening, eye-blink, stirring arousal from sleep, startle	65 dB
6w-4m	50-60 dB	47 dB	eye-widening, eye-shift, eye blink quieting; beginning rudimentary head turn by 4 mo.	65 dB
4-7m	40-50 dB	21 dB	head-turn on lateral plane toward sound; listening attitude	65 dB
7-9m	30-40 dB	15 dB	direct localization of sounds to side, indirectly below ear level	65 dB
9-13m	25-35 dB	8 dB	direct localization of sounds to side, directly below ear level, indirectly above ear level	65 dB
13-16m	25-30 dB	5 dB	direct localization of sound on side below and indirectly above	65 dB
16-21m	25 dB	5 dB	localizes directly all signals to side below and above	65 dB
21-24m	25 dB	3 dB	localizes directly a sound at any angle	65 dB

APPENDIX - F

Ear Check Patients who Underwent Surgery

	Operation	OR Findings	Examiner's Score	PRP score
EP 2	canal down mastoidectomy, AD	lateral sinus eroded; subcutaneous tissue & muscles necrotic; malleus & incus missing	17	14

EP48	intact canal wall mastoidectomy, AS	granulatons over the middle ear; cholesteatoma over the antrum	13	11
EP67	radical mastoidectomy, AS	granulation tissues over the masotid cortex; cholesteatoma eroding the posterior canal wall & mastoid cortex; tegmen tympani & sigmoid sinus intact; ossicles absent	14	14
EP65	intact canal wall mastoidectomy, AD	granulation tissues & cholesteatoma occupying the mastoid cortex & middle ear. Ossicles intact	17	14
EP62	canal down mastoidectomy, AS tympano-plasty III	Contracted mastoid cavity; cholesteatoma found in the antrum & epitympanum; posterior canal wall partly eroded by cholesteatoma; malleus & incus eroded by granulations, stapes covered with granulation	16	11
EP64	intact canal wall mastoidectomy, AS tympanoplasty III	Cholesteatoma occupying the mastoid antrum. middle ear filled with granulation tissues. malleus and incus eroded by granulations, stapes covered with granulation	17	10
EP69	radical mastoidectomy	Granulation tissues occupying the middle ear. ossicles eroded	16	11
EP72	canal down mastoidectomy burr holing of cerebellar abscess	Cholesteatoma occupying the mastoid antrum eroding the bony plates of the sigmoid sinus. Middle ear filled with granulations.	16	13

CORRELATION MATRIX

Leader Date for: A: Eardata Label: Earcheck database
Number of case: 85 Number of variables: 15

APPENDIX - G

	dis-charge	duration	URTI	otalgia
discharge	1.00000			
duration	.77120	1.00000		
URTI.	.33021	.23115	1.00000	
otalgia	-.15002-	.14841	-.14043	1.00000
color/DS	.67650	.61443	.31578	-.9764
odor/DIS	.69388	.75468	.17243	-.02669
fever	-.00406	.01658	.11264	.06515
deafness	.24187	.40234	.11103	-.15532
F nerve	-.00220	.11063	.03909	.06044
LOC	.13959	.22628	.10381	.01752
vomit	.18885	.31071	.01277	.10294
abscess	.28641	.40814-	.06734	.16485
P-total	.74128	.81567	.36244	.03899
E-total	.67609	.78889	.28089	.08969

	F nerve	LOC	abscess	vomit
F nerve	1.00000			
LOC	.11580	1.00000		
abscess	.34247	.33297	1.00000	
vomit	.00664	.46223	.41211	1.00000
P-total	.25371	.38333	.54586	.48258
E-total	.13999	.27293	.37647	.46730

	color/DS	odor/DIS	fever	deafness
discharge				
duration				
URTI				
otalgia				
color/DS	1.00000			
odor/DIS	.79493	1.00000		
fever	.09694	.13117	1.00000	
deafness	.19669	.29435	.17189	1.00000
F nerve	.00787	.07098	.19050	.3106
LOC	.04335	.06502	.21400	.4661
vomit	.22783	.32699	.26060	.1553
abscess	.16310	.25961	.32526	.2979
P-total	.77304	.83893	.37117	.4944
E-total	.72597	.76122	.16160	.4483

	P-total	E-total
F nerve		
LOC		
abscess		
vomit		
P-total	1.00000	
E-total	.86934	1.00000

Critical value (1 tail, .05)=+ or - .17971
Critical calue (2-tail, .05)= +/- .21317
N=85

APPENDIX - H

Table IV. Correlation Coefficients between PRP Parameters and PRP and EP total scores

Parameter	PRP total score	EP total score
1. presence of discharge	.74128	.67609
2. duration of discharge	.81567	.78889
3. presence of URTI	.36244	.28029
4. presence of otalgia	.03899	.08969
5. color of discharge	.77304	.72597
6. odor of discharge	.83893	.76122
7. presence of fever	.37117	.16160
8. hearing acuity	.49446	.44831
9. facial nerve palsy	.25371	.23999
10.level of consciousness	.38333	.27293
11.subperiosteal abscess	.54586	.37647
12.presence of vomiting	.48258	.46730

APPENDIX I: Validity Indices of the PRP vs Positive AOM and Positive COM

Table V. Total Patient's Score against Postive AOM

Score	A	B	C	D

AOM4	18	52	3	12
AOM5	16	51	5	13
AOM6	15	48	6	61
AOM7	7	44	14	20
AOM8	5	39	16	25

Score	sensitivity	specificity	PPV	NPV
AOM4	85.71%	18.75%	25.71%	80.00%
AOM5	76.19%	20.31%	23.88%	72.22%
AOM6	71.43%	55.96%	23.81%	91.04%
AOM7	33.33%	31.25%	13.71%	58.82%
AOM8	23.81%	30.06%	11.36%	60.98%

Score	accuracy	prevalence	P-value	relative risk
AOM4	35.29%	24.71%	.6434288	1.29
AOM5	34.12%	24.71%	.7351006	0.86
AOM6	58.46%	16.15%	.0219614	2.66
AOM7	31.76%	34.71%	.0042667	0.33
AOM8	35.29%	24.71%	.0033127	0.29

Table V. Total Patient's Score against Positive COM

Score	A	B	C	D
COM6	47	16	1	21
COM7	43	8	5	29
COM8	39	5	9	32
COM9	32	2	16	35
COM10	22	1	26	49

Score	sensitivity	specificity	PPV	NPV
COM6	97.92%	56.76%	74.60%	95.45%
COM7	89.58%	78.38%	84.31%	85.29%
COM8	81.25%	86.49%	88.64%	78.05%
COM9	66.67%	94.59%	94.12	68.63%
COM10	45.83%	98.00%	95.65%	65.33%

Score	accuracy	prevalence	P-value	relative risk
COM6	80.00%	56.47%	.000000	16.41
COM7	84.71%	56.47%	.000000	5.73
COM8	83.53%	56.47%	.000000	4.04
COM9	78.82%	56.47%	.000000	3.00
COM10	72.45%	48.98%	.000004	2.76

APPENDIX - J

Table VI. Validity Indices of the PRP vs Positive AOM and Positive COM

parameter	optimal cut-off score	relative risk	sensitivity	specificity
AOM	6	2.66	71.43	55.96
COM	8	4.04	81.25	86.49

Table VII. Cut-off values set for AOM and COM

PRP score	Diagnosis	Earcheck classification
0-4	normal findings	no disease
5-7	AOM	with disease
8 and above	COM	severe disease

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A NEW APPROACH IN THE MANAGEMENT OF SUPPURATIVE PERICHONDRITIS OF THE AURICLE

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CLINICAL ABSTRACT

OBJECTIVE : To present the experience in the management of suppurative perichondritis of the auricle utilizing a new technique of a Posteriorly Triangular Excision (PPTE).

DESIGN : Case series

SETTING : Tertiary Government Medical Center

PATIENTS : Six

RESULTS : Six patients seen from 1992 to early 1994 and diagnosed to have suppurative perichondritis of the auricle were managed utilizing a new technique of a posteriorly placed triangular excision. Cure was attained on all patients with no report of recurrences. Three of these had excellent post-operative cosmetic results and 3 had good aesthetic results.

CONCLUSIONS: The new technique of a Posteriorly Placed Triangular Excision Technique (PPTE) offers a reliable treatment procedure in the management of suppurative perichondritis of the auricle affording a fast, convenient, permanent, and practical cure with aesthetically acceptable results. Long-term comprehensive analytical study to compare the effectiveness of the various techniques so far suggested is recommended.

2ND PRIZE, PSO-HNS
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INTRODUCTION

The relative rarity of perichondritis of the auricle has resulted in scanty literature dedicated to this disease entity. Since most of the cases seen by previous authors were complications of endaural incisions for mastoidectomy, this may have been the reason why many felt that these cases were best left unadvertised [1]. With the advent of potent antibiotics, and the overall improvement of surgical techniques, this disease is now encountered rarely as a entity still haunts so many otologists aware of the possible deformity that could ensue despite careful treatment [1].

The objectives of management in suppurative perichondritis have remained constant: complete and permanent eradication of disease; and an aesthetically-acceptable post- infection ear. Simple incision and curettage have long been proven to be ineffective in achieving these, and in the attempt to arrive at a more cosmeticaly-acceptable post operative result, two methods have gained prominence: the excision technique as pioneered by **Straud** in 1963: and the through-and-through tubal drainage, also known as "**Dakinization**", which was introduced by **Stevenson** in 1964. Other authors who have printed articles on this topic offered techniques which are modifications of these two, more commonly, the through and through tubal drainage. Table 1 of the Appendix A enumerates the reported cases to date and their respective management's.

Straud's technique included a circumscribed excision of the overlying anterior skin, anterior perichondrium, and cartilage. Light dressing is applied and the defect, if warranted, is alter covered with a flap or graft. This method has been claimed to be very effective in the management of Gram negative infections such as ***Pseudomonas*** and ***Proteus***.[1,3]

Stevenson's technique was an incision and curettage with insertion of polythylene tubes at the anterior and posterior aspects of the concha which was used for drainage and intillation of an antibiotic solution as determined by culture and sensitivity. [1,2,5,6] At least one perichondrium was preserved. **Bassiouny** later recommended that the tubes be retained for at least a month, stating that elevation of the subperichondrial

space promoted chondrocytic growth. This procedure was claimed to have a more cosmetic result than that proposed by Straud [1]. Please refer to Appendix B for illustrations.

The aim of this report is to present the experience obtained in the management of suppurative perichondritis of the auricle utilizing a new technique of a posteriorly-placed triangular excision (PPTE), and to show it to be a reliable alternative to present forms of management being easier to perform, more convenient and practical to patients, and affording complete cure of the disease with cosmetically acceptable end results.

MATERIALS AND METHODS

All patients diagnosed to have suppurative perichondritis of the auricle from 1992 to 1994 were included in the study. A definite area of fluctuancy had to be present, and cases with only diffuse swelling were treated medically and not included in this study. The procedure was explained to them and their consent was obtained. All patients were admitted to facilitate monitoring and routine blood examinations and culture and sensitivity of discharge were done. IV cloxacillin was given initially which was then shifted accordingly with the result of the sensitivity test. Within 2 days, the patient underwent the procedure under general or local anesthesia.

The surgical technique included: an approximately one (1) centimeter per side triangular incision at the posterior aspect of the most independent and fluactuant area of the swelling: This incision was carried down to include the skin, posterior subcutaneous tissue, the posterior perichondrium, and the cartilage. The anterior perichondrium was spared as much as possible and the necrotic areas were curetted as neede (Please refer to Figure 2 of Appendix B). Moist and occlusive dressings were applied and changed twice daily. The wounds were monitored daily while in the hospital, and, upon discharge, the patient were followed up every 3 days for 6 days, then weekly for 2 weeks, and every 2 weeks for 2 months. IV antibiotics were discontinued after the procedure and oral preparations were prescribed for a week after discharge. Response to treatment was graded relative to the improvement on follow-up examinations as follows:

WORSE - if there was an increase in swelling and amount of discharge;

NO IMPROVEMENT - no change in swelling and amount of discharge;

FAIR - minimal discharge and diminished swelling but with impending marked deformity;

GOOD - no discharge and swelling but with moderate deformity;

EXCELLENT - no discharge and swelling, with minimal or no obvious deformity.

RESULTS

PT.	AGE/SEX	ETIOLOGY	CULTURE	MX	1 WK	1 MO	HOSP DAYS
1	22/F	infected pre-auricular sinus	no growth	PPTE	G	EX	5
2	29/M	post-traumatic	Staph.sp.	PPTE	F	G	4
3	50/M	infectious dermatitis	Staph.sp.	PPTE	F	G	21
4	41/M	post-traumatic	no growth	PPTE	G	EX	5
5	35/M	post-traumatic	no growth	PPTE	G	EX	5
6	28/M	burn	no growth	PPTE	G	G	19

PPTE - Posteriorly Placed Triangular Excision
F - FAIR
G - GOOD
EX - EXCELLENT

There were 6 suppurative perichondritis patients seen in this institution from 1992 to early 1994 and included in the study. In all of the cases, no more than two-third of the entire auricle was involved. Most of the helical structures were intact and these were preserved as much as possible during the operations. Five of the patients were male and one female. All the patients were admitted if not already admitted. Patient 3 and patient 6 were referrals from other departments. Except for patient 2, all underwent the procedure under general anesthesia, and apparently all tolerated the procedure well with disappearance of symptoms within 24 hours after the procedure. Persistent swelling and some amount of discharge persisted on patient 2 up to the second post-operative day and a repeat excision was contemplated. However, the patient requested to be discharged immediately because of an emergency at home, and when he was next seen after 5 days, marked improvemenmt of the wound was noted, thus, the procedure was deferred. Concomitant excision of the pre-auricular sinus was performed on patient 1 (refer to figures Appendix C for representative pictures).

No recurrence was reported and the deformities were minimal to almost absent after 1 month, with further improvement on succeeding follow ups. The patients were taught on how to regularly administer to their wounds, and no problem regarding this was relayed to the authors. Patients were able to go back to work upon discharge with minimal discomfort. Except for the two patients who were referrals from other departments, the patients' hospital stay never exceeded 5 days.

DISCUSSION

The external ear or pinna, with its very accessible position in the head is very susceptible to injury. Composed mainly of elastic cartilage that is covered only by minimal subcutaneous tissue and skin, this provides its main framework giving its usual form. Like all cartilages, which are a vascular and derive their nourishment mainly by diffusion from their adherent perichondrium, the auricle becomes very susceptible to infection whenever its sources of nourishment are compromised by infection and trauma. Necrotic and fibrotic changes easily occur, and because of its anatomical location, more than mild distortion of its shape leads to a permanent disfiguring result, worst of which is the development of a "cauliflower ear". Treatment, therefore must address these expected changes with prompt and complete elimination of disease and an intention of coming up with a good post-infection cosmetic result. Prompt cure can be achieve by early diagnosis and treatment which include a good drainage and complete removal of diseased and necrotic tissues. Proper understanding and application of the principles of wound healing would be a valuable tool in insuring an acceptable post-operative cosmetic result.

Wound healing involves a complex cellular and biochemical. It is composed of temporarily overlapping phases namely: an inflammatory or substrate phase, a proliferative phase, and the phase of contraction and remodeling.[7] The inflammatory phase is the body's initial reaction to an injury which includes the migration of polymorphonuclear cells, lymphocytes, platelets, fibroblasts, and macrophages to the site of injury in the attempt to contain it and to any down the initial groundwork for repair. During the proliferative phase, the synthesis of structural proteins dominates the activity within the wound where the deposition of collagenous matrix, the beginning of neovascularization, and resurfacing of the epithelium occur. Epithelial cells migrate from the wound edges at 12 to 21 um/hr.[7] depending on local humidity and oxygenation. While fibroblastic replication and neovacularization are stimulated by the initial lowered oxygen tension, as blood flow returns, oxygen tension increases, and more efficient fibroblastic collagen synthesis occur. Wound contraction phase coincides with the decline of the inflammatory and proliferative phase, and is maximal at about 10 days. The average rate of contraction is 0.6 to 0.7 mm per day and is somewhat faster in stellate or rectangular defects than in round injuries.[7] It is in this phase that remodeling of wound and strengthening occurs, and because of contraction, the wound defect if reduced by 40% to 60%.

Factors that prolong any of these phases would prolong the over-all rate of healing. These include, poor surgical technique, hematoma, foreign body reaction, desiccation and ischemia.[7] Infection is the most common local depreciator of wound healing. It alters wound healing by excerbating and prolonging the inflammatory response, and bacterial competition for oxygen and other nutrients cause sustained decreased oxygen tension and pH that interferes with effective collagen synthesis, deposition, and maturation. In the same manner, poor surgical technique, ischemia and desiccation predispose to tissue necrosis that could become a medium for bacterial growth. Poor hemostasis, hematoma, and foreign bodies mechanically stress the wound and provide additional material for bacterial growth.

Stroud's technique which included a circumscribed excision of the abscess anteriorly with removal of the anterior skin, subcutaneous tissues, the anterior perichondrium, and cartilage undoubtedly was able to provide eradication of infection and necrotic debris, good drainage, exposure, and aeration.[3] Unfortunately, because of its anteriorly-placed incision and the greater size of the resulting defect, healing was expectedly slower with more fibrosis and consequently greater wound contraction that often led to problematic cosmetic results.

Through and through tubal drainage, pioneered by ***Stevenson*** and later modifed by ***Bassiouny*** has been claimed to be effective in the management of all types of suppurative perichondritis.[1] It provided drainage, a passageway for direct instillation of antibiotic, and has been demonstrated to provide acceptable aesthetic end results.[4,1] But because of the limited incision, curettage is done blindly and some necrotic tissues may be left behind. The tubes, being foreign bodies and left in place for at least a month, are cumbersome, encourage bacterial superinfection, and prolong the inflammatory phase of wound healing. These are likewise prone to clog necessitating repeated cleaning with trocar.[1,7] Additional tissue stress, injury, and further bacterial contamination is thereby introduced repeatedly. More frequent follow ups is also required to monitor the wound, resulting in increased patients' absence from work.

Lastly, the present cost of antibiotic and steroid solutions are quite inhibitory and may not very practical in an economically depressed society.

In this experience, it is demonstrated that the new technique of a posteriorly-placed triangular excision (PPTE) for the management of suppurative perichondritis of the auricle, particularly those affecting less than 2/3 of the auricle with most of the helical structures intact, afforded a reliable, convenient, easy, and practical mode of management. To attain complete excision of diseased and necrotic tissues with a small resulting defect, and minimize the expected wound contraction brought about by a large defect as what happens with Stroud's technique, a triangular incision was performed. This minimized the size of the wound with the three angles providing extensions that facilitated access in the visualization and removal of diseased and necrotic tissues. It also provided an opening for drainage of remaining debris and aeration necessary for healing and to occur at a faster rate. The

APPENDIX A

SUPPURATIVE PERICHONDRITIS...

TABLE I. REVIEW OF 206 CASES REPORTED TO DATE[1]

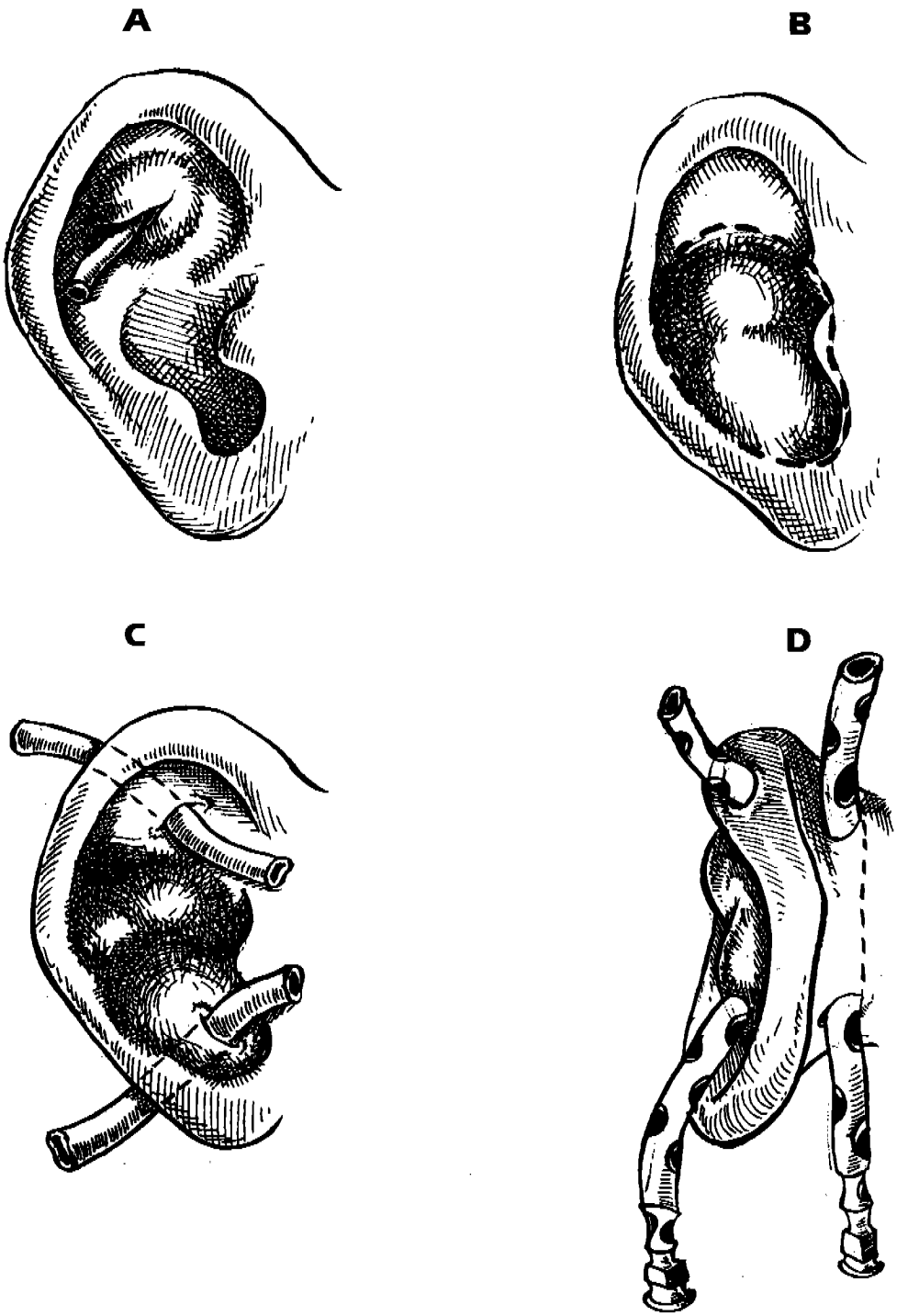
AUTHOR	NO. of CASES	ETIOLOGY	Methods of Treatment
Lombardo 1955	8	postoperative	antibiotics (streptomycin, chloramphenicol)
Salem 1960	1	postoperative	multiple incisions
Bordial & Richard 1960	4	postoperative	antibiotics (colimycin)
Stroud 1963	10	postoperative	repeated incision (3 cases) excision (7 cases)
Stevenson 1964	1	postoperative	tubal drainage
Lele 1964	4	postoperative (2 cases) post-traumatic (2 cases)	ultraviolet
Wanamaker 1972	6	postoperative (2 cases)	tubal drainage
Dowling et al. 1968	147	Burn	excision method and total chondrectomy
Apfelberg, et al 1974	5	Burn	tubal drainage
Martin et al 1976	5	Burn	excision technique
Bassiouny 1981	15	Postraumatic (12 case) Burn (3 cases)	excision (4 cases) tubal drainage (12 cases)

TABLE 2. COMPARISON OF THE 3 MODES OF MANAGEMENT OF SUPPURATIVE PERICHONDRITIS OF THE AURICLE

	Stroud's Excision	Through & through tubal drainage	**Posteriorly-Placed Triangular Excision (PPTE)**
Ease of surgical execution	easy	harder	**easier**
Elimination of disease	(+) cure	(+) cure	**(+) cure**
Cosmetic end result	frequent deformity	minimal deformity	**minimal to no deformity**
Dressing & wound maintenance	simple moist occluded dressing	frequent instillation of antibiotic drops & cleaning of tubes w/ trocar	**simple moist occluded dressing**
Recurrence	(+)	(-) reported	**(-) reported**
Cost	inexpensive	expensive	**inexpensive**

APPENDIX B

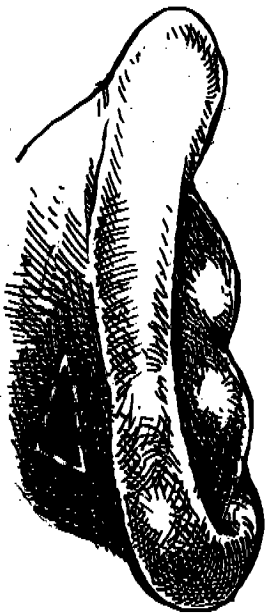
Figure 1: The different surgeries done for suppurative perichondritis of the auricle. A. Incision and drainage using an indwelling catheter, B. Stroud's proposed excision technique (incision is outlined); C. Through and through penrose drains; D. A modification of through and through tubal drainage. [1, 6]



APPENDIX B

Fiigure 2: A. The posteriorly-place trainagular excision technique (PPTE) as proposed by the authors.
B. The excision is carried down to include the posterior skin and subcutaneous tissues, the posterior perichondrium, and the cartilage.

A



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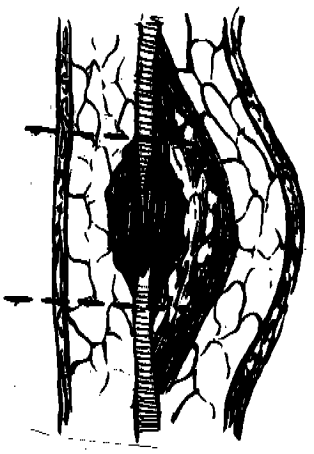

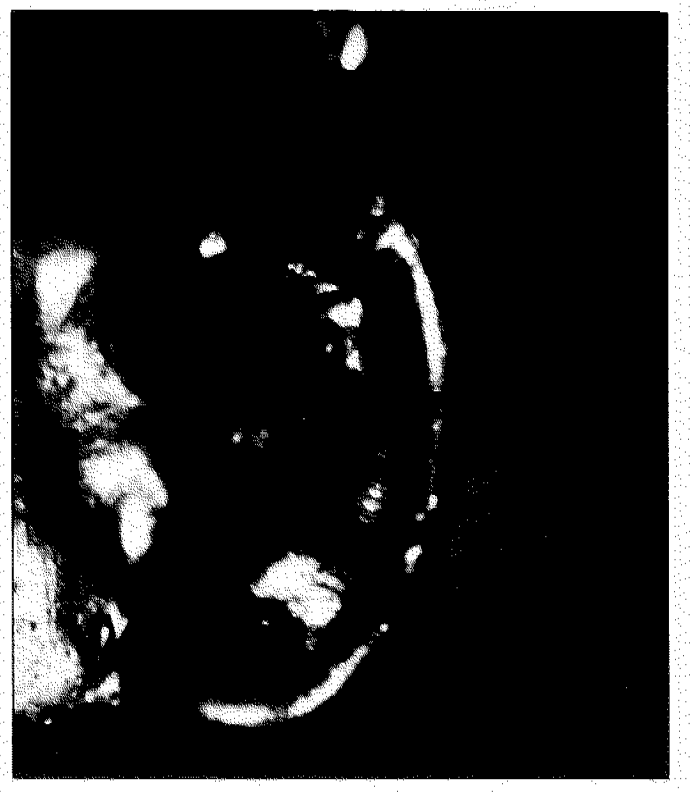

FIGURE 1: PATIENT 3 ON ADMISSION. A DIFFUSELY SWOLLEN AURICLE WITH MULTIPLE PUSTULAR ERUPTIONS AT THE EAR, SCALP AND BACK AREAS. FLUCTUANCY WAS NOTED AT THE SUPERIOR 2/3 OF THE AURICLE.

FIGURE 2: POSTERIOR VIEW OF THE SAME PATIENT, NOTE THE MULTIPLE PUSTULAR ERUPTIONS.

FIGURE 3: RPTE PERFORMED ON THE SECOND HOSPITAL DAY UNDER GENERAL ANESTHESIA.

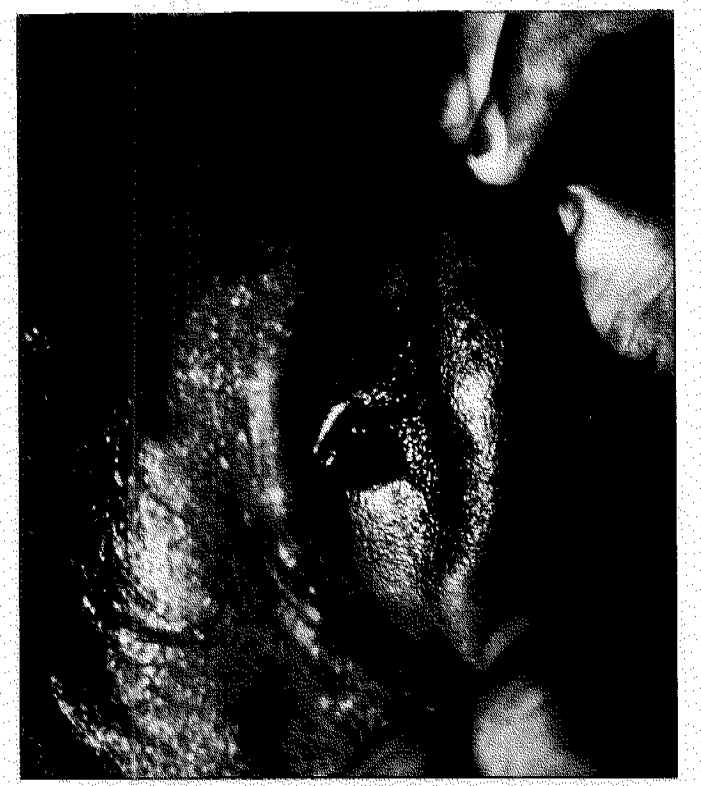

FIGURE 4: PATIENT 2 AFTER 3 WEEKS. NOTE THE SIGNIFICANT REDUCTION IN SWELLING AND SIZE OF WOUND WITHOUT MARKED DEFORMITY.

FIGURE 5: LATERAL VIEW POF THE SAME PATIENT AT 3 WEEKS POST OPERATION.

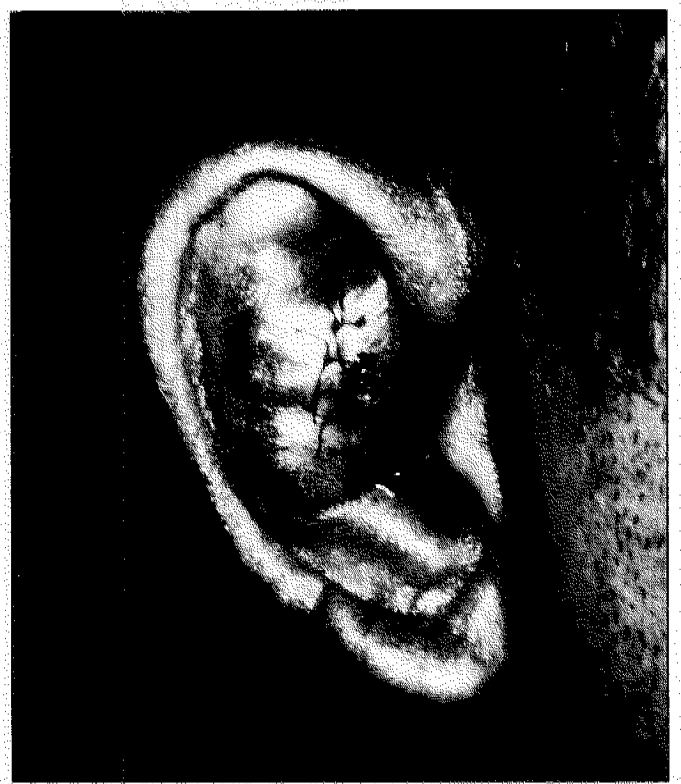

FIGURE 6: PATIENT 5 ON ADMISSION AFTER DEVELOPING A FLUCTUANT SWELLING OF THE RIGHT AURICLE 1 WEEK POST-TRAUMA.

FIGURE 7: 5 DAYS POST-PPTE WITH NOTICEABLE DECREASE IN SWELLING AND TENDERNESS. NOTE THAT PATENCY OF INCISION HAS BEE MAINTAINED.

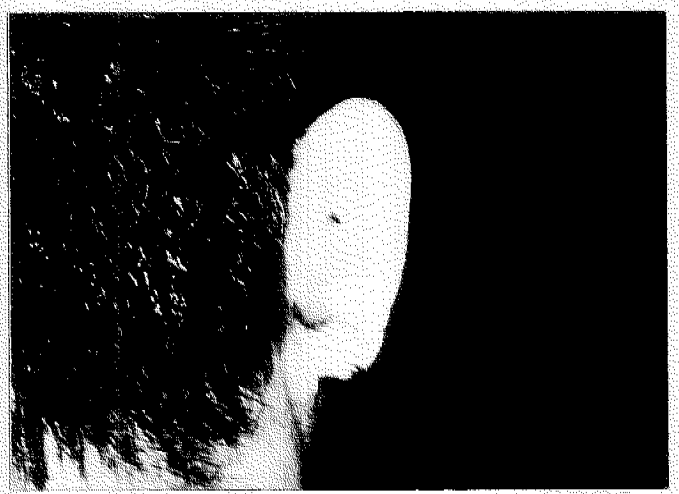

FIGURE 8: PATIENT THREE WEEKS POST PPTE WITH MARKED DIMINUTION OF SWELLING. NOTE THAT THE SIZE OF THE WOUND HAS DECREASED BUT REMAINED PATENT.

FIGURE 9: ANOTHER VIEW OF PATIENT 5 AT 3 WEEKS POST - PPTE. COSMETIC RESULT WAS EXCELLENT.

shape, being nearly stellate, has been determined to hasten the contraction and remodeling phase of wound healing.[7] It was easier to execute surgically, with the one centimeter sides conveniently conforming with the average dimensions of our patients' ears, especially when helical structures were to be preserved.

Because of the natural-concave configuration of the auricle, it is believed that a posteriorly placed defect, in addition to being less conspicuous, would be more resistant to the contractile forces in wound healing, resulting in minimal, if any, cosmetic deformity. Furthemore, because of this relative resistance, patency of the drain was maintained, a problem usually encountered with an anterior excision. Despite the common belief that an abscess should be incised at the most fluctuant and affected area, this experience reveals that a positive effect in the healing and cosmetic result was brought about by a posterior incision. With this procedure, no foreign body, such as unsightly tubes were maintained, eliminating a possible source of infection and a prolonged inflammatory reaction. Since only simple wound cleaning and dressing were required, which the patients themselves could accomplish, few follow-up meetings were needed to monitor the wounds. Prolonged absence from work and cumbersome dressing procedures and instillation of expensive antibiotic solutions were avoided. Table 2 of the Appendix A compares this new technique with the more commonly used procedures.

This experience evidently shows that the objectives in the management of suppurative perichondritis of the auricle could be accomplished utilizing a triangular excision technique, particularly those limited to less than 2/3 of the auricle with most of the helical structures intact. It is relatively easy to execute surgically, provides adequate drainage, is more practical, and affords complete cure of the disease with aesthetically acceptable end results. It is therefore, suggested that this procedure be considered as the primary treatment modality in suppurative perichondritis.

RECOMMENDATIONS

In the light of deficient literature dedicated to this disease entity, it is advisable that more reports be submitted and experiences shared. A thorough long term, analytical study comparing the present modes of management's is likewise deemed necessary.

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THE MODIFIED TOWNE'S VIEW: AN ALTERNATIVE TO THE STANDARD SUBMENTOVERTICAL VIEW IN THE DIAGNOSIS OF ZYGOMATIC ARCH FRACTURES*

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ABSTRACT

OBJECTIVE:
To evaluate the Modified Towne's View (MTV) as an alternative tool in the diagnosis of zygomatic arch fractures. To compare the sensitivity of MTV with that of the Submentovertical View (SMV) in zygomatic arch fractures.
DESIGN: Validative Study using intraoperative findings as the gold standard
SETTING: Tertiary Government Hospital
PATIENTS: 48
RESULTS:
A copositivity of 76.7% and a conegativity of 13.3% for an overall agreement of 90% was found between the SMV and MTV. The sensitivity of the MTV and the SMV are 94.6% and 96.2% respectively, the difference not being statistically significant.
CONCLUSION:
The Modified Towne's View is a reliable alternative to the Submentovertical View in the radiologic evaluation of zygomatic arch fractures. The procedure proves valuable in the assessment of patients with concomittant multiple head and neck injuries.

INTRODUCTION

The ever increasing frequency of assaults and motor vehicle accidents, the two most frequent etiologies for facial fractures, has resulted in a rising incidence of these injuries in the past decade. Radiologic evaluation of these injuries has become an important aspect of management. However, radiologists frequently feel uncomfortable interpreting facial radiographs in a severely traumatized patient because of unfamiliarity with the complex craniofacial anatomy and the difficulty in obtaining high quality radiographs in these patients.

Facial fractures account for 2% of all hospital admissions in the United States and are a significant source of morbidity. Chae, in a Korean retrospective statistical study on 83 cases of zygomatic fractures, revealed that these types of fractures occupied 31.9% of facial bone fractures, the main age group being the second and third decades (37.5% male to female ratio). The percentage of an isolated zygomatic fracture account for about 17% of all ENT admissions. Of these, 25% involved the zygoma, either isolated or in combination with other facial fractures.

Nakamura and Gross described a series of 323 patients admitted for fractures of the zygoma. The common fracture pattern consists of three fracture lines crossing the arch, with depression of the central two fragments and outer displacement of the zygomatic and temporal ends of the arch. Disruption of the zygomatic arch can be identified on the Water's view by noting the interruption or overlap of bony fragments. The zygoma has an appearance similar to an "elephant's trunk" - an analog useful for evaluation of zygomatic injury. However, this view, while showing the fracture in most cases, is not adequate for assessing the degree of depression and rotation and other available projections are usually necesssary.

Presently, the radiographic procedure of choice in the evaluation of zygomatic arch fractures is the basal or submeto-vertical (SMV) view,(7,8) where the canthomeatal line is placed parallel to the film and the central ray is passed through the sagittal plane of the skull perpendicular to the canthomeatal line at its midpoint. This therefore requires positioning the patient in full neck extension because the more nearly perpendicular the axis of the head is to the film, the more satisfactory is the projection of the zygoma. This provides an excellent assessment of the zygoma for fractures and estimation of depression of bony fragments. Unfortunately, this position may be difficult to acheive in patients who are uncooperative or those who have sustained severe injuries to the maxillofacial framework including the neck. Understandably,cervical spine injuries have to be ruled out prior to positioning the patient in the SMV as it is obtained with the neck in hyperextension which may cause pain, discomfort or, worse, additional injuries.

Improper positioning eventually leads to poor projections of the zygoma rendering the evaluation of the arch inadequate. Ultimately, this results in costly repeat examinations, poor preoperative evaluation and possible delay or neglect in management.

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An alternative radiographic procedure, therefore, needs to be utilized - one that is more tolerable but would not sacrifice a clear projection of the zygoma.

In the standard Towne's view, the patient is placed in a supine position with the canthomeatal line perpendicular to the plate. The central ray is directed through the foramen magnum at a caudal angle of 30 degrees to the orbitomeatal line or 37 degress to the inferoorbitomeatal line. (Towne recommended that with the chin depressed, the central ray be directed through the median sagittal plane from a point 3 inches above the eyebrows to the foramen magnum with the central ray angulation dependent on the flexion of the head.)

In a variation of this procedure - the Modified Towne's View (MTV) - the central ray is angulated 37 to 45 degrees caudally to the inferoorbitomeatal line and an excellent picture of the zygomatic arch is projected free from its surrounding bony structures. With this procedure, uncooperative and severely injured patients could be evaluated in comfort and safety as the need for neck hyperextension is eliminated.

Presently, no available literature, whether foreign or local, has ever mentioned the use of the MTV in the evaluation of the zygomatic arch for fractures.

The study aims to: (a) evaluate the MTV as an alternative diagnostic tool for zygomatic arch fractures; and (b) compare the sensitivity of the MTV to that of the SMV in the diagnosis of zygomatic arch fractures.

METHODOLOGY

A. STUDY OBJECTS

The subjects consisted of 48 trauma patients with suspicious zygomatic arch fractures seen at the ENT Emergency Room of this medical center from January, 1993 to August 1994 (3 with gunshot wounds in the maxilla, 1 with facial hack wounds, 11 vehicular accident victims, and 33 mauling victims).

All patients were made to undergo radiologic evaluation using the standard SMV and MTV. In some cases, however, only one particular view was used (MTV only) as certain subjects could not be positioned properly for a particular procedure (SMV) due to extent of injuries and uncooperativeness. In 18 of the 48 subjects (2 with gunshot wounds, 1 with hack wound, 5 vehicular accident victims and 10 mauling victims), only the MTV could be done as the patients could not be positioned properly.

The distribution of subjects by radiograph procedures are shown in Tables I and II. Table I classifies subjects into 2 groups based on x-ray procedures (MTV only, both). Table II shows the total number of subjects who underwent each procedure.

Table I. Number and Percentage of Patients According to x-ray Procedure

	No.of patient	Positive #	Positive %	Negative No.	Negative %
MTV	18	11	61.1	7	38.9
MTV + SMV	30	26	86.7	4	13.3
TOTAL	48	37	77.1	11	22.9

Table II. Number and Percentage of Patients with Radiologic Evidence of Fractures

	No. of Patients	Positive No.	Positive %
MTV	48	35	72.9
SMV	30	25	83.3

B. STUDY DESIGN

This is a validative study where, first, the MTV is validated against the SMV and, second, the MTV and SMV were separately validated against the intraoperative findings which served as the gold standard.

C. DATA COLLECTION

All patients with suspicious zygomatic arch fractures underwent surgical exploration based on the following criteria:

a. clinical presence of fractures (step-off deformity, depressed zygoma, trismus, bony crepitation)
b. open wound with exposed zygomas
c. presence of multiple maxillofacial fractures
d. radiologic evidence of zygomatic arch fractures in either MTV and SMV

All those with negative findings on PE and x-rays were observed, subsequently discharged and followed up at the OPD for reevaluation.

A total of 37 patients underwent exploration of the zygoma either by utilization of the open lesions or via Caldwell-Luc incisions. The zygomatic arch was identified, visualized and palpated for evidence of fractures. Reduction of the fractures was done and, if warranted, fixated with interosseus wiring. The intraoperative findings were recorded and the x-ray plates collected.

All plates were then randomly assessed for radiologic evidence of fracture by a team of radiologists who were unaware of the intraoperative findings.

ANALYSIS

In the validation of the SMV against MTV, the copositivity and conegativity were computed and the

degress of agreement and disagreement between the two procedures on the presence and absence of fractures were taken.

In the validation against the gold standard (intraoperative findings), the sensitivity of the MTV and SMV separately and in combination were computed.

RESULTS

Of the 48 subjects included in the study, 30 were evaluated using both the SMV and MTV procedures. However, in 18 patients, only the MTV could be done as the patients could not be positioned in the SMV.

Of the 18 subjects who underwent the MTV procedure, 11 had radiologic evidence of fractures and were thus admitted for exploration. The remaining 7 cases were subsequently discharged and made to follow up at the OPD.

Of the 30 patients who underwent both MTV and SMV procedures, 26 patients had radiologic evidence of fracture broken down as follows: 23 positive on both MTV and SMV plates; 2 positive on SMV but negative on MTV; and 1 positive on MTV but negative on SMV. These were admitted for exploration and the remaining 4 cases who were negative on both procedures were discharged and made to follow up at the OPD.

All the patients who underwent exploration were noted to have zygomatic arch fractures intraoperatively (37). Of these, 7 cases (18.0%) were isolated zygomatic arch fractures while the rest (30 cases or 82.0%) had arch fractures in association with other facial fractures.

VALIDATION OF MTV AGAINST SMV

Table III shows that MTV and SMV have a copositivity of 76.7% and a conegativity of 13.3%. There is a high degree of agreement between the two procedures (90.0%).

VALIDATION AGAINST THE GOLD STANDARD

Table IV shows the sensitivity of MTV at 94.6% and SMV at 96.2%. The difference in their sensitivities are not statistically significant.

TABLE III. DISTRIBUTION OF 30 PATIENTS WHO HAD BOTH X-RAY PROCEDURES

		SMV +	SMV -	TOTAL
MTV	+	23 (76.7)	1 (3.3)	24
	-	2 (6.6)	4 (13.3)	6
TOTAL		25	5	30

(+) with radiologic evidence of fracture
(-) with no radiologic evidence of fracture

Table IV. SENSITIVITY OF PROCEDURE

	No. of Cases w/ intra-op fracture	No. of Cases w/ fracture on x-ray	Sensitivity
MTV	37	35	94.6%
SMV	26	25	96.2%

DISCUSSION

A meticulous Clinical and radiological evaluation of an injured bone is imperative before any surgical repair could be planned and carried out to approximate the deformed architecture to its nearest preinjury state. This principle especially holds true with injuries involving the facial framework since an inadequate preoperative evaluation of facial injuries leads to an ill prepared surgery whose results are functionally inadequate and aesthetically unaccpetable. Needless to say, a maxillofacial trauma surgeon is concerned not only with the restoration of function but is also wary of the psychological misery that can result from an improperly reconstructed facial anatomy.

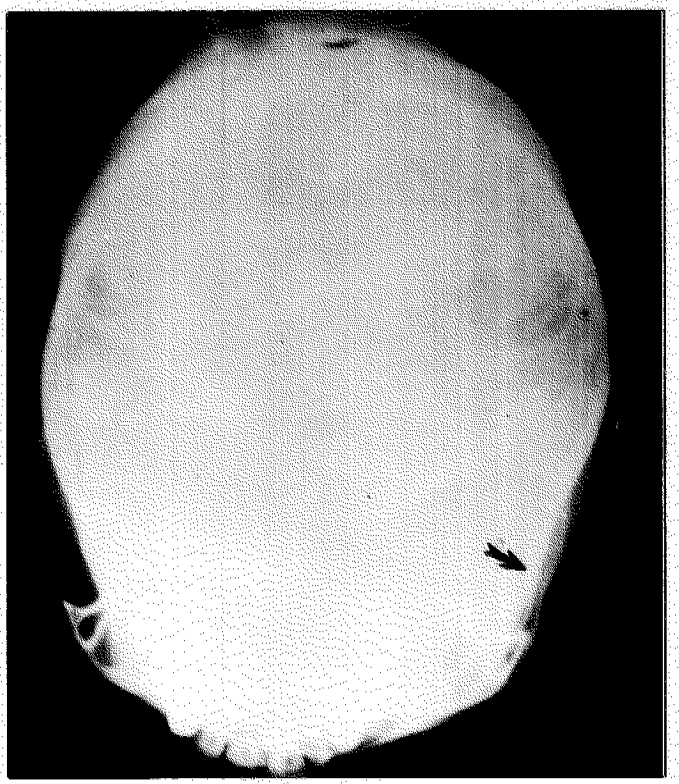
With zygomatic arch injuries, fractures are routinely diagnosed radiologically using the standard SMV view. However, this procedure is limited by factors which affect the patient's cooperation to be positioned in this procedure like multiple injuries and changes in levels of consciousness.

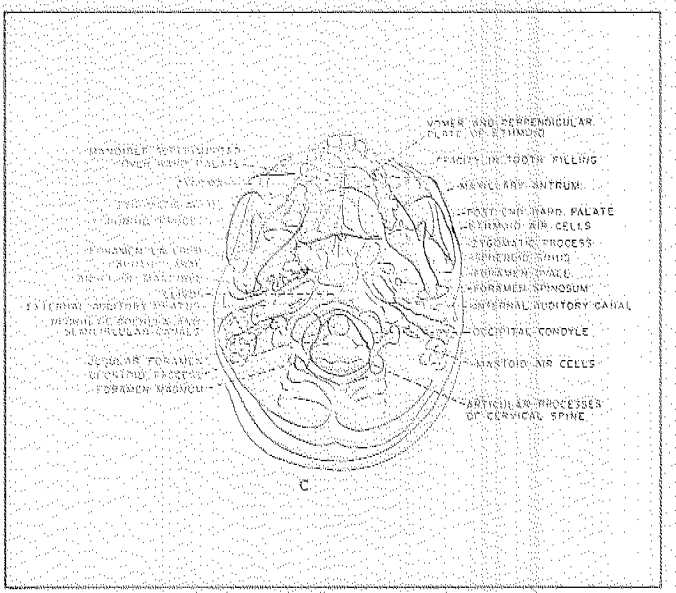
It is not infrequent that one encounters patients with concommitant neck injuries where hypertension, or any manipulation of the neck for that matter is contraindicated. In addition, recently traumatized patients even without concommitant neck injuries are hesitant to hyperextend the neck, often complaining of pain or discomfort when placed in such positions. It is worthwhile to note the experience with some mauled subjects who were highly intoxicated and were thus very uncooperative for the procedure.

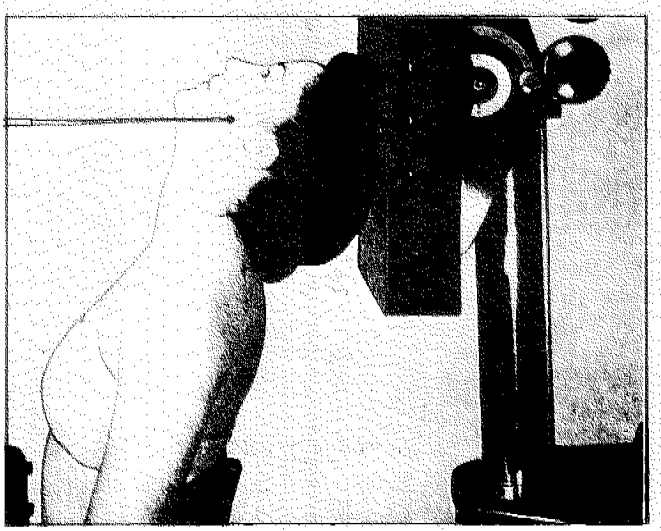
These conditions, among others, resulted in an improperly done SMV procedure, causing the zygoma to be poorly assessed and, most likely, would be poorly managed. In addition, permanently documenting the fracture may be a disappointing attempt - an unfortunate situation for the surgeon who knows only too well that these trauma cases have the potential for medicolegal adventures.

This study shows that the MTV could be used as a valuable alternative in the diagnosis of zygomatic arch fractures in lieu of the SMV. Both procedures have a high degree of agreement (90%) in identifying the presence or absence of arch fractures. The difference in their sensitivities (94.6% and 96.6%) is not statistically significant.

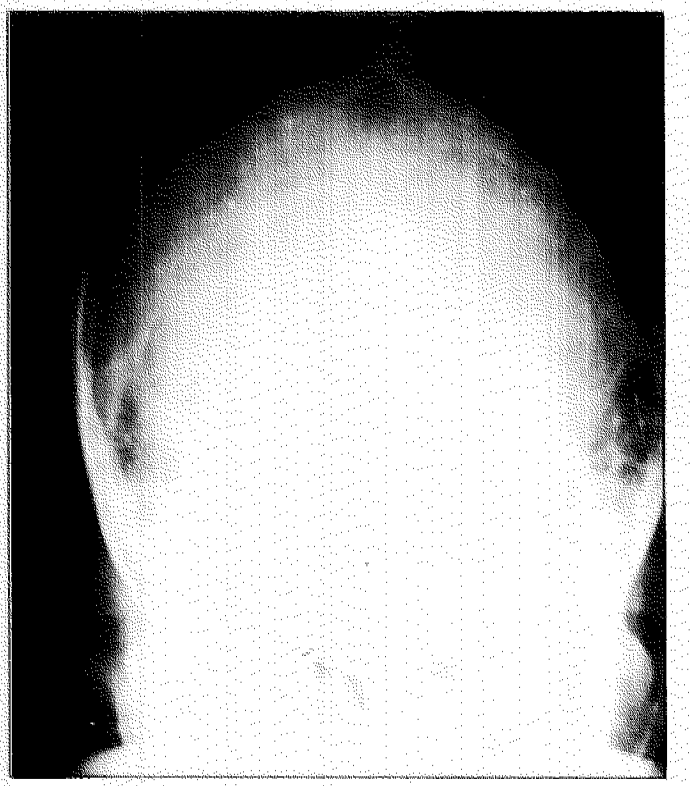
The advantage of the MTV over the SMV becomes even more apparent in cases of multiple head and neck

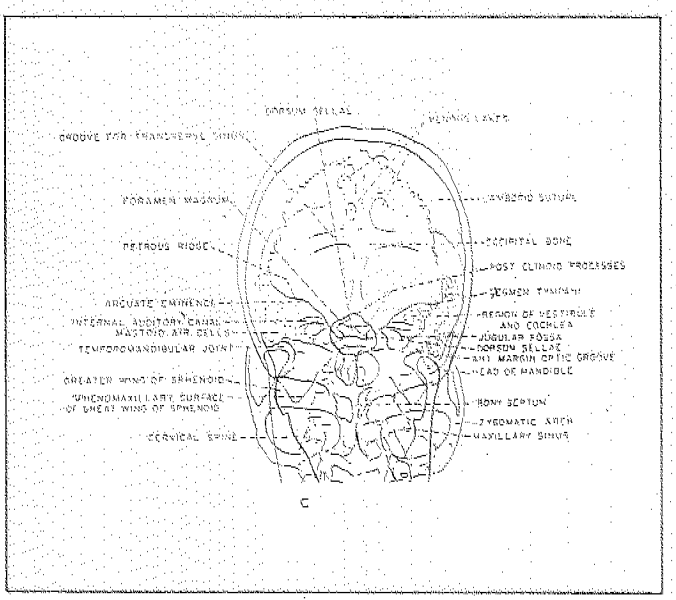


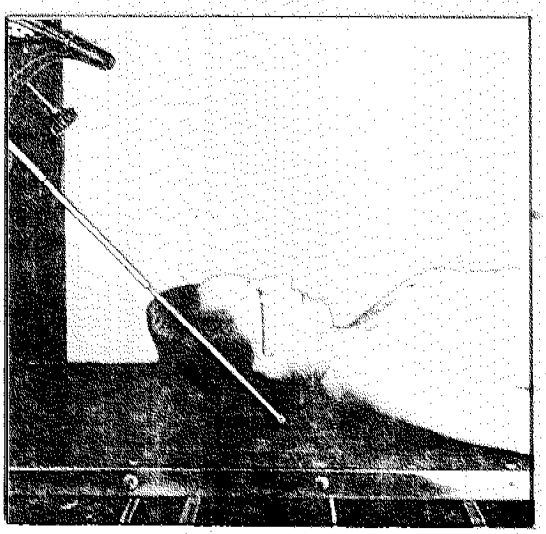




SUBMENTO VERTICAL VIEW







MODIFIED TOWNE'S VIEW

injuries, suspicious cervical injuries and uncooperative patients. In the course of this study, a significant number of patients (18 of 48 subjects) could not be properly positioned for the SMV procedure but were safely and comfortably positioned in the MTV. Furthermore, additional radiographic data can be gathered on the status of the temporal bone, segments of the mandible and other neighboring bony structures in cases of extensive maxillofacial injuries. With MTV, repeat costly examinations are minimized, assessment is adequate and surgical planning and execution is not delayed.

There were 3 cases which accounted for 10% disagreement between the two procedures. Two of these were interpreted radiographically as negative for fracture in the MTV plates but positive in the SMV plate. Intraoperatively, fractures were present. This disagreement may be due to the uncertainty in interpretation by the radiologists in these two particular plates since utilizing the MTV in the diagnosis of arch fractures is a relatively new expeience.

The other case of disagreement involved one set read as negative on SMV but positive on MTV. Intraoperatively, a linear nondisplaced fracture involving the basal portion of the zygomatic process of the temporal bone was noted which was not evident on the SMV but was delineated in the MTV.

The specificity of the procedure was not estimated since most of those found negative on x-rays did not undergo any surgical exploration.

CT scan in this case would have been the ideal gold standard used and findings in this procedure can be used to confirm not only those who were positive on x-rays but also those found negative. However, the prohibitive cost of this procedure negates its practical application.

In the MTV, the length of the zygoma appears longer than it actually is, due to the angulation of the central ray. Further studies may be done to delineate its grid on the plate compared to its actual anatomic size. This may prove helpful in establishing guidlines for future radiologic interpretations on the presence of fractures, their site and degrees of depression and rotation.

CONCLUSION

The MTV is an sensitive as the SMV in the diagnosis of zygomatic arch fractures. The difference in their sensitivities (94.6% and 96.2% respectively) is not statistically significant.

The MTV and the SMV have a copositivity of 76.7% and a conegativity of 13.3% - a high 90% degree of agreement.

In 18 of the 48 subjects, only the MTV could be done as the patients could not be properly positioned for the SMV procedure due to extent of injuries and uncooperativeness.

Although the SMV remains the standard procedure in the evalaution of the zygomatic arch, the study shows that the MTV could be used as a reliable alternative - providing an attractive option for the maxillofacial surgeon to adequately evalaute trauma patients, especially those who are poor candidates for the SMV procedure.

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ANGIOIMMUNOBLASTIC LYMPHADENOPATHY PRESENTING AS A SALIVARY GLAND TUMOR: REPORT OF A CASE*

FLORDELINA PIO, M.D.

ABSTRACT

Angioimmunoblastic lymphadenopathy (AILD) is a rare lymphoproliferative disorder with lymphoma-like clinical presentation. Despite its unclear etiology and pathogenesis, it presents with a specific histologic picture in the lymph node consisting of diffuse obliteration of the nodal architecture due to the pronounced proliferation of small vessels and pleomorphism in the spleen, bone marrow, liver, lungs, and skin. This paper describes the first reported case of angioimmunoblastic lymphadenopathy presenting as salivary gland tumor. Precise diagnosis of this case is important because it has a clinically malignant course despite its benign histologic features.

INTRODUCTION

In the mid-seventies, a group of acute lymphoproliferative diseases were described under a variety of names such as immunoblastic lymphadenopathy, angioimmunoblastic lymphadenopathy with dysproteinemia and lymphogranulomatosis X. These diseases usually occur in the elderly and clinically present with lymphadenopathy, hepatosplenomegaly and constitutional symptoms like fever, weight loss and skin rash. Despite the lymphoma-like clinical features, the histologic findings of the involved lymph nodes are often consistent with benign polymorphous lymphoproliferative processes. Other organs of the reticuloendothelial system and the skin have been involved in the disease process but never the salivary glands.

This report describes a patient presenting with parotid and palatal masses with histologic features of angioimmunoblastic lymphadenopathy.

CASE REPORT

A 58 year old asthmatic woman was seen in February, 1994 because a one-year history of an enlarging left pre-auricular mass. There was also a palatal mass of nine months duration. Fine-needle aspiration biopsy of the pre-auricular mass and wedge-incision biopsy of the palatal mass were done thrice, and always revealed reactive lymphadenitis and chronic inflammation, respectively. Later, the patient also developed dryness of the mouth, loss of appetite and 40-50% weight loss. A two-week course of Prednisone was taken at an unrecalled dose which decreased the size of both masses. However, bipedal edema and skin rash developed prompting discontinuation of the medication. Re-growth of both masses occured. The patient was subsequently advised excision.

On examination, the patient was found to have:

1. a 5 x5 cm firm, nontender, fixed mass on the left pre-auricular area;
2. a 1.5 x 1.5 cm firm, nontender, fixed mass on the left cervical area; and
3. a 2.5 x 2.5 cm erythematous, nontender ulcer with elevated borders on the hard palate.

The rest of the P.E. findings were unremarkable. The CBC, platelet count and biochemical profile were within normal limits.

With an equivoval pre-operative diagnosis and frozen section report, patient underwent left total parotidectomy with facial nerve preservation and wide excision of the palatal mass.

Intraoperatively, a 4 x 4 cm left parotid mass was noted posterosuperiorly with involvement of the deep lobe of the gland and the buccal division of the facial nerve. The mass was highly vascular. This was also noted on the palatal mass.

Histologic examination revealed the left parotid gland to have marked pleomorphic cellular proliferation obliterating the gland architecture (see Fig. 1) except for some remnants of small ducts (see Fig. 2). The predominant cells were mature lymphocytes (see Fig. 3) and plasma cells (see Fig. 4)with some histiocytes and immunoblasts (see Fig. 5). The endothelial cells of the smaller vascular channels are enlarged with prominent nuclei (see Fig. 6). Similar features were present in the preauricular lymph node and the palatal mass. The diagnosis was Severe Chronic Inflammation with primary differential of Angioimmunoblastic lymphadenopahty.

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Three other medical centers were consulted and they agreed with the diagnosis of Angioimmunoblastic lymphadenopathy.

Three weeks postop, chemotherapy was started with cyclophosphamide (1g on day 1), adriamycin (50 mg on day 1), vincristine (2 mg on day 1) and prednisone (100 mg on days 15). Three cycles of the regimen were given at three weeks interval. Follow-up CBC, platelet count and biochemical profile remained within normal limits. The patient remains asymptomatic with no signs of tumor recurrence and has even started to gain weight.

DISCUSSION

Angioimmunoblastic lymphadenopathy (AILD) is a nonneoplastic lymphoproliferative disorder which has been described in the last 30 years, but only gained acceptance as a clinical and pathologic entity world wide two decades ago. Frizzera and colleagues defined the diagnostic criteria for this disease based on lymph node biopsy. These are:

1. extensive alteration of nodal architecture;
2. abundance of small vessels;
3. pronounced proliferation of immunereactive cells (lymphocytes, plasma cells and immunoblasts).

All these must be satisfied before a diagnosis of AILD can be made since none of these alone is pathognomonic.

The same type of angiocellular process is seen in the white pulp of the spleen, liver, bone marrow, lungs and dermis. However, these do not have the diagnostic specificity of the lesion. Hence lymph node biopsy remains the basis of diagnosis. The surgical specimen included a preauricular lymph node which showed similar histologic features to the rest of the specimen submitted. There were also reported cases of AILD with Hashimoto's thyroiditis and carcinoma of the pancreas but their exact association has not yet been established.

The clinical features of AILD indicate an aggressive systemic disease with multi-organ involvement despite its initial morphologic description as benign proliferation. The benignity of this condition is based on the findings of :

1. recognizable peripheral sinuses and remnants of germinal centers despite pronounced obliteration of the nodal structure and capsular involvement;
2. lymphocyte transformation associated with pronounced vascular proliferation in the lymph nodes is not seen with any known malignant lymphoma;
3. in extranodal sites, it is not infiltrative like leukemia, nor does it have nodular character of malignant lymphoma;
4. lymphocyte depletion with perivascular fibrosis is the end result and not tumoral replacement of organ structures.

The etiology and pathogenesis of AILD remain unclear. Controversy still exists over whether iti s a florid immune reaction or a neoplasm. Currently, it is basically considered to be a T-cell abnormality inducing B-cell hyperactivity.

Although clinical freatures led to the belief that AILD is a single illness, there are differences which have been stressed in some reports. It is also possible that AILD represents a syndrome with more than one clinicopathologic spectrum and/or more than one etiology.

This patient presented the more common clinical picture of AILD like preauricular and cervical lymphadenopathies, skin rash and weight loss. What distinguishes this case from previous reports is the involvement of a salivary gland presenting as a parotid tumor.

The diagnosis of parotid tumor is difficult preoperatively largely due to its varied pathology and unpredictable biologic course. This patient is no exception with the equivocal clinical presentation (see Table I) coupled with the negative results of the FNA and wedge incision biopsies and frozen section. The rarity of this condition and the unusual presentation of this case in a salivary gland contributed to the difficulty in the diagnosis.

As to the palatal lesion, it cannot be categorically stated whether it is the mucosa or the minor salivary glands which was involved in the disease process. Nevertheless, Batsakis stated that the developement of tumor in 2 or more salivary glands is an unusual phenomenon.

TABLE I
PRESENTATION OF DIFFERENT SALIVARY GLAND TUMORS

		MALIGNANT		
	benign	low-grade	high-grade	patient
Mobility	movable	movable	fixed	fixed
Tenderness	(-)	(-)	(+)	(-)
Growth	slow	slow	rapid	slow
Facial nerve involvement	(-)	(-)	(+)	(-)
Invasiveness	(-)	(-)	(+)	(-)
Regional lymph mode metastasis	(-)	(-)	(+)	(+)

The closest differential of AILD is Angiolymphoid hyperplasia with eosinophilia (ALHE) or Kimura's Disease. This is characterized by single or multiple cutaneous nodules, often located in the cheek and auricular area. Histologically, it presents with:

1. irregular vascular proliferation with capillary neogenesis associated with polymorphous lymphocytic and eosinophilic component in early and active cases followed by;

2. hyperplasia lymphoid tissue dominance with follicle and germinal center formation in the later quiescent stage.

Other differentials of lymphoid salivary lesion pose no difficulty because of the nonsalivary origin of AILD and the polymorphism of its cellular constituents. The latter feature contrasts with the monomorphic composition of salivary lymphomas and benign lymphoid lesions (Miculicz's disease and Warthin's tumor).

Although the clinical course of some patients remains indolent, the majority experience an aggressive clinical course, terminating either fatally or by evolving into malignant lymphoma, which is observed in up to 18% of the cases. The earliest phase of malignant progression is recognized by the presence of a monomorphic infiltrate of large lymphoid cells in clusters.

Because of the rarity and variable clinical course of AILD, the best treatment has not yet been established. Various therapies recommended range from initial abstention to the more aggressive combination chemotherapy. Other regimens used include: prednisone, plasmapheresis, Danazol, interferon , and most recently, cyclosporin-A.

Frizzera and colleagues advocated symptomatic treatment and observation because of the occurrence of spontaneous regression of the disease. If necessary, small doses of steroid may be given instead of combination chemotherapy for a safer therapeutic approach. However, the data they presented support the opposite conclusion. Their observations were similar to later studies by Schauer et. al., Siegert et.al., and Oshaka et. al.. Their findings revealed that initial prednisone treatment exerts a certain degree of efficacy, but it never produces a lasting clinical improvement. Most patient who receive prednisone alone as initial therapy have to be treated with combination chemotherapy because of disease progression. Short cycles of intensive chemotherapy is preffered to prolonged administration of high-dose prednisone to avoid long-lasting immunosuppression.

This patient was given a short-course of a commonly used first-line chemotherapy regimen (CHOP). Other commonly used first-line chemotherapy regimens, aside from corticosteroid alone, include: nitrogen mustard, vincristine, procarbazine and prednisolone (MOPP); carboque, voncristine and prednisolone (CVP); and cyclophosphamide, doxorubicin, vincristine and prednisolone (CHOP).

Other investigators reported success with alternative therapies for patients refractory to steroid and/or chemotherapy. However, immunosuppression also occurs whenever lymphoproliferation is controlled, predisposing patients to fatal infectious complications.

Ordinarilly, a total parotidectomy with facial nerve preservation is the management of choice for benign tumors involving the deep lobe of the parotid gland. In case of doubtful diagnosis intra-operatively, this also serves as the conservative alternative until a permanent section biopsy result indicates further needed intervention. Radiotherapy and/or chemotherapy are reserved only for aggressive treatment of malignant neoplasms.

The diagnosis of AILD in this patient modified the treatment plan for benign parotid tumors with the addition of a three-cycle combination chemotherapy, as managment protocol for AILD dictates. So far, local control, if not systemic control, of the disease has been achieved.

The prognosis of AILD remains poor despite treatment. Median survival is reported at 30 months in the largest series published to date. Hence, vigilance in monitoring the clinical course of the patient is warranted. With current advances in the field of medicine, the cure for this potentially life-threatening disease may not be too far-fetched.

SUMMARY

The uniqueness of this case rests on the presentation of AILD as a salivary gland tumor, particularly that of the parotid gland. This has never been reported in any series to date. Until the cause and pathogenesis of AILD are better understood, it will be important to continue reporting all findings associated with this disorder. Let such rare cases alert the clinicians and the pathologists alike, to search diligently for the proper diagnosis and consequently, a rational therapeutic approach, especially for a life-threatening disease like Angioimmunoblastic Lymphadenopathy.

FIGURE 1. LOW-POWER VIEW OF THE PAROTID GLAND SHOWING PLEOMORPHIC CELLULAR INFILTRATE AND VASCULAR PROLIFERATION (H & E).

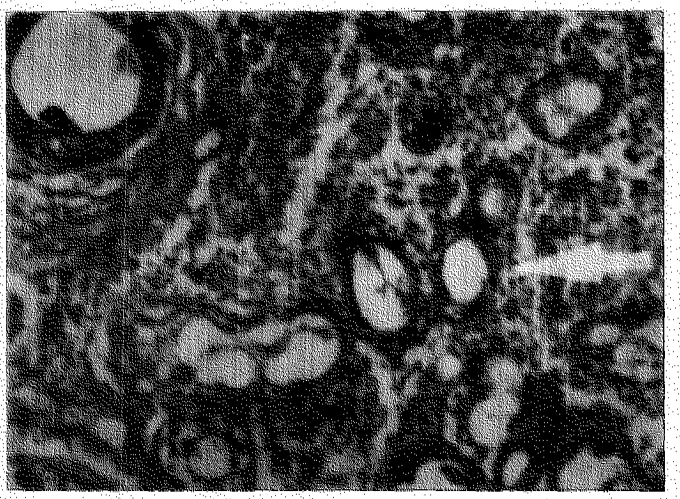

FIG. 2 - HIGH-POWER VIEW OF THE PAROTID GLAND SHOWING SMALL DUCTAL REMNANTS (H & E)

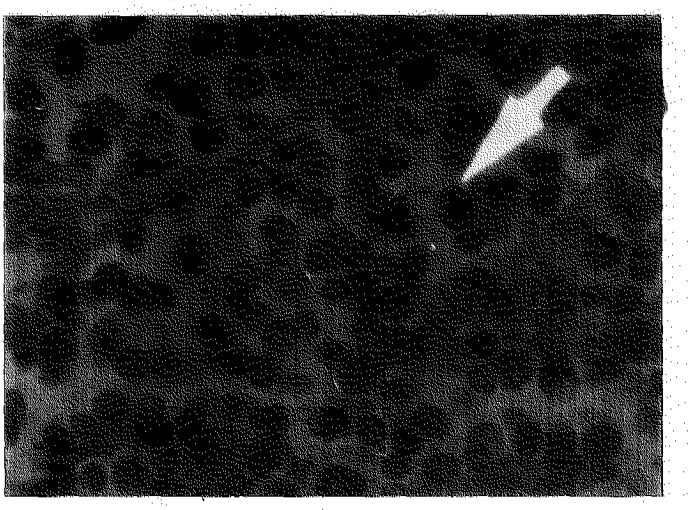

FIG. 5 - PLEOMORPHIC INFILTRATE WITH ARROW POINTING AT AN IMMUNOBLAST (H & E)

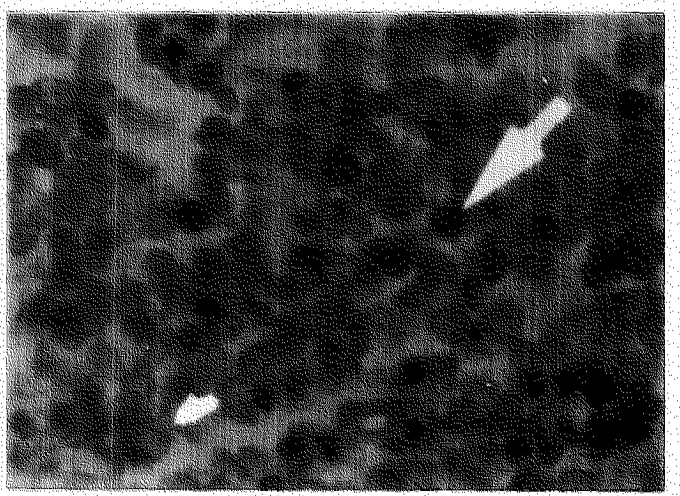

FIG. 3 PLEOMORPHIC INFILTRATE WITH ARROW POINTING AT A LYMPHOCYTE (H & E)

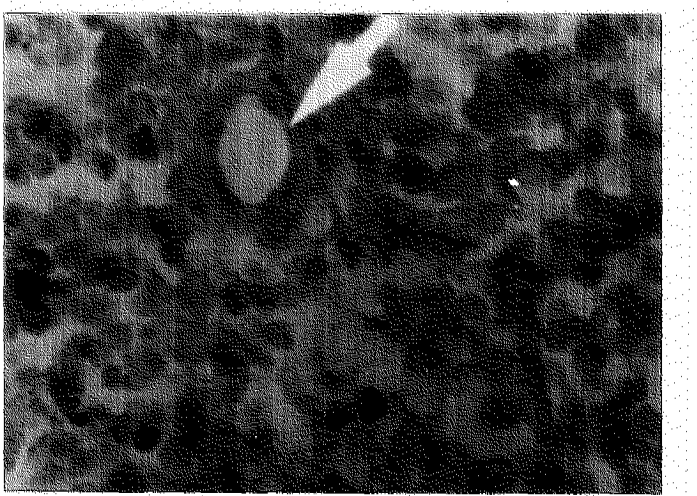

FIG. 6 - PLEOMORPHIC INFILTRATE SURROUNDING A SMALL BLOOD VESSEL ENDOTHELIAL HYPERPLASIA (H & E)

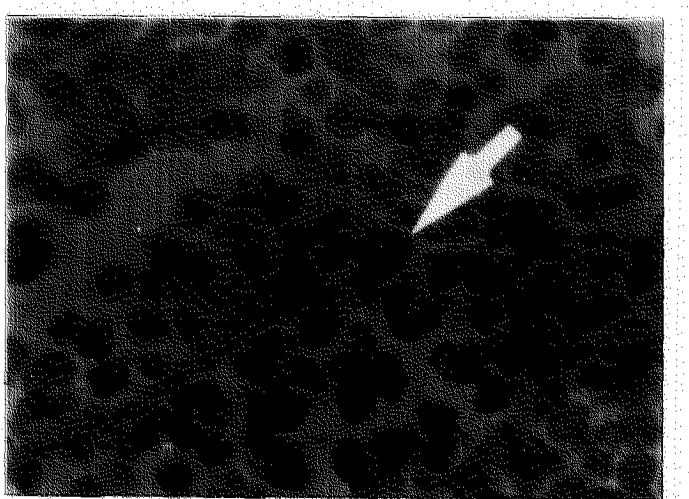

FIG. 4 - PLEOMORPHIC INFILTRATE WITH ARROW POINTING AT A PLASMA CELL (H & E)

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CERVICAL GERM CELL TUMOR: A CASE REPORT*

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ABSTRACT

This is a case report of a 25 year old female with a supraclavicular mass of 3 months duration wherein no definite diagnosis was established despite different diagnostic procedures like FNAB, thyroid scan, CT scan of the head and neck and section biopsy. Surgery was performed and the histopathological findings caused a suprise.

Germ cell tumors are a relatively uncommon type of ovarian malignancy, comprising only about two to three percent of the total number of incidence.

Extragonadal germ cell tumors may be metastatic or of the primary type. The two types are rare, but the primary extragonadal tumor is rarer. A review of both local and foreign literature is discussed in this paper to substantiate our claim.

This paper aims to share this experience of a relatively rare case, to make other clinicians aware of the importance of investigating other organ systems when dealing with cervical masses and to discuss accepted modes of treatment of germ cell tumors.

INTRODUCTION

The differential diagnosis of a mass in the neck encompasses a broad range of possibilities, including the most common entity squamous cell carcinomaas well as adeno-carcinomas, different types of sarcomas, renal cell tumors and others. Under most circumstances, the otolaryngologist-head and neck surgeon familiar with the neck region can make an appropriate differential diagnosis quickly based on history, physical examination and basic knowledge of probabilities. One of the most remote possibilities is the presence of a germ cell tumor in the cervical areas. Germ cell tumors are usually gonadal in origin but, rarely, may appear in the neck as a distant metastasis or as an extragonadal primary. Germ cell tumors have many subtypes among them is dysgerminoma. Dysgerminoma is one of the most common types of germ cell tumors and yet it only comprises about one percent of total ovarian malignancies. The Memorial Sloan Kettering Cancer Center Germ Cell Tumor Study does not have even a single case of primary extra-gonadal supraclavicular dysgerminoma. However, their series includes five out of 82 patients with distal metastasis in the supraclavicular region. The series of Krepart et.al., likewise does not have any primary neck dysgerminoma but has four cases out of 12 patients with recurrence in the cervical area. Review of other series failed to show a primary cervical dysgerminoma.

The objectives of this paper are the following:

1. to share with fellow otolaryngologists this experience in a relatively rare case
2. to make others aware of the necessity of investigating other organ systems when dealing with a cervical mass
3. to discuss the ideal management of dysgerminoma

CASE REPORT

This is the case of L.S., a 25 year old female from Leyte, admitted for the first time because of a left supraclavicular mass of three months duration.

The history of present illness apparently started 3 months PTA when a 2 x 2 cm, nonerthymatous, doughy, non-tender, non-movable mass located at the left supraclavicular area was noted. Consult was done at this institution and fine needle aspiration biopsy was performed which revealed negative findings. Thyroid scan was then requested which showed left extra-thyroidal mass. Direct laryngoscopy, esophagoscopy, and bronchoscopy were likewise performed revealing negative results. With these findings on hand, the service decided to do a section biopsy of the mass with a result of malignant tumor with the following as the differential diagnosis; Fibroblastic liposarcoma, Granular cell myoblastoma, Anaplastic carcinoma, Liposarcoma and Malignant histiosarcoma. Another biopsy was done which showed the same results. A CT scan of the neck to

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include the superior mediastinal area revealed the presence of a 6 x 5 x 16 cm mass in the left supraclavicular region underneath the sternocleidomastoid muscle with thin internal septation, smoothly marginated, without invasion of the carotid sheath. Superiorly, it reached the level of the thyroid cartilage and inferiorly, it reached the suprasternal notch and crossed the midline. The CT scan further revealed absence of lymphadenopathy and bony erosion. With this result, the patient was then advised to be operated as soon as possible.

The patient underwent neck exploration using a Macfee incision. Wide excision of the mass was performed. When the left sternocleidomastoid muscle was freed from its surrounding sructures, the mass was found beneath it. The caramel-colored mass measured 7 x 5 cm and was well encapsulated, doughy to firm and located just on top of the left subclavian vein. The internal jugular vein was totally encircled by the mass. The wall of the vessel was grossly invaded so the team decided to ligate the vein. The vagus nerve and the common carotid artery were pushed medially. The team had a hard time separating the tumor from those structures. The mass was noted to be segregated from the left lobe of the thyroid gland. The surgeons had difficulty dissecting out the inferior border of the mass from the wall of the left subclavian vein. Minimal bleeding was noted intraoperatively. The procedure lasted for two hours. No surgical complication was noted at the immediate postoperative period. The patient was able to ambulate on the first post-operative day.

Histopathological studies showed the specimen to be a well defined grayish brown ovoid, soft to doughy mass, measuring 8 x 6 x 3.5 cm and weighing 98.5 grams. Cut section showed a grayish white, smooth glistening surface. Section of the specimen revealed findings compatible with dysgerminoma characterized by large vesicular cells arranged in sheets and cords. The individual tumor cells had eosinophilic to clear cytoplasm, central rounded nuclei and prominent nucleoli. The intracellular stroma consisted of thin to broad fibrous bands infiltrated by mature lymphocyte with occasional lymphoid follicles. Some sections showed epithelial cells that were large, pale and polyhedral with prominent nucleoli. Mitotic figures were numerous.

The patient was then referred to Gynecology for further evaluation. External genitalia of the patient normal with a sexual maturity rating of 5. However the patient refused to submit herself to internal examination. In the absence of an internal examination findings, the Gyne service requested for a pelvic ultrasound which revealed an enlarged uterus, measuring 11 cm x 6.5. cm x 8.5 cm with heterogenous myometrial echo-texture. Hyperechoic and hypoechoic foci in the corpus uteri were noted. There was a 5.5 x 3.5 cm solid mass in the fundal area. However both adnexae were unremarkable. It was signed out as myoma uteri.

Alpha - feto protein, lactic dehydrogenase and Human chorionic gonadotrophin were requested but not performed because of financial constraints. The patient was then referred to The Kidney Institute and to the Tumor Clinic for Cobalt therapy and possible chemotherapy respectively. The asymptomatic patient was discharged on the seventh hospital day. She followed up one week later but was eventually lost to follow up.

DISCUSSION

Multi-institutional studies have shown that 95 to 98 percent of non-thyroid neck tumors are either primary or metastatic squamous cell carcinoma. The remaining two to five percent are shared by many histological entities such as adenocarcinomas, different forms of sarcomas, lymphomas, renal cell carcinomas but rarely a germ cell tumor. According to a Memorial Sloan-Kettering Cancer Center Germ Cell Tumor Study, not even one case of germ cell tumor manifested primarily as a cervical mass. However, their series involved five cases of dysgerminoma that had supraclavicular metastasis.

Germ cell tumors have many subtypes as shown by Table I. The most common type of malignant germ cell tumors is the dysgerminoma.

Dysgerminomas are uncommon tumors accounting for one to two percent of primary ovarian neoplasms and for three to five percent of ovarian malignancies. Retrospective studies done in four leading medical institutions in the Philippines reported only 5 cases of dysgerminomas in the last 5 years. In one particular hospital, not even a case of dysgerminoma was reported in the last ten years. De Palo et.al. studied 56 patients with dysgerminoma from 1958 to 1980. The M.D. Anderson Cancer Center has seen one hundred eleven patients, and not even one manifested with a supraclavicular mass. The Memorial Sloan-Kettering Cancer Center reported 82 cases of dysgerminoma, five of which had a positive supraclavicular node. The Emil Nivak Ovarian Tumor Registry reviewed 158 cases of dysgerminoma and no incidence of a neck mass was noted. The University of Texas System Cancer Center studied 36 patients and found four patients with supraclavicular recurrence of dysgerminoma.

Dysgerminomas may occur at any age, from infancy to old age, reported cases range between the ages of seven months and seventy years but the majority of cases occur in adolescence and early adulthood.

Approximately 95 to 98 percent of dysgerminoma cases are located in the ovaries and only a fraction can be extragonadal. Extragonadal dysgerminomas and other germ cell tumors have long been the subject of fascination for pathologists and developmental biologists as well as a subject of controversy for clinicians. Speculations regarding etiology have ranged from the opinion that these tumors are really of gonadal origin and represent spread from an occult or burned out primary tumor to

New FIGO Staging for Ovarian Carcinoma

STAGE I - Growth limited to the ovaries
- IA - Growth limited to ovary, no ascites, no tumor on external surface, capsule intact
- IB - Growth limited to both ovaries, no ascites, no tumor on the external surfaces, capsule intact
- IC - Tumor either Stage IA or Stage IB but with tumor on surface of one or both ovaries with capsule ruptured or with ascites present containing malignant cells or with positive peritoneal washing

STAGE II - Growth involving one or both ovaries with pelvic extension
- IIA - Extension, metastasis or both to the uterine tubes or both
- IIB - Extension to other pelvic tissues
- IIC - Tumor either Stage IIA ot IIB but with tumor on surface of one or both ovaries with capsule ruptured or with ascites present containing malignant cells or with positive peritoneal washing

STAGE III - Tumor involving one or both ovaries with peritoneal implants outside the pelvis and or positive retroperitoneal implant. Superficial liver metastasis equal Stage III. Tumor is limited to the true pelvis but with histologically proven malignant extension to small bowel or omentum
- IIIA - Tumor grossly limited to the true pelvis with negative nodes but with histologically confirmed microscopic seeding of abdominal peritoneal surfaces
- IIIB - Tumor of one or both ovaries with histologically confirmed implants of abdomen/peritoneal surfaces, none exceeding 2 cm in diameter. Nodes are negative
- IIIC - Abdominal implants greater than 2 cm in diameter and or positive retroperitoneal or inguinal nodes

STAGE IV - Growth involving one or both ovaries with distant metastasis. If pleural effusion is present, there must be positive microscopic findings

TABLE I. CLASSIFICATION OF GERM CELL TUMORS

I. **BENIGN**
- A. Mature Teratoma
- B. Mature teratoma with immature component

II. **MALIGNANT**
- A. With areas of primitive germinal tissues

  Derived from primitive germ cell, eg. Dysgerminoma Seminoma

  Derived from blastocyte 8-15 days, eg. dysembroma and Embryonal Carcinoma

  Teratocarcinoma eg. Embryonal Carcinoma plus Teratoma

  With extra-embryonal derivative eg. Yolk sac Tumor Chorio-carcinoma

- B. Immature Teratoma
- C. With non-germinal malignant tumor component eg. Carcinoma and Sarcoma
- D. Combined tumor eg. mixed pattern

the view that these tumors are of the extragonadal origin with separate clinical and biological behavior. There is now general acceptance that extragonadal germ cell tumors represent malignant transformation of germinal elements distributed to these sites without any gonadal primary focus. Some investigators suggest that the distribution arises as a consequence of abnormal migration of germ cells during embryogenesis. Others have suggested that there is widespread distribution of germ cells in the body during normal embryogenesis and that these cells may provide important regulatory functions at somatic sites or convey genetic, hematologic or immunologic information. In this case, a dysgerminoma presented as a cervical mass with possible mediastinal extension. Even though adequate internal examination was not done, pelvic ultrasound was able to reveal unremarkable adnexal findings. Knowing that Pelvic ultrasound is an accurate ancillary procedure in assessing pelvic pathology, a very important question to be addressed is whether this tumor represents a rare type of primary extragonadal dysgerminoma in the cervical area or distal metastasis of an occult ovarian malignancy. The usual sites of extragonadal germ cell tumors are the mediastinum, paratracheal nodes, paraaortic nodes, abdomen and thorax. Review of available data revealed that a primary dysgerminoma of the neck is indeed very rare finding.

TABLE II. PRESENTING SIGNS AND SYMPTOMS OF DYGERMINOMA

	No. of pt.	Percent
Abdominal mass & pain	6	17
Abdominal mass	13	36
Pain	13	36
Vaginal Bleeding	1	3
At the time of Caesarian section	1	3
Unknown	2	6

-Based on the study done by Krepart etal. 1980

TABLE III. SITE OF RECURRENCE OF DYGERMINOMA IN 12 PATIENTS

SITE	NO. OF PATIENT
Abdomen	8
Pelvis	5
Paraaortic Nodes	5
Supraclacivular Nodes	4
Vertebral column	2
Lungs	1
Liver	1

-Based on the study done by Krepart et.al.

TABLE IV. RELATIONSHIP OF INITIAL THERAPY TO SURVIVAL IN STAGE II AND IV DYSGERMINOMA

TREATMENT	No. of Patients	Survival No.	Survival Percent	Duration of Survival
SURGERY	6	4	67	12-60 mos.
SURGERY PLUS RADIATION	64	52	82	2-313 mos.
SURGERY PLUS CHEMOTHERAPY	18	16	89	6-120 mos.
SURGERY PLUS RADIATION PLUS CHEMOTHERAPY	6	5	83	44-144 mos.

Data from Afrindi et al., 1976. Asadourian and Taylor, 1967 Bianchi et al., 1986. Burkons and Hart, 1977. Freel et al. 1979. Gershensons et al., 1986. Jose et al., 1984. Krepart et al., 1980. Newlands, 1982. De Palo et al., 1982. Pesta et al., 1984. Schwartz, 1984. Tewhk et al., 1982 and Wemblat and Ortega, 1982.

TUMOR MARKERS:

Alpha-feto protein, Lactic Dehydrogenase and Human Chorionic Gonadotrophin were suggested because of their potential usefulness as markers in the diagnosis and management of patients with dysgerminomas.

Elevated serum LDH, a glycolytic enzyme, can be seen in patients with dysgerminomas. In contrast to LDH isoenzyme patterns typical of other malignant neoplasms, serum LDH1 and LDH2 fractions are characteristically elevated in patients with dysgerminomas. The study done by Schwartz et al. in 1988 revealed dysgerminoma patients to have preoperative elevations of serum LDH two to five times that of the upper limit of normal control values in association with minor elevations of liver function tests. Serum LDH levels correlated well with tumor size and stage of disease.

The roles of serum LDH as a guide to the efficacy of chemotherapy and in the follow-up of patients with dysgerminoma are separate issues. Serum LDH levels can be elevated for many reasons, not all of which are related to the presence of cancer. Isoenzyme analyses might be useful in identifying non-specific elevation of serum LDH.

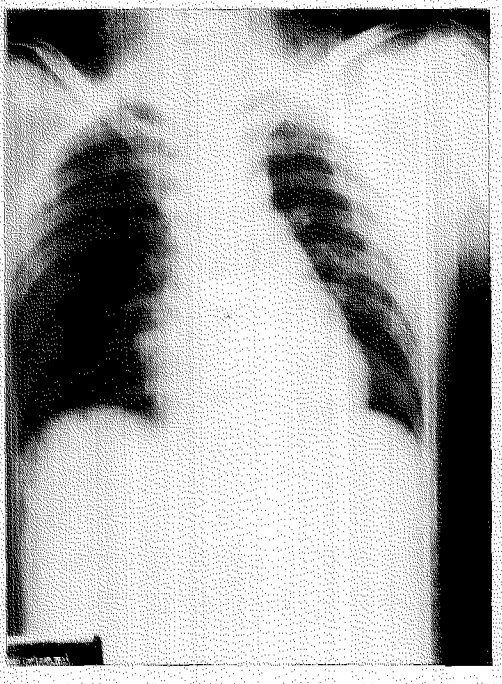
Although both human chorionic gonadotrophin and alpha-feto protein were both identified and described before 1970, it was the development of specific and sensitive radioimmunoassay techniques for measuring these substances in the serum that lead to dramatic improvement in the monitoring of patients with dysgerminomas. Although this type of tumor is generally considered to be hormonally inert, numerous well documented cases of pure dysgerminomas with a positive pregnancy test result or elevated serum HCG have been reported. Immunohistochemical evidences suggest that HCG is produced by synctial-like giant cells that can be present in dysgerminomas. An elevated serum HCG level in patients with pure dysgerminomas does not appear to worsen the prognosis.

HISTOLOGICAL APPEARANCE

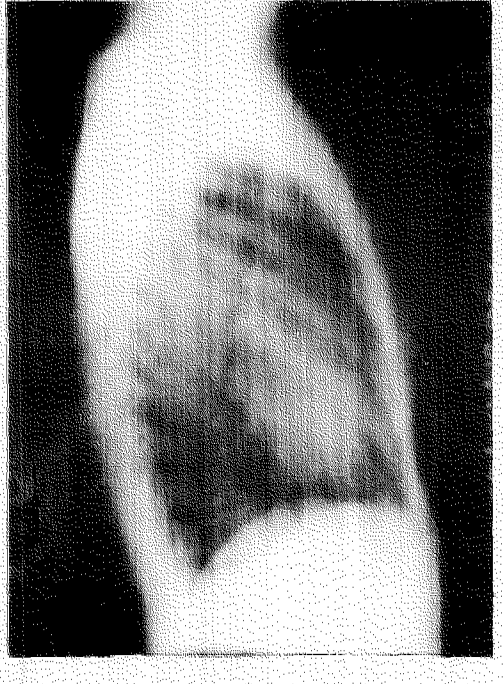
Dysgerminomas usually have a yellow white to gray pink appearance and are often soft and fleshy. Histologically, the dysgerminoma cells are dispersed in sheets or cords separated by scant fibrous stroma. As in the seminoma, the fibrous stroma is infiltrated with mature lymphocytes and, occasionally, has focal granulomatous foci reminiscent of tuberculosis or sarcoidosis. Dysgerminomas may also be a component of mixed germ cell tumors containing teratoma, choriocarcinoma and endodermal sinus tumor.

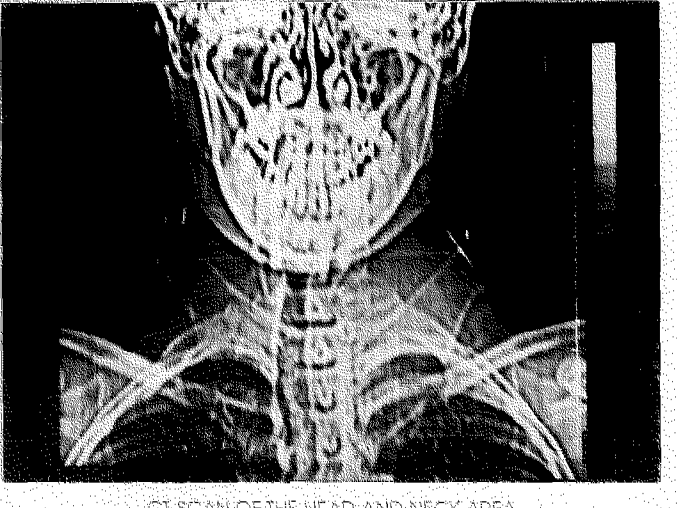
SIGNS AND SYMPTOMS

The presenting signs and symptoms of dysgerminomas are non-specific in nature. In the study of Krepart et al. (Table II), an abdominal mass with or without pain accounted for 53 percent of the initial complaints and pain with or without abdominal mass accounted for an equal number of complaints. Vaginal bleeding and accidental finding of the tumor at the time of Caesarean section were also noted. Presence of supraclavicular masses was not mentioned as presenting symptom. However as shown in Table III, Krepart et al were able to study four cases of dysgerminoma, who later developed recurrence in the supraclavicular nodes.



CT-SCAN OF THE HEAD AND NECK AREA





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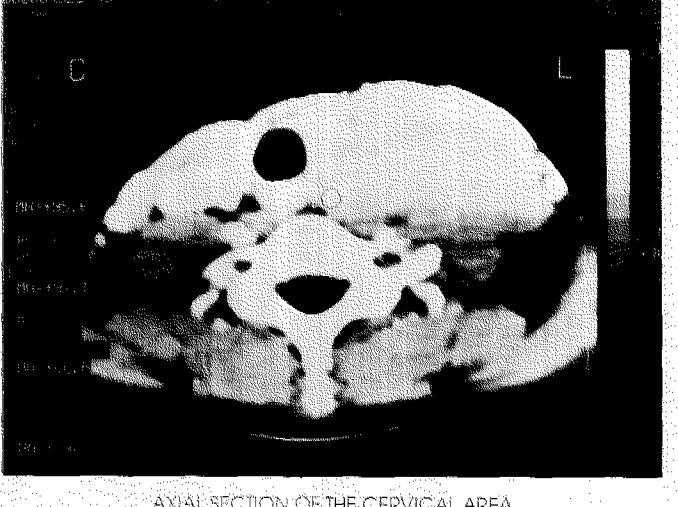
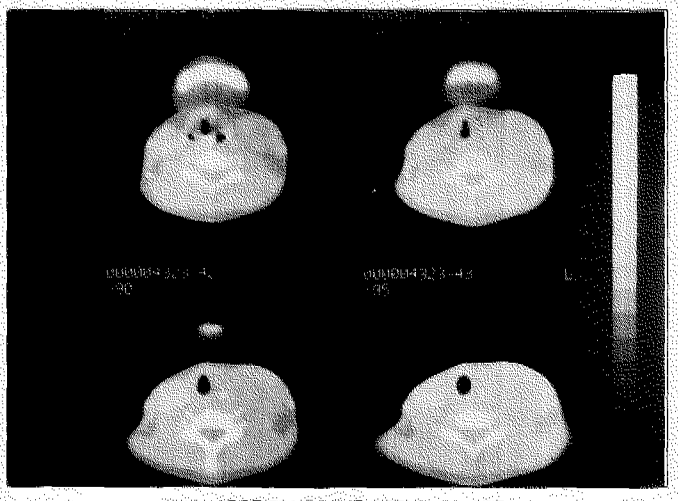


AXIAL SECTION OF THE CERVICAL AREA



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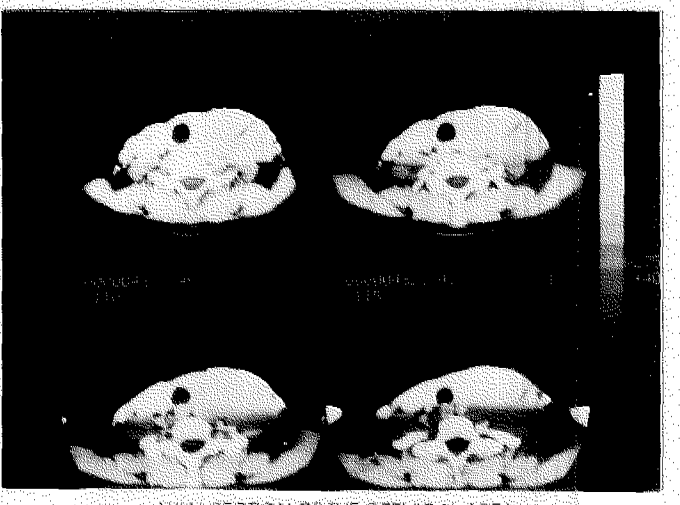

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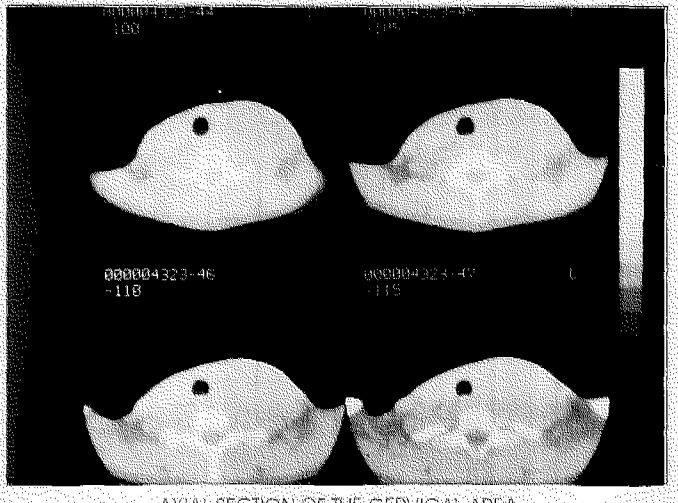

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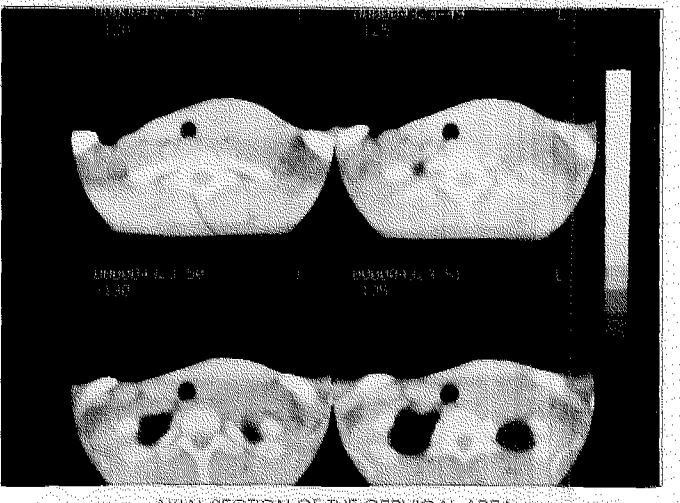

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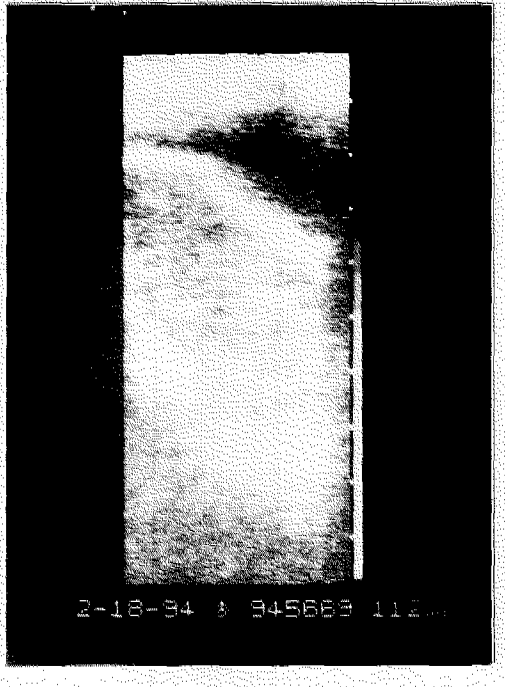
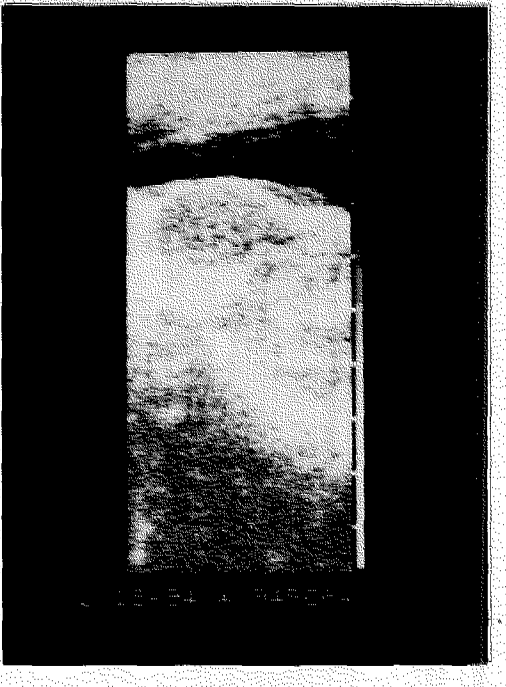
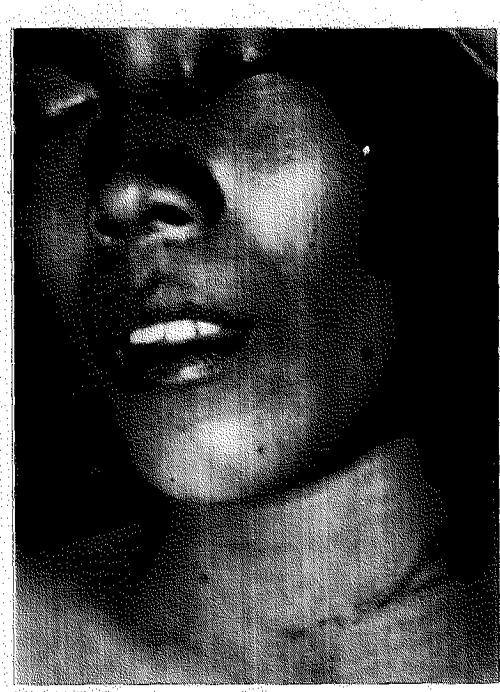
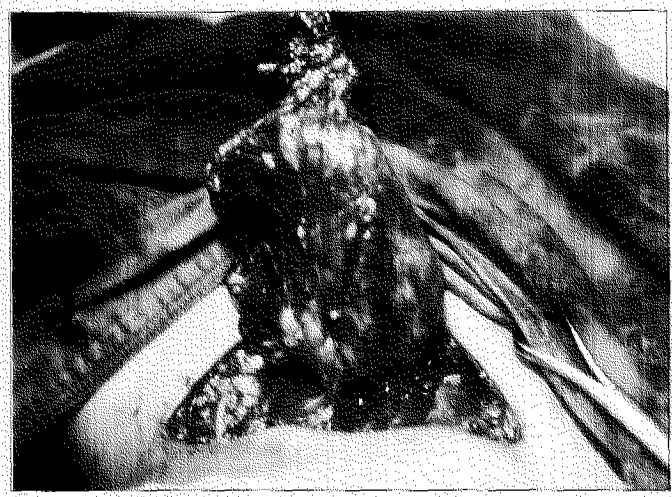
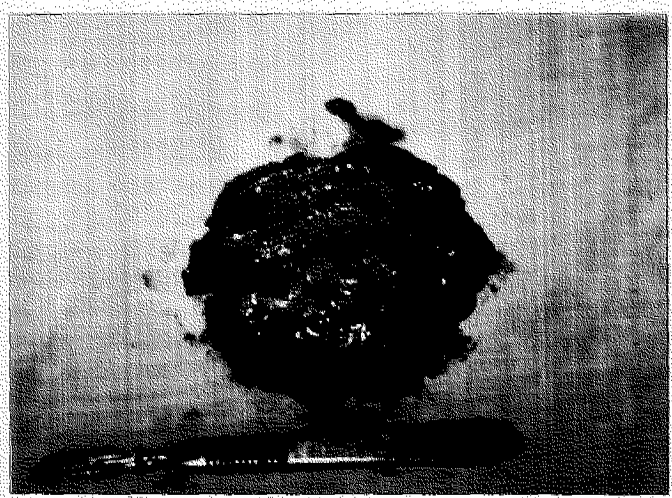
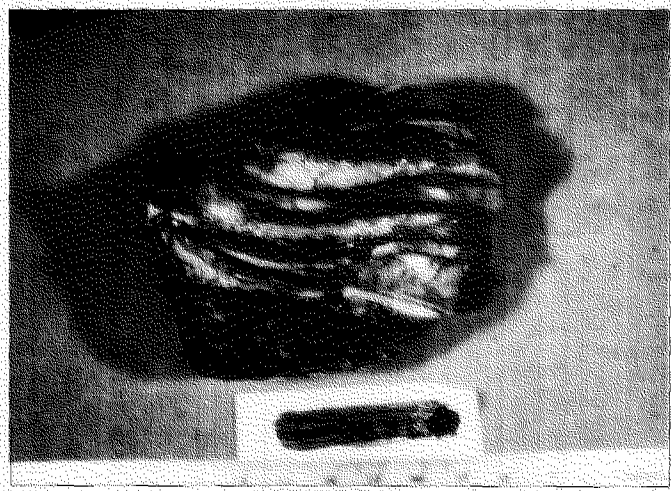




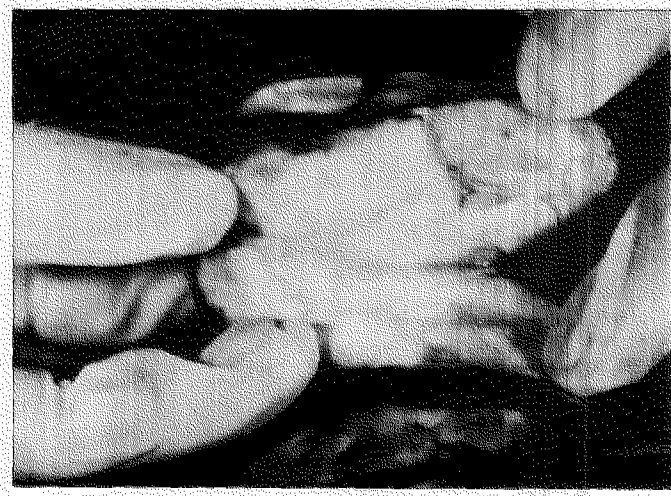








MACROSCOPIC APPEARANCE OF THE SPECIMEN



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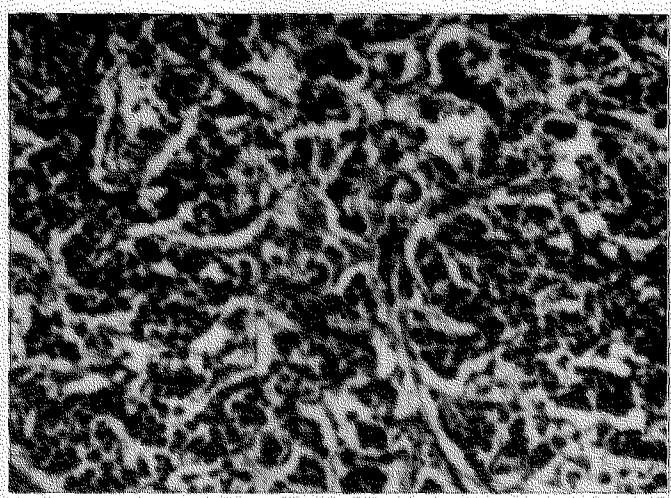
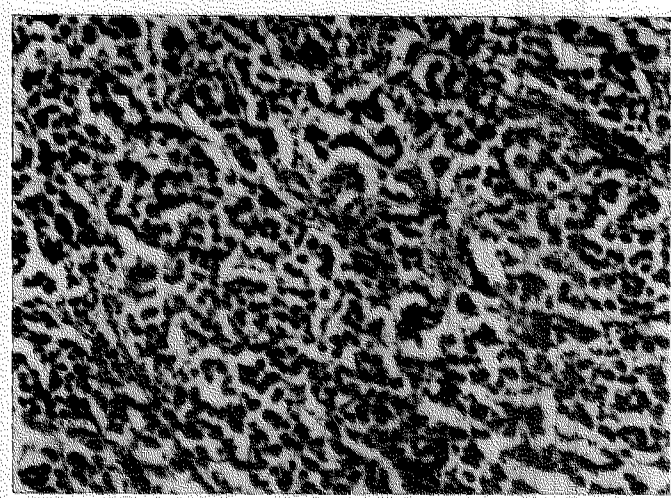
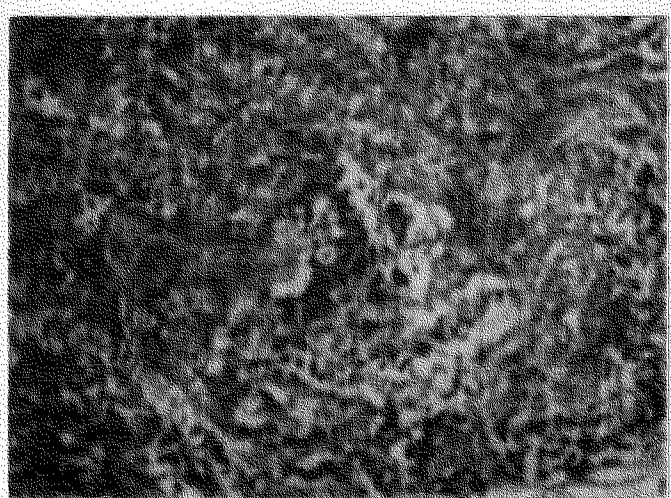


MICROSCOPIC APPEARANCE OF THE TUMOR



MICROSCOPIC APPEARANCE OF THE TUMOR



MICROSCOPIC APPEARANCE OF THE TUMOR

MANAGEMENT

The marked improvement during the last 10 to 15 years in the prognosis of germ cell tumors is rivaled only by the now almost complete curability of gestational trophoblastic disease. Reports in the late 1960's and even in the 70's noted poor survival in patients with germ cell tumors if operation only or operation combined with radiation was performed. Operation ranges from unilateral oophrectomy to total hysterectomy and bilateral salphingooophrectomy. Distal metastases are usually treated either by radiation or chemotherpay.

Table IV shows that 5-year survival rates of patients who underwent surgery alone was 67 percent. Those who had surgery plus radiation had an 82 percent survival rate while patients with surgery plus chemotherapy had an 89 percent survival rate.

With the advent of multiple agent therapy, the last decade has noted survival rates approaching 90 percent.

Initially it was felt that total abdominal hysterectomy plus bilateral oophorectomy with surgical excision of

the extra-gonadal extension was the procedure of choice since cure was the prime consderation and fertility was not an issue. The trend of the 90's is for surgical conservatism and application of multiple agent chemotherapy. As greater knowledge was accumulated and survival greatly improved, the question of fertility was rightly addressed.

Multiple-agent chemotherapy has dramatically improved survival in germ cell tumors. The chemotherapy of choice is still being debated by different investigators. In many instances it is the personal preference of the physician that dictates the exact drugs, doses and the time intervals.

The most frequently used chemotherapy combination have been Bleomycin, Etoposide and Cisplatin; Vincristine, Actinomycin D and Cytoxan and Methotrexate, Actinomycin D and Chlorambucil. The study done by Gersherson revealed greater 95 percent 5 year disease free survival rates using Bleomycin, Etopside and Cisplatin combination. In the series of Creasman in 1987 utilizing Methotrexate, Actinomycin D, and Chlorambucil, the 5 year survival rate was 90 percent. For patients with metastatic dysgerminoma, chemotherapy has replaced radiation therapy as the treatment of choice. For those patients who do not respond to first line therapy, the combination of Vinblastine, Ifosfamide and Cisplatin is the most popular regimen for the subset of Platinum-sensitive tumors. Table V shows the relationship of types of chemotherapy to response rates in metastatic dysgerminomas. Different combinations are being utilized giving very promising results with response rates ranging from 67 to 100 percent.

Second-look laparotomies in germ cell tumors continue to be advocated by some, while others feel the rationale for a second look is derived from epithelial ovarian tumors and may not be applicable to germ cell tumors. With recurrence rates of 25 percent in many series, many authors advise close monitoring of patients with previous germ cell tumors using markers such as LDH and AFP.

Radiation therapy has a limited role in the management of dysgerminomas. Historically this mode of therapy was used as adjunct to surgery. Radiotherapy is effective at relatively low doses in dysgerminoma and may be the treatment of choice in certain lesions. But the problem is that dysgerminomas are frequently observed in mixed tumors. In such situations, radiation may destroy the dysgerminomas but will have no apparent effect on the other germ cell components. The present mode of therapy is to supplement the surgery-chemotherapy regimen and for non-responsive metastatic dysgerminoma.

CONCLUSION

Dysgerminomas are a specialize form of ovarian tumor, being of dysontogenic origin and presenting no specific signs and symptoms other than those usually associated with any enlarging intrapelvic neoplasm. Head and neck surgeons should be aware of the possibility that they may not be dealing with a common neck mass but rather a rare germ cell tumor which can create a significant/diagnostic dilemma and may eventually jeopardize the treatment plan. Advances in the field of therapy have been achieved, more tumor markers have been discovered to diagnose and to monitor improvement after treatment, multiple-drug chemotherapy is gaining success, researches in the use of other modes of treatment are gaining ground, but without a high index of suspicion on the part of the clinicians, all of these potential armamentaria will be wasted. Dysgerminomas are a potentially curable malignant entity, which if undiagnosed, are deadly.

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CEREBELLOPONTINE ANGLE TUMOR: A HUGE LESION WITH SILENT MANIFESTATIONS*

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NORBERTO V. MARTINEZ, M.D.***

ABSTRACT

This study aims to confront and piece together the puzzle generated by a 60 year old female patient with regard to the identification of the disease entity from which the symptoms emerged. It challenges the adequacy of relying on physical examination alone in arriving at an accurate diagnosis. The study strongly concludes that the necessity of ancillary procedures cannot be overemphasized, especially in such potentially ambiguous cases, in order to unravel the mysteries that may be present initially. More importantly, the utilization of a good clinical eye and inquisitive as well as intuitive mind in patients with ordinary symptoms, such as dizziness, is the key to its identification.

INTRODUCTION

The extraction of a good clinical history with a complete and through physical examination constitute integral parts in the proper diagnosis of a disease entity. Certain illnesses, however, present some degree of ambiguity that presents the physician with a diagnostic dilemma. Such is this case report of a 60-year old dizzy female seen on an outpatient basis.

Dizziness is one of the most common complaints that causes a patient to seek immediate medical attention, ranking only second to headache. It may be due to a multitude of causes and a systematic approach must be formulated to properly evaluate and manage the disease.

It is the objective of this paper to reiterate the need to involve all concerned specialties in the assessment of such patients, hence the term holistic approach is no less appropriate in the dizzy patient.

CASE REPORT

This is the case of a 60 year old female who came in with a chief complaint of dizziness. The condition started eight weeks PTC, when the patient complained of body weakness characterized as difficulty in getting up from bed and doing household chores. One week later, patient accidentally hit her head against a wall and developed dizziness with associated blurring of vision. The patient consulted a private physician who claimed that the PE findings were normal, and was given unrecalled medications which afforded temporary relief.

Six weeks PTC, the patient consulted the outpatient department of the Division of Medicine for persistent body weakness and dizziness and was diagnosed to have Contusion Hematoma, right hip, Secondary to trauma, Rule out Hip Joint Dislocation and Vertigo. X-ray of the pelvis was normal. Patient was then referred to Neurology for further evaluation and management of dizziness. Neurological evaluation was essentially normal, hence the referral to ENT.

At the ENT-OPD a Dizziness Questionnaire was accomplished which revealed the dizziness to have started a year ago, occuring at least once a week, lasting for about two or three minutes per attack. Dizziness was characterized as a "falling" sensation during these attacks, usually on assuming the right supine position, associated with a sensation of spinning or turning of objects. There was accompanying tinnitus and decreased hearing on both ears of undetermined duration, which was attributed to signs of old age.

Physical examination centered on otoscopy which revealed a non-hyperemic external auditory canal and an intact tympanic membrane in both ears. Vestibular function testing showed equivocal Romberg's Test, positive (+) right-swaying on Mann's Test, and with the aid of Frenzel glasses, a positive (+) right beating spontaneous nystagmus. Neurologic examination was unremarkable. Cerebellar function tests were normal. Binaural bithermal caloric tests showed a directional preponderance of (-) 26% and canal paresis of 6%. Positioning test (Dix-Halpike Maneuver) showed a left-beating nystagmus when assuming a head to the left position and a right-beating nystagmus when assuming a head to the right position.

Pure Tone Audiometry, Tympanogram, Acoustic Reflex and Tone Decay were requested. An initial impression of Positional Paroxysmal Vertigo was given, based on the Dizziness Questionnaire. However, a possibility of a central lesion was entertained because of the right-bearing spontaneous nystagmus, and the patient was given Almitrine-Raubasine (Duxaril) two tablets once daily.

* SECOND PRIZE, PSO-HNS INTERESTING CASE CONTEST
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Four weeks PTC, she came back with the audiometric studies. Pure Tone Audiometry showed bilateral mild to moderate sensorineural hearing loss with 100% Speech Discrimination Score and a Type A Tympanogram (Figures 1,2 & 4). Normal ipsi lateral/contralateral Acoustic Reflex Threshold and a positive (+) Tone Decay on the right ear (Figures 3&5). Physical Examination findings essentially were unchanged. Because of a positive (+) Tone Decay (Figure 6), Auditory Brainstem Response (ABR) was requested to verify the existence of a retrocochlear lesion. This revealed an interaural latency difference in Wave V of 0.5 m/sec and an absolute latency at Wave V of 6.5 msec (Figure7).

A Magnetic Resonance Imaging (MRI) was also requested to document the suspicion of a retrocochlear lesion. True enough, there was a solitary mass lesion, extraaxial with benign charactristics and situated on the right cerebellopontine angle. Suspicious extension of the mass into the posterior right cavernous sinus was likewise noted. The lesion measured 4.2 x 4.2 x 3.6 cm. (HxLxW). (Figure 8)

DISCUSSION

Dizziness has always posed a problem to the general practitioner. It is for this reason that history taking is very demanding and time consuming. Examination of a dizzy patient is very tedious, and diagnostic procedures have to be evaluated in the light of other diagnostic armamentaria because these cannot stand alone.

In evaluating the patient, a Dizziness Questionnaire was indispensable because it allowed the patient to thoroughly look back and vividly describe the symptoms. Likewise, the time involved in the history taking was shortened and needed vital information was obtained. The presence of hearing loss and tinnitus which was taken for granted and attributed to old age was elicited. The patient experienced dizziness after head trauma may be other way around.

The eye is the window into the soul of the labyrinth. It was essential for us to consider that the spontaneous nystagmus seen in this patient was by no means insignificant. In addition, a positive (+) nystagmus to the right as well as a right swaying Mann's test spoke of a central lesion. Frenzel glasses have been indispensable tools in the routine evaluation of nystagmus, because they eliminates optic fixation as well as present a magnified view of the eyeball making examination easier.

Positional vertigo was considered in this patient because the dizziness occured intermittently lasting for a few minutes, characterized as a sensation of spinning, triggered by assuming a left supine position. Positioning tests that showed multidirectional nystagmus weresuggestive of a central lesion.

Meniere's disease was another consideration because of the presentation of the classical triad of vertigo, hearing loss and tinnitus. However, the symptoms were not fluctuant, not occuring together and the vertigo occured only for a few minutes unaccompanied by nausea, vomiting and fullness of the ear.

Initially, a binaural bithermal caloric test was performed. There was no canal paresis, and a directional preponderance was (-)26% contrary to what was expected. It was necessary to recognize the limitations and pitfalls of this particular test, among which are: the length of the transmission pathway, blood-flow into the middle ear, amount and temperature of water introduced, and other variables. However, these may be minimized with the use of an automated calorimeter and computerized electronystagmographic instrument.

Hearing loss and tinnitus in this patient necessitated a request for a complete audiologic work up. Pure Tone Audiometry (PTA) showed mild to moderate sensorineural hearing loss bilaterally which may be attributed to presbycusis. The Speech Discrimination Score (SDS) was compatible with the Speech Reception Thresholds (SRT), pointing to a cochlear lesion. (In retrocochlear leasions, the SDS tends to be poorer compared to the SRT). The acoustic reflex was normal, and when compared to the PTA, showed signs of recruitment, also indicating a cochlear lesion. Ipsilateral and contralateral were normal binaurally, which were indicative of a cochlear lesion.

A positive (+) Tone Decay was suggestive of a retrocochlear lesion. However, it ranks very low as far as sensitivity-specificity is concerned in the diagnosis of retrocochlear lesions compared to the Acoustic Reflex. (Table 2 & figure 9)

The Tone Decay Test examines whether the patient is able to hear sustained tones. A tone is presented at a level where the patient can hear it, then the patient responds when the tone is no longer heard. Abnormal decay or disappearance of the tone is indicative of a retrocochlear pathology and may be caused by neural degeneration, inflamation, trauma, or space-occupying lesions such as tumours. Based on this finding, there appeared to be a discrepancy between the results of the Acoustic Reflex and the Tone Decay Test.

The Acoustic Brainstem Response (ABR) is a very sensitive test in diagnosing retrocochlear lesions. The ABR may actually reflect the synchrony of the auditory brainstem rather than the specific site. A difference of greater than 0.3 to 0.4 msec. between either ears for Wave V or prolonged Wave I to Wave V interval, suggests a retro-cochlear disorder. Of vital importance is that with a symmetrical PTA, the ABR should likewise be a mirror image if all were normal. There was a marked discrepancy between the PTA and ABR thus, a retrocochlear lesion was highly considered. In this patient, the interaural latency difference was 0.5 msec. and the absolute latency of Wave V was at 6.5 msec.

It was a Magnetic Resonance Imaging (MRI) scan which ultimately confirmed the initial impression of a retrocochlear lesion.

TESTS	COCHLEAR	RETROCOCHLEAR
Pure Tone Audiometry	Equivocal	Equivocal
Speech Discrimination Test	+	
Pure Tone Audiometry	+	
Tympanogram	Equivocal	Equivocal
Tone Decay		+
Acoustic Reflex	+	
Auditory Brainstem Response		+

Table 1. Actual Comparative Test Results Of The Patient With Regard To The Site Of The Lesion

	*d
Posterior fossa cisternography	>5
Computerized tomography,gas cisternography	>4
Computerized tomography, metrizanide cisternography	>4
Auditory Brainstem Response	2.9
Computerized tomography, intravenous enhancement	2.6
Combined Acoustic Reflex Threshold/Decay	2
Threshold Tone Decay	1.6
Alternate Binaural Loudness Balance	1.5
Bithermal caloric	1.5
Bekesy Audiometry (sweep frequency)	1.4
Short Increment Sensitivity Index	1.4
Plain X-Ray	1.3
Speech Discrimination Score	0.6
Tomography	1.8

Table 2. Values of d' for various diagnostic test
*the higher the d'value, the higher the sensitivity

TEST	RIGHT	LEFT
SRT	30	30
PB	100%	100%
MCL	70	70
TOL	100	100

Figure 2: SPEECH DISCRIMINATION

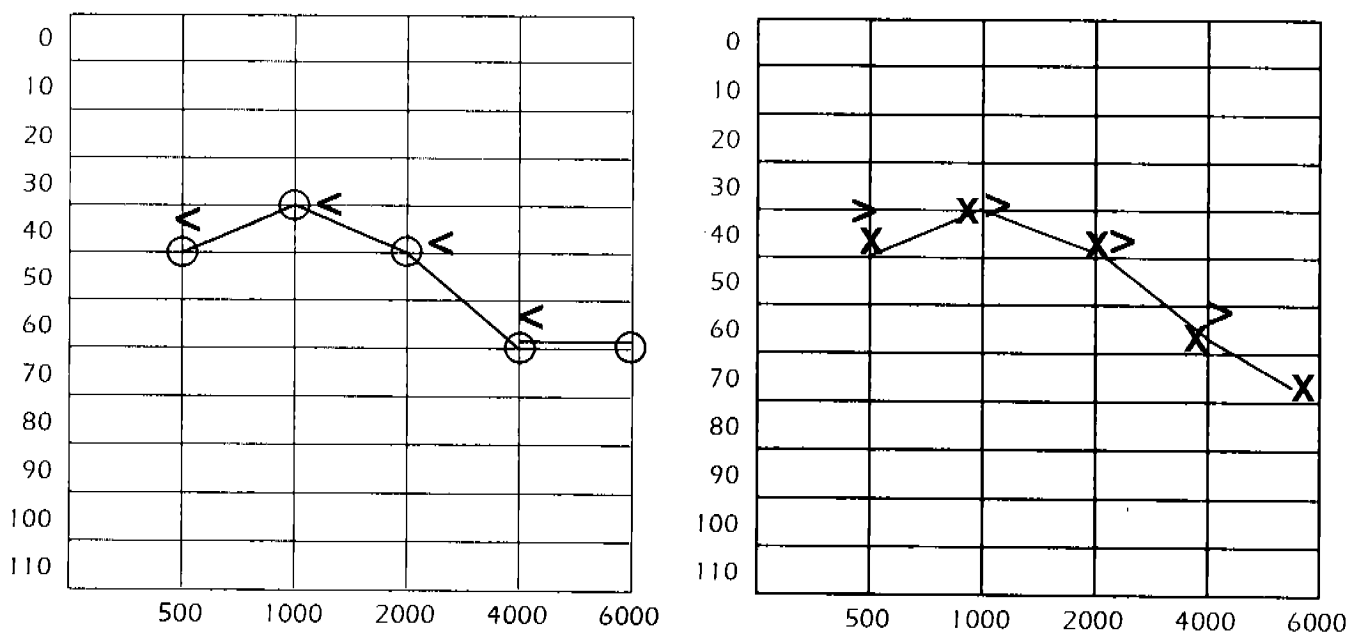


Figure 1: PURE TONE AUDIOGRAM

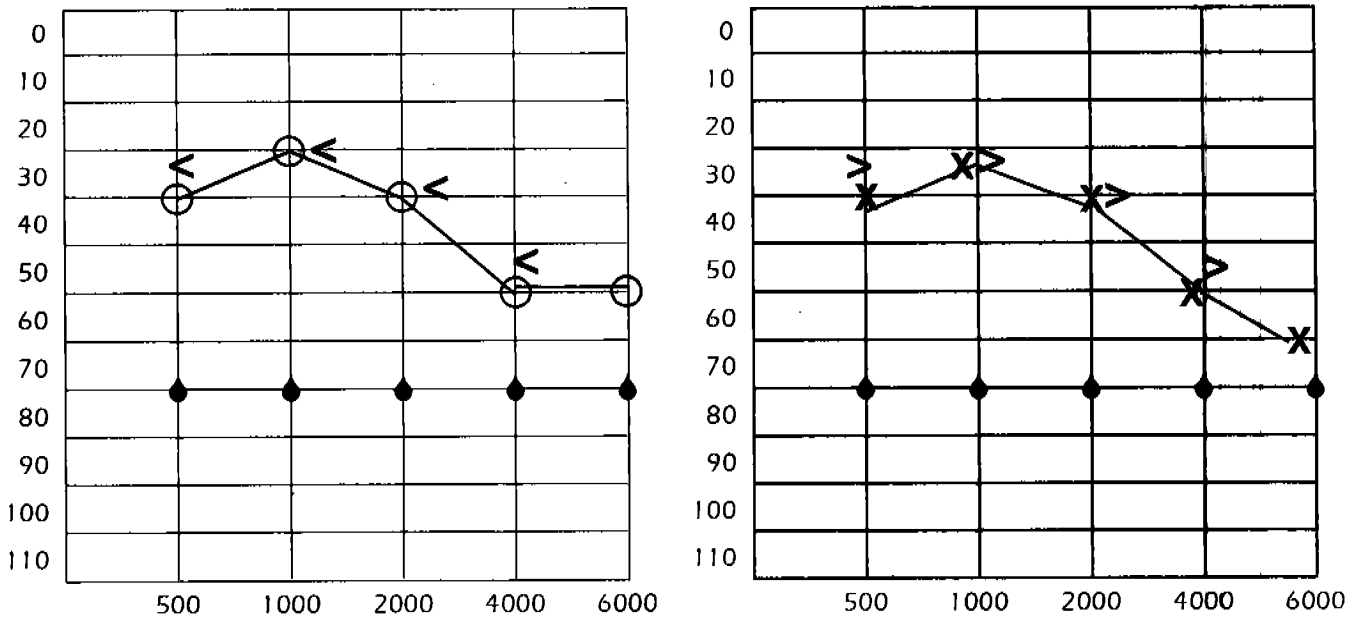


Figure 3: REFLEX THRESHOLD VS PURE TONE AVERAGE

Figure 4: TYMPANOGRAM

	FREQUENCIES			
ACOUSTIC REFLEX	**500Hz**	**1000Hz**	**2000Hz**	**4000Hz**
Ipsilateral,AD	100dB	90dB	100dB	95dB
Contralateral, AD	100dB	90dB	105dB	115dB
Ipsilateral, AS	110dB	100dB	110dB	120dB
Contralateral,AS	110dB	100dB	100dB	110dB

Figure5: ACOUSTIC REFLEX

HL	500		1,000		2,000		4,000	
	R	L	R	L	R	L	R	L
0								
5								
10								
15								
20								
25				T				
30		T	T	60		T		
35	T	60	25		T	60		
40	11		28		24			
45	17		16		33			
50	32		42		37		T	T
55	27		60		38		60	60
60	38				39			

Figure 6: TONE DECAY

Figure 7: Auditory Brainstem Evoked Response

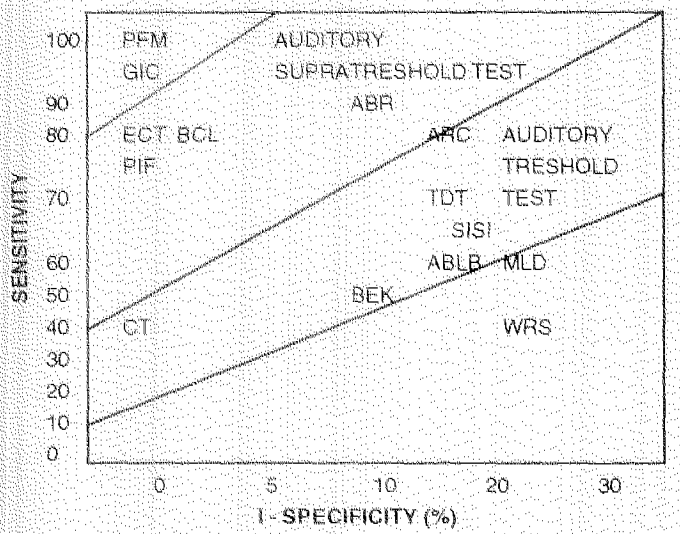
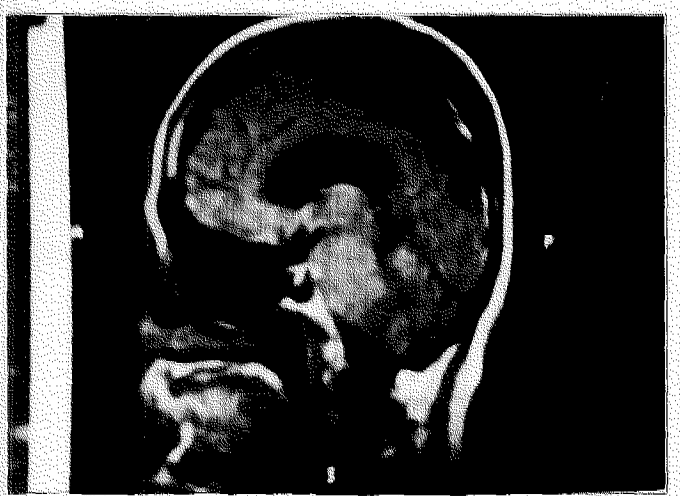


Figure 9: RECEIVER OPERATING CURVES (ROC'S) FOR NEURODIAGNOSTIC PROCEDURES IN IDENTIFICATION OF EIGHT NERVE PATHOLOGY



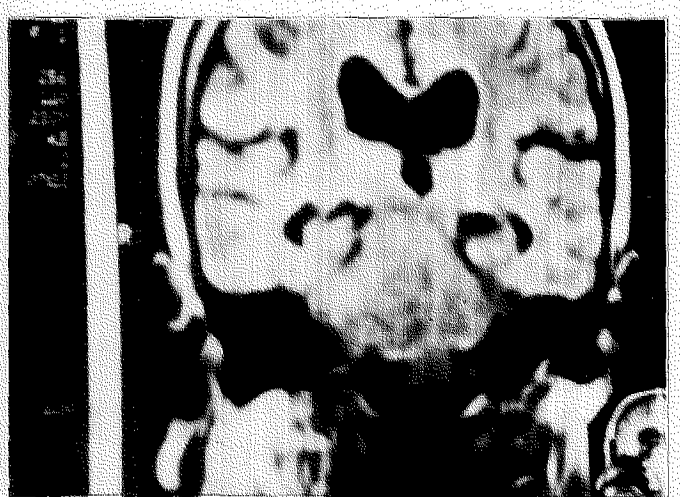


FIGURE 8. MAGNETIC RESONANCE IMAGING

Table 1 illustrates the battery of actual audiologic tests performed on the patient and the corresponding results as to the site of the lesion. Table 2 and Figure 9 depict the respective sensitivity and specificity of various audiologic and radiologic tests that may be requested in similar cases.

CONCLUSION

This case has demonstrated the intricacies involved in a disease entity with respect to its generalized symptom. The problem therefore was twofold: to accurately diagnose the patient and to request for the proper diagnostic procedure that would give the highest yield without unduly financially compromising the patient. Through the use of an orderly and systematic approach, diagnosis was obtained with a much better understanding of the pathology of the disease involved, so that management and prognosis could be readily evaluated.

A holistic approach can not be overemphasized in dealing with a patient who suffers from dizziness. The astute physician should be able to realize one's limits and subsequently refer to other specialists who may be in a better position to evaluate and manage the patient.

Finally, a seemingly simple case of a dizzy patient may not be all that simple for one may be harboring a huge lesion presenting with silent manifestations.

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AIR-FILLED CYST IN THE NECK: THE ONLY DOCUMENTED SIXTH BRANCHIAL ANOMALY*

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ABSTRACT

There are various congenital anomalies of branchial origin found in the neck region. This paper reports a case of a right anterolateral cervical air-filled cyst in a 47 year-old female. Several radiologic studies were done to establish a possible connection with the digestive and respiratory tracts. Differential diagnoses such as branchial cyst, laryngocele, a bronchogenic cyst or a pneumatocele were entertained. Subsequent neck exploration revealed a cyst with a sinus tract leading into the right apical pleura. Histopathologic examination showed findings consistent with a branchial cyst. It is, therefore, valid to conclude that this is a cyst originating from the sixth branchial arch, the recurrent laryngeal nerve. This is perhaps the first and only documented case of such an anomaly in world literature.

INTRODUCTION

The branchial cyst is one of the more controversial cysts of the head and neck. Despite their infrequent occurrence, these congenital anomalies continue to arouse interest, due to the complex development of the structure of the neck and the changing relationships that occur during embryonic life.

The branchial apparatus was first described by Baer in 1827 (8). It consists of a series of six mesodermal arches that are separated from each other externally by ectodermally-lined branchial clefts (grooves) and, internally, by endodermally-lined pharyngeal pouches (2). The fifth arch eventually disappears and the sixth becomes rudimentary.

Branchial remnants are slightly more common than cystic hygromas but are considerably less common than thyroglossal duct cysts. They usually manifest as sinuses, cysts, fistulae and cartilagenous nests (9). A fistula of branchial origin involves remnants of pouch and cleft. It is an epithelial-lined tract that connects the gut to the skin. On the other hand, a sinus is a tract that is open to either gut or skin but not both. A cyst is a mucosa or epithelium lined structure with no external or visceral openings (3). Other authors define a branchial cyst to be a tract with only an internal or external opening (8).

First branchial anomalies are much less common than those of second arch origin (~95%). Third branchial defects are even more rare. Fourth branchial cleft remnants are so rare that a case presentation is always noteworthy (1). Several authors have considered these anomalies to be more of a theoretical possibility. More recently, several reports of anomalies believed to have originated from the fourth branchial pouch have been reported. Takimoto et al. (1990) in their review of the literature for the past 20 years collected reports of 31 fourth branchial pouch sinuses confirmed by barium swallow or surgery (11). Another rare and mystifying anomaly is the branchial cyst in the mediastinum without connection to the larynx or neck, which has been described by Downey in1969 (13). Never has there been any report of a sixth branchial anomaly or any branchial anomaly with a connection to the lung.

This paper aims to:

a. report a rare case of a branchial anomaly originating from the skin arch, perhaps the first to be reported internationally.
b. discuss the differential diagnosis of an air-filled cyst in the neck.

The significance of this dissertation lies in the rational approach of diagnostic reasoning in the diagnosis of an air-filled cyst in the neck based on the basic precepts of embryology and anatomy. Such knowledge would be of great help in future analysis of similar cases.

CASE REPORT

A.Y., a 47 year old housewife from Bulacan was admitted for the first time at this institution for a right-sided anterolateral neck mass. About three years PTA, patient noted a soft, non-movable, non-tender mass measuring about 2 x 2 cm located at the right mid-supraclavicular area. There were no associated symptoms. The mass gradually increased in size such that seven

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months PTA, the mass was 6 x 6 cm, hyperemic but non-tender, with associated moderate grade fever and upper respiratory tract infection. The patient was admitted in a local hospital where allegedly aspiration of the mass was done yielding two cupfuls of milky-brown material. The patient was given unrecalled antibiotics and discharged after twelve days, with resolution of the mass. Five months PTA, the patient noted a recurrence of the mass and progressive increase in the size prompted consult at the out-patient department.

Pertinent physical examination centered on the neck where there was a right anterolateral cystic mass measuring 11 x 11 x 9 cm situated at the anterior border of the sternocleidomastoid muscle, slightly crossing the midline. This cystic mass was tympanitic upon percussion and breath sounds be appreciated upon auscultation. It also transilluminated and would slightly bulge upon performance of the Valsalva manuever. Indirect and fiberoptic lryngoscopy showed bulging of the right lateral wall of the hypopharynx, pushing the epiglottis to the left, obscuring a good view of the laryngeal inlet. The rest of ENT examination was unremarkable. Primary working impression was: Right Anterolateral Neck Mass, probably a Branchial Cyst.

A thyroid scan done the year before showed a large multinodular thyroid consistent with multiple colloid adenomatous goiter. A repeat thyroid scan revealed thyroid gland with large cold mass involving the right lobe. An ultrasound of the thyroid, defined this air-filled mass to be lying adjacent to the right thyroid gland. A x-ray of the chest and neck showed an eccentric cystic lesion displacing the tracheal air column to the left. When aspiration of the cyst was done, up to 30 cc of air was drawn without any appreciable decrease in cyst size.

Contrast studies were then planned to delineate the cyst. The fluoroscopy-guided percutaneous neck mass puncture done showed the cystic cavity to extend down to T4 level. Swallowing manuevers disclosed a communication between cyst and the right pyriform sinus demonstrated by the passage of contrast and air bubbles. Approximately 300 cc of air had to be aspirated before the mass flattened out but gradually grew back to its former size in ten days.

An MRI was done to locate the described communication with the pyriform sinus. Instead, the MRI showed findings compatible with a right paraesophageal duplication cyst which communicates with the esophagus at the level of the hypopharynx. A barium swallow was then done to demonstrate the esophageal duplication. However, the study showed extrinsic indentation of the esophagus by the cystic mass without any communication. Documentation of the barium swallow by computed tomography showed similar findings.

If there was anything the radiologists all agreed on and emphasized, it was that there was absolutely NO communication between this cyst and any part of the airway or lung. However, amidst and despite this array of radiologic studies, the primary impression was still that branchiogenic cyst, to rule out a laryngocele, ectopic bronchogenic cyst or pneumatocele. It was then decided that the patient undergo triple endoscopy, surgical exploration, and excision of the cyst.

The patient was placed under general anesthesia. A zero-degree Hopkin's telescope was inserted through a 1.0 cm incision on the anterior cyst wall. This showed that the cyst had multiple layers of septations. The inner mucosa was noted to be smooth and pinkish in color. There was no fluid noted inside. The cyst was hollow, confirming that it was air-filled. Laryngoscopy, bronchoscopy and esophagoscopy were subsequently done afterwards. None of the above procedures showed any sinus opening.

Excision of the cyst via an external approach was then performed. The cyst was bounded anteriorly by the thinned-out strap muscles and sternocleido-mastoid muscle. The cyst wall was noted to be thin, elastic and pinkish on the outer surface. There was communication with the pyriform sinus. It encroached medially on the right thyroid lobe and esophagus. Careful dissection showed no communication between these structures and the cyst. Posterolaterally, the cyst was adherent to the carotid sheath. There was relationship with the thyroid cartilage or any part of the larynx.

Dissection continued into the mediastinum where the cyst tapered to a narrow tract which was noted to course under the medial third of the right clavicle. A probe was carefully inserted, showing that the tract led to the medial aspect of the right apical pleura. This tract was clamped, ligated two times, then cut. Unfortunately, the knots gave way to strong gushing of air from the lung. Prompt thoracostomy and subsequent pleurodysis was done to manage the pneumothorax that occured.

The Post-operative course was marked by high-pitched hoarseness. Fiberoptic scoping done revealed findings compatible with right recurrent laryngeal nerve injury. Otherwise, the rest of the hospital stay was uneventful. The patient was discharged after nine days of confinement.

Histophathologic examination showed a wide sheet of grayish-brown flattened tissue measuring 13 x 12 cm. The external aspect was smooth while the inner aspect contained fibrous adhesions. Microsections disclosed a fibrocollagenous cyst wall lined by cuboidal to pseudostratified columnar cells with cilia, with note of some lymphoid cells. These histologic findings were consistent with a branchiogenic cyst.

DISCUSSION

The differential diagnoses of this lesion is that of any lateral neck mass. It includes any of the following: lymphadenitis, lymphangioma, atypical thyroglossal duct remnants, ectopic thyroid, tuberculous adenitis, lymphoma,

hemangioma, branchiogenic carcinoma, metastatic malignant neoplasms or carotid body tumor (3). However, due to the cystic nature of the lesion, manner of presentation and clinical findings, the admitting impression was a cyst of branchiogenic origin, to rule out a laryngocele or an ectopic bronchogenic cyst, or a pneumatocele.

A very important differential diagnosis based on clinical findings is that of an external laryngocele. Although this patient did not present with any of the classical symptoms of a laryngocele, many cases will manifest asymptomatically. External laryngoceles may present as air-filled swellings anterior to the sternocleidomastoid muscle which are tympanitic on percussion and increase in size with Valsalva manuever (1). Laryngoceles are generally lined by respiratory (ciliated pseudo-stratified columnar) epithelium. As tomograms may provide helpful information, the more sophisticated MRI done in this patient did not yield significant findings to support a diagnosis of laryngocele which showed a cyst-like structure that was supposed to communicate with the proximal esophagus. This was eventually disproved by barium swallow. Furthermore, the laryngoscopy did not show any communication between the cyst and any part of the larynx.

Bronchogenic cysts are simple congenital cysts, usually located in the lung hilum or adjacent to the lower trachea. These are not expected to occur in the apices (10), but may rarely be found near the lower cervical trachea, thus presenting as a low neck mass (9) and may contain any or all tissues normally present in tachea and bronchi. Bronchogenic cysts are usually fluid-filled but may rupture into a bronchus and thus contain air and may communicate with a bronchus by a check valve mechanism which causes hyper-inflation of the cyst (7). Diagnosis rests on the histologic appearance-an inner lining of respiratory epithelium with smooth muscles and occasional bits of cartilage in its wall (9). The lining may also contain stratified squamous epithelium. On fluoroscopic examination, it moves with respiration (4). These findings were not seen in the patient.

Pneumatoceles are air-filled loculations from the lung, usually multiple, thin-walled cystic structures, with no known tract formation. It is postulated to be due to small airway disease with a sleeve valve mechanism which results in localized air trapping. Another theory is the loss of pulmonary elasticity resulting in its formation. They do not indicate destruction of lung parenchyma and usually resolve within weeks or months. Another type is the traumatic pneumatocele which follows blunt injury to the chest. Pneumatocele is best excluded on the basis of history, since it typically follows staphylococcal pneumonia, hydrocarbon aspiration pneumonia ot trauma (10), none of which were true in this patient.

The primary impression is that of a branchial cyst. Persistent remnants of the embryonic branchial apparatus produce various lesions in and around the ear and down the lateral aspects of the neck. It is important to understand the embryologic basis of these defects. By considering the anatomic location and radiologic appearance, a precise embryologic origin can be accurately predicted. There should be a high index of suspicion in any person presenting with a recurrent neck abscess and a lateral neck cyst. Microscopically, branchial cysts are usually lined with a stratified squamous epithelium with lymphoid tissue deep to the lining membrane. In about 4% of cases, the cysts will have their lining composed entirely of columnar (respiratory) epithelium (1). This shows precisely this histologic finding.

There are six branchial arches and four branchial pouches and clefts - any of which can develop in to an anomaly.

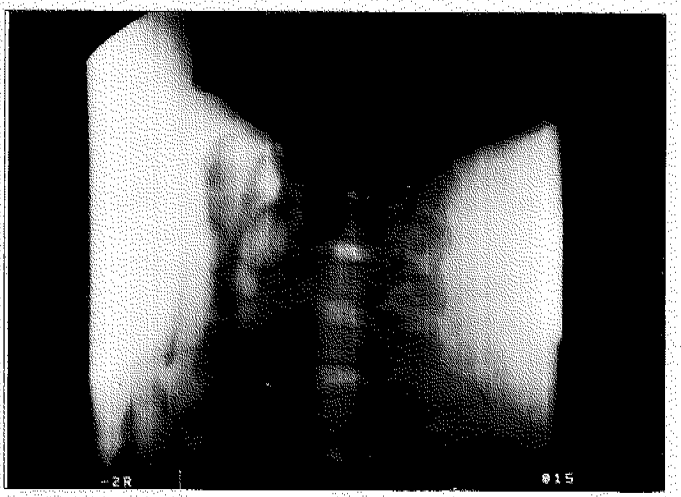
First branchial arch anomaly can immediately be ruled out because of the location. These usually originate anywhere along the nasopharynx, middle ear cavity, or external auditory canal and extend anterior or posterior to the pinna (2).

The more common second arch anomaly is not highly considered. The tract usually runs deep to the platysma muscle, ascends along the carotid sheath, passing between the internal and external carotid arteries after crossing over the hypoglossal and glossopharyngeal nerves (2). It would then pass below the styloligament to a usual internal opening in the intratonsillar cleft of the palatine tonsil (5). Branchial cysts of second arch origin usually become clinically evident as gradually enlarging masses that lie deep to the anterior border of the sterno-cleidomastoid muscle in its upper third (9). This does not conform to the position taken by our cyst. Furthermore, in all previous reports of this common branchial anomaly, there has been no known connection to the lung.

With regards to the third branchial arch, the only way to determine this vestigial structure is by careful anatomic examination. The anatomic relationships that are most important include their connections with the foregut derivatives and their relations to both the main vascular and neural components. A third branchial arch anomaly must pass posterior to the common carotid or internal carotid arteries, originating from the posterior compartment behind the sternocleidomastoid muscle (2). They may have a sinus opening into the piriform fossa. These points were not appreciated during the surgical dissection of this case.

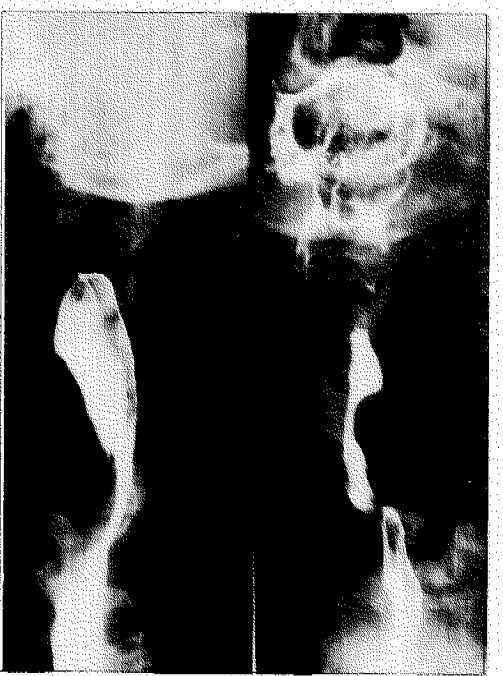
The fourth branchial arch anomaly is a very rare entity. Because fourth branchial remnants are not evident as a complete anomaly and there are overlaps with other anomalies, they can be very difficult to prove with certainty. Several authors agree that a complete fourth branchial fistula may never be surgically demonstrated owing to the aggressive surgical approach in exposing the cervical and mediastinal components of the tract (5,6). Whitworth et al. (1993) has also cited the case of a fourth branchial cleft cyst which was unusual in both its asymptomatic nature, the age of this patient (49 years old) and that no sinus tract was identified (13). Fourth branchial cleft anomalies theoretically travel the subclavian artery on the right side (arch of the aorta on the left)to

A. PRE-OP PHOTOGRAPH

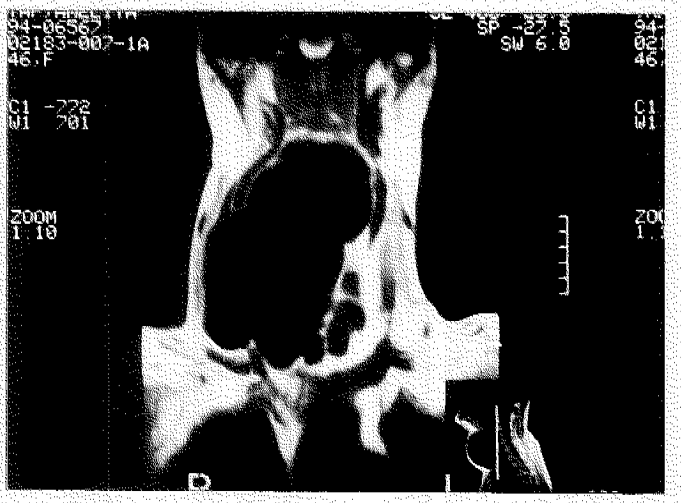


PHOTOGRAPH OF FLUOROSCOPY PROCEDURE SHOWING PASSAGE OF CONTRAST AND AIR BUBBLES THROUGH A COMMUNICATION BETWEEN THE CYST TO THE AREA OF THE RIGHT PIRIFORM SINUS.

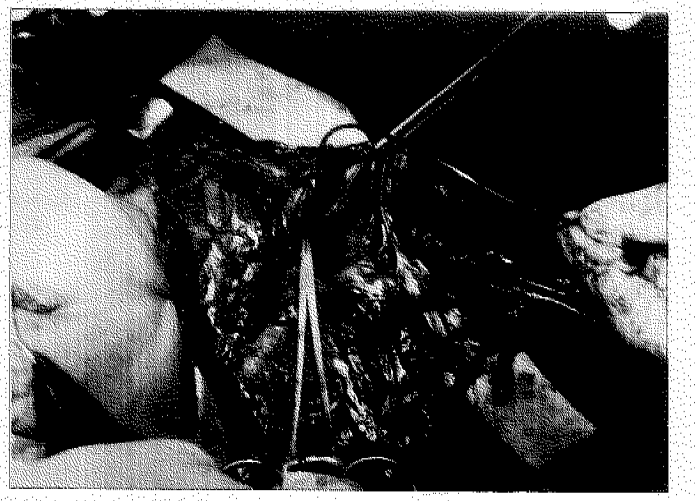
B. POST-OP PHOTOGRAPH



PHOTOGRAPH OF BARIUM SWALLOW PROCEDURE SHOWING INDENTATION OF THE ESOPHAGUS.

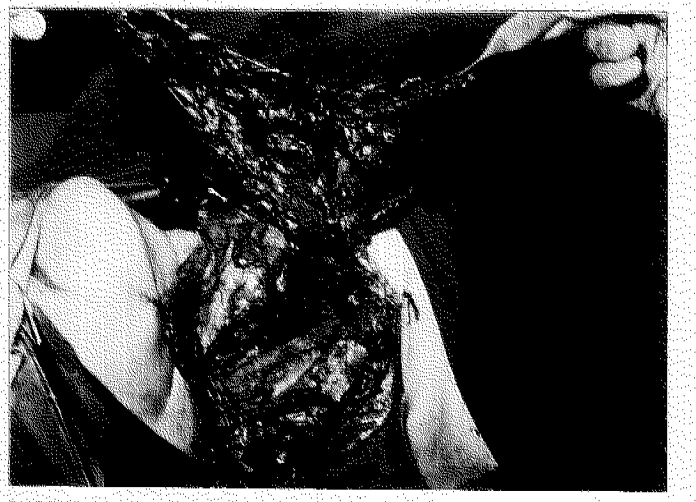


PHOTOGRAPH OF MRI, SAGITTAL VIEW, POSTERIOR ASPECT OF THE CYST SHOWING NO COMMUNICATION BETWEEN CYST AND RIGHT LUNG.



PHOTOGRAPH SHOWING A POLYTHELENE TUBE INSERTED TO PROBE THE TRACT TO THE LUNG.

PHOTOGRAPH OF THE CT SCAN, AXIAL VIEW, SHOWING THE CYST WITH ANY COMMUNICATION WITH THE ESOPHAGUS OR THE TRACHEA.



PHOTOGRAPH OF THE INTERIOR ASPECT OF THE CYST WITH A TRACT LEADING UNDERNEATH THE RIGHT CLAVICLE.

PHOTOGRAPH SHOWING THE INNER SURFACE OF THE CYST.

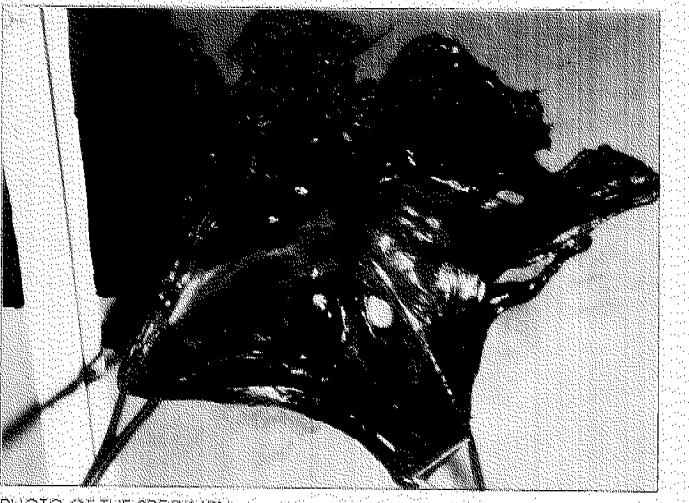


PHOTO OF THE SPECIMEN.

reascend in the neck and approach the cervical esophagus (9). There has yet been no reported case of communication with the lungs. These features are also not compatible with those of our patient.

Finally, it is believed that this case would most likely to be a sixth branchial anomaly. In support of this claim, it can be argued, based on the associations of tbe cyst and tract to the different structures derived from the sixth arch.

A. The fact that the cyst possessed a tract to the lung which can be explained embryologically by the close proximity of the sixth arch and the origin of the lung. The ventral folds of the sixth arch are the lateral boundary of the laryngotracheal groove which divides dichotomously to form the right left lung buds (12). Failure of the sixth arch to degenerate, as expected, might have contributed to the formation of a tract and cyst as it did in this patient.

B. The fact that there was injury to the right recurrent laryngeal nerve during excision of this cyst also supports the contention because this nerve is the nerve of the sixth arch. This injury had occurred despite all precautions taken in dissecting the cyst. The very intimate association of the tract to the recurrent laryngeal nerve has caused unavoidable injury to the nerve during dissection of the tract below the clavicle.

C. The cyst has a very uncharacteristic position and anatomic relationship in the neck with a definite tract into the lung-never before described or even approximate in all the previous reports of branchial anomalies reviewed. This, in itself, excludes anomalies of the first to fourth branchial arches, leaving us with the convincing possibility that this is in fact a cyst which originated from the sixth branchial arch.

Therefore, based on the above presented evidence, this may be a previously unreported entity - a case of a sixth branchial arch anomaly.

As a last point in the discussion, in the process of the investigation of this very rare, reportable case, modern imaging techniques were employed to gain better visual access into this anomaly. These various sophisticated diagnostic imaging modalities are certainly of benefit, but are definitely not without limitations as seen in this extraordinarily worked-up case. The service handling this case was confronted with a diagnostic dilemma, further confounded by the varied conflicting results obtained from their various imaging findings. Furthermore, a majority of the interpretations derived did not correlate with the intraoperative findings. Still the clinician had to depend on the old reliables-knowledge of anatomy and embryology, history and physical examination - to arrive at the diagnosis.

CONCLUSION

In summary, a case of an air-filled anterolateral neck cyst has been presented. Primary consideration was a cyst of branchiogenic origin. Subsequent neck exploration showed a cyst with a tract leading to the lung. Sound logical reasoning based on literature review and knowledge of embryology and anatomy led to the conclusion that this is the first locally, if not internationally, reported case of a brachiogenic cyst with a communication with the lung.

The objective of presenting the case and providing a list of possible diagnoses will probably help the ENT specialist in the analysis of any air-filled cyst in future encounters with a similar entity.

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A CASE OF CEREBRAL ISCHEMIA AFTER MASTOID SURGERY

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ABSTRACT

A case of a seven year old girl who developed ischemic stroke after an emergency radical mastoidectomy for chronic tympanomastoiditis with subperiosteal abscess is presented. Computed tomographic scan of the head showed a large area of infarction in the region supplied by the right middle cerebral artery. Search for possible causes of the neurological problem such as cardiac disease, hematologic abnormalities and connective tissue disorders proved to be unsuccessful. The role of surgery as a potential risk factor in causing the complication is discussed.

INTRODUCTION

Intracranial complications of chronic otitis media are well documented in the standard text-books of ear surgery. Complications affecting the central nervous system following mastoid surgery, however, are extremely rare. An extensive search of foreign literature revealed only three previous reports of intracranial complications after mastoid surgery. Review of local journals failed to show reports on similar post-operative complications. Not a single case of cerebral ischemia after mastoidectomy has been reported.

This paper describes a case of ischemic stoke which appeared after a mastoid surgery. This paper is being presented to increase awareness of the existence of such an unusual complication and to discuss the role of surgery as the potential risk factor in causing the complication as well as other considerations that might have contributed to the problem.

CASE REPORT

A seven year old girl presented with a history of recurrent right otorrhea since infancy. Several consultations were made and treatments included various otic drops and courses of aural toilette. However, the ear continued to discharge intermit-tently. There was no history of frequent nasal congestion, tinnitus, vertigo nor hearing loss. A week prior to admission in this institution, the patient developed a right post-auricular subperiosteal abscess accompanied by undocumented low grade fever. On admission, otoscopic examination on the right revealed a near total tympanic membrane perforation with congested middle ear mucosa and greenish foul-smelling discharge. The right post-auricular area was swollen, tender and erythematous. The rest of the ENT examination and systemic findings were normal. Past medical history, family history and growth and development history were all unremarkable. Initial impression was chronic tympanomastoiditis, AD, active with subperiosteal abscess, right. Incision and drainage of the abscess was done and patient was advised to undergo an emergency mastoid operation the following day.

A right radical mastoidectomy was performed via a post-auricular incision. Intra-operatively, there was a break in the mastoid cortex and a cavity was formed and enlarged by the cholesteatoma (Figure 1). The middle ear, ossicles, attic and antrum were also involved by the cholesteatoma and granulation tissue. The facial canal wall, tegmen dura and lateral sinus were not exposed. The posterior canal wall was removed and the facial ridge lowered. The cholesteatoma, diseased mucosa and ossicles were removed. However, during the process of cleaning, the stapes was accidentaly removed exposing the oval window. A tiny strip gauze soaked with antibiotic was placed and meatoplasty done.

Immediately post-opera-tively, the patient experienced vertigo as expected. Promethazine HCl was started. On the second post-op day, patient was noted to be agitated and restless. The following day (3rd day post-op), patient developed a left-sided hemiparesis associated with a transient aphasia. Neurologic examination revealed a drowsy patient with grossly deranged motor functions. Patient was referred to the pediatric neurology service and was assessed to have Stroke in the Young, right middle cerebral artery distribution R/O intracranial extension R/O congenital heart disease, acyanotic, probably atrial septal defect on the basis of cardiac findings of a grade 2/6 systolic murmur on the left upper parasternal border. Emergency computed tomographic scan was requested which showed a large right middle

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cerebral artery territory ischemic infarct, presumably embolic (Figure 3). Appropriate management was instituted. The patient, however, did not show any signs of increased intracranial pressure.

The patient was further worked-up for presence of probable cardiac pathology or collagen disease. Complete blood count showed leukocytosis that may be attributed to the ear infection. There was no polycythemia. Erythrocyte sedimentation rate was elevated. Serum electrolytes were within normal limits except for a slight decrease in chloride. Screening anti-nuclear antibody and lupus erythematous cell results were negative. Chest radiograph and electrocadiogram were reported as normal. 2D echocardiography showed absence of valvular disease and there was no evidence of thrombus formation nor vegetations.

Computed tomographic scan of the temporal bone was also requested. The visualized bony structures which include the carotid canal, tegmen of the middle cranial fossa, internal auditory canal and the petrous apex were all intact (Figure 4). Cerebral angiography was not carried out because the parents of the patient refused further work-ups done on the patient.

The patient was referred to Rehabilitation Medicine and physical therapy started. The patient was discharged on the 30th post-op day with improvement in her motor functions (figs. 5 & 6).

DISCUSSION

An ischemic stroke is not usually seen as a complication of mastoid operations as evidenced from the lack of reference in the standard text-books of otology. An extensive search of literature revealed only three previous reports of complications affecting the central nervous system which were described variably as superficial venous thrombosis, nominal aphasia and unexplained neurological problems after mastoid surgery. Not one reported cerebral ischemia as a complication of mastoid surgery.

The authors of the above journals suggested the possibility of venous thrombosis as the cause of the abnormal neurologic presentation in those cases. Clinically, the symptoms of cortical venous thrombophlebitis include changes in consciousness, pyrexia, focal or generalized seizures, focal motor deficits and evidence of increased intracranial pressure. These symptom complexes were not observed in this patient. Instead the patient had an acute onset of contralateral hemiparesis and transient aphasia. There were no signs of increased intracranial pressure. Exposure or damage to dura was also a feature during mastoid clearance operations in those cases. In this patient, there was no evidence of damage to dura of the middle cranial fossa. There is usually no diagnostic finding on CT scan of patients with venous thrombosis although some cases may show evidence of low attenuation in the region affected by the thrombosis. The CT scan of this patient showed a wedge-shaped infarction in the area supplied by the right middle cerebral artery (Figure 3). Lastly, presuming that there was venous thrombosis and the thrombus accidentally thrown off anytime during and after surgery, it could not possibly go directly into the arterial system of the brain. The thrombus has to pass through the general or systemic circulation and, most likely will end up as a pulmonary embolus.

Since this is a clear cut case of arterial occlusion, the possibility that the surgery may have caused the arterial thrombosis cannot be dismissed. The internal carotid artery from which stems the middle artery is closely related to the surgical field since the carotid canal is found in the anteromedial part of the temporal bone (Fig.2). However, trauma to the internal carotid artery after mastoidectomy alone is extremely rare. Review of literature showed only one case of traumatic aneurysm of he internal carotid artery after mastoid operation. Carotid artery dehiscence in the middle ear has been reported but usually identifiable on pre-operative CT scan. The clinical presentation of the patient in case of damage to the carotid artery is that of a life-threatening hemorrhage and not thrombosis. In this case, there was no hemorrhagic incident during surgery. This is further reinforced by the post-operative CT scan finding of an intact carotid canal (Figure 4).

The caroticotympanic artery, a branch of the internal carotid in the middle ear, may also be injured during the procedure since it is located in the anterior walls of the tympanic cavity in an area of natural bone dehiscence. During the surgery, this area was not aggressively dissected and again there was no profuse bleeding encountered that may have suggested injury to the vessel. If a thrombus was formed in this area, the possibility of the thrombus being dislodged back to the internal carotid in a retrograde manner and occluding the middle cerebral artery is improbable. One should bear in mind that the caroticotympanic artery is very small and thrombi from this area cannot totally occlude the middle cerebral artery which is the largest terminal branch of the internal carotid. In addition, the carotid artery is a high flow area and the possibility for a thrombus in the smaller caroticotympanic branch to go against the flow is highly unlikely.

Another factor that may explain the neurologic finding in this case was inadvertent drilling during surgery. This is a more plausible explanation for the case presented. The vibration caused by the drilling of the bone can be transmitted down to the carotid canal. This may have induced spasm of the internal carotid consequently, formation of thrombus. However, this is purely speculative. In case of spasm, not only the middle cerebral branch territory will be infarcted but the areas supplied by the other branches of the internal carotid as well. If indeed a thrombus was formed and dislodged from the canal

wall, it must have been too sufficiently large to cause complete occlusion of the middle cerebral artery. In those cases, the surgery must have been aggressive. This operation was not that extensive nor very aggressive. It was just a radical mastoid procedure.

Anesthesia during surgery is another consideration. Traumatic arterial thrombosis has been explained in relation to surgery but the possibility of arterial embolism being the case has not been totally ruled out. It is possible that an embolus from another focus was thrown off when the patient was anesthe-sized. However, the problem arose three days after the operation and not within the twenty-four-hour golden period of post-anesthetic care. Furthermore, the anesthesia record failed to show any evidence of untoward reaction to the anesthetic delivered. The induction, maintenance and recovery from anesthetic was uncomplicated and unremarkable.

If neither surgery nor anesthesia was the cause of this CNS complication, diligent investigation is warranted to find the cause of this predicament. In a study of 86 children by Solomon et al., the causes of arterial thrombosis or acute hemiplegia are enumerated as follows (Table I): trauma, CNS infections, cardiac disease, sickle cell anemia, arteriovenous malformations, documented occlusive vascular diseases and unknown origin. Surgery as a form of trauma has already been discussed above. CNS infections has been ruled out clinically and by laboratory methods. Cardiac disease as the cause of thrombosis has not been totally ruled out since the patient was assessed to have a probable arterial septal defect. However, 2D echocardiography showed absence of valvular heart disease and there was no evidence of thrombus formation nor vegetations. The patient did not have sickle cell anemia nor AV malformation. Still, a large percentage of cases of cerebro-vascular thrombosis have unknown etiologies and are unaccounted for. Other possible causes include autoimmune diseases such as systemic lupus erythematous and periarteritis nodosa, inborn errors of metabolism and demyelinating diseases.

On the other hand, cerebral is usually encountered within the framework of cardiac disease, specifically cyanotic congenital heart disease, bacterial endocarditis or rheumatic valvular disease. The patient in this case did not have any of the above-mentioned conditions. Fat or air embolism was less likely encountered in this case.

In adult life, arterial occlusion is most frequently the consequence of arterioscelorosis of the cerebral vasculature. In childhood, arterial occlusion usually results from cerebral arteritis, atheroscelorosis, congenital dysplasia or fibro-muscular hyperplasia of the vessels. In the study by Solomon et al., occlusive vascular disease comprises only 19% of the cases. Cerebral angiography is indicated for every child with an acute onset of hemiparesis to establish a diagnosis. Although arteriography can delineate the lesion causing acute hemiplagia, it carries with it significant risks of local vascular damage, systemic reactions, transient neurologic deficits, permanent neurologic compromise and even death. Complications of cerebral angiography have an incidence rate as high as 8.5%. This procedure was contemplated in this case. However, given the information on the risks versus the benefits from the procedure, the relatives refused because of the observed recovery to a significant degree of the patient.

After identifying all the possible risk factors that might have contributed to the neurologic problem of the patient, the dilemma in this case still remains unsolved. The only remaining possibility still left unexplained is that of a pre-existing disease. Surgery might have triggered the condition to be manifested clinically and since none were identified, safeguards cannot be instituted. A pediatric clearance prior to surgery might have helped but this is usually short-circuited in emergency cases. Though a chronically discharging ear with complication is considered an emergency, the question remains in the urgency of the required surgical procedure.

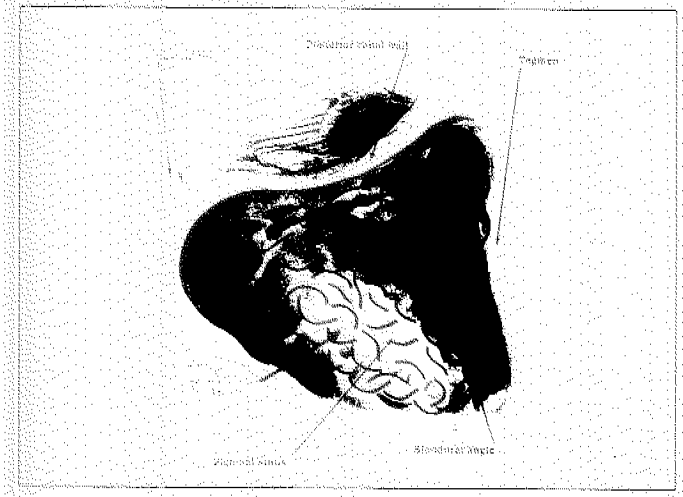
SUMMARY

A case of cerebral ischemia following mastoidectomy is described. Extensive review of the literature revelead not one case of ischemic stroke after ear surgery has been reported. All the possible risk factors that may have caused the neurologic problem are identified. Assuming that it is a complication of surgery, rare and inexplicable as it is, the only way to prevent this from happening is by strict evaluation of patients for surgery.

TABLE I Causes for Acute Hemiplagia in 86 Children

Cause	No. of Patients	Percentage
Trauma	11	12.8
CNS infections	11	12.8
Cardiac disease	10	11.6
Sickle cell anemia	5	5.8
Arteriovenous malformations	4	4.6
Documented occlusive vascular dse	16	18.7
Unknown origin	25	29.1
Miscellaneous	4	4.6
	86	100.0

(From Solomon, GE, et al.)



INTRAOPERATIVE FINDING: THE MASTOID CAVITY IS FILLED WITH CHOLESTEATOMA AND GRANULATION TISSUE.

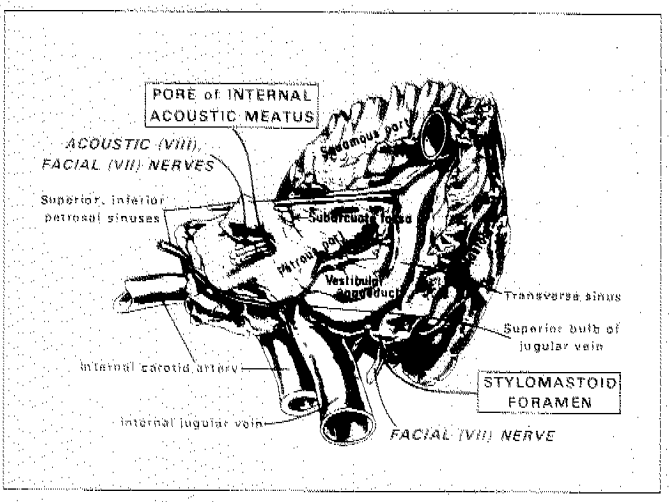


FIG. 2 - THE INTERNAL CAROTID ARTERY IN RELATION TO THE TEMPORAL BONE.

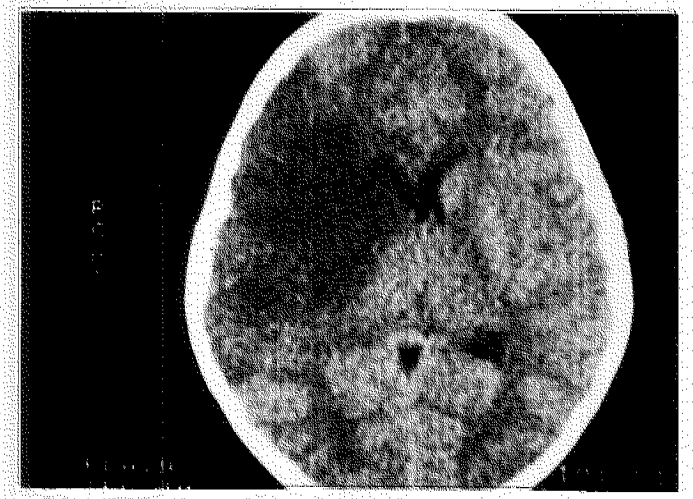


FIG. 3 - POST-OPERATIVE COMPUTED TOMOGRAPHIC SCAN OF THE HEAD DEMONSTRATING A LARGE AREA OF INFARCTION OF THE RIGHT FRONTO-TEMPORO-PARIETAL REGION.

FIG. 4 - COMPUTED TOMOGRAPHIC SCAN OF THE TEMPORAL BONE (BONE ALGORITHM) SHOWING INTACT TEGMEN, LATERAL SINUS PLATE, CAROTID CANAL AND INTERNAL AUDITORY CANAL (ARROW POINTING TO THE CAROTID CANAL).

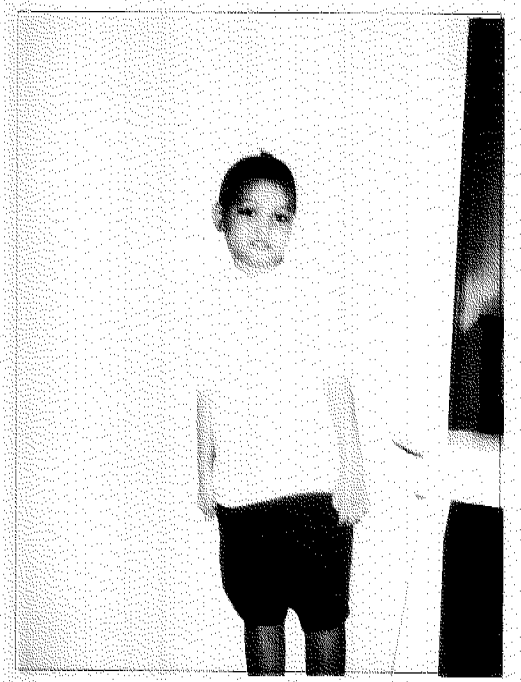
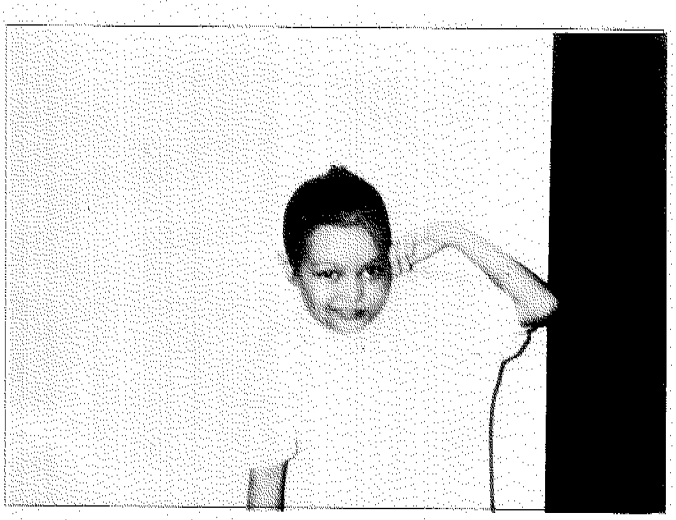


FIG. 5 & 6 - THE PATIENT AFTER 6 WEEKS OF PHYSICAL THERAPY WITH GROSS IMPROVEMENT IN HER MOTOR FUNCTIONS.



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ARYTENOID FRACTURE WITH DISPLACEMENT: RARE BUT POSSIBLE INTUBATION*

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ABSTRACT

This is a case report of a 28 year old female who presented with progressive dyspnea of 14 years duration. The patient went into severe stridor on fiberoptic direct laryngoscopy, thus tracheostomy was done. Then endolaryngeal partial arytenoidectomy by direct suspension laryngoscopy using an operating microscope was done. Decannulation was carried out a few days post-op, with voice preservation. Final diagnosis was right arytenoid fracture with displacement probably secondary to an emergency endotracheal intubation. This case was presented to illustrate that larygneal trauma could happen after intubation. Hence patients who had an emergency, difficult or prolonged intubation should be examined for possible injuries in order to institute the proper treatment early.

INTRODUCTION

Breathing is almost life itself. Thus any disruption becomes a critical situation. Over the years, intubation with an endotracheal tube has become the most practical means of securing an airway fast. This piece of plastic tubing has delivered life saving air into hypoxic cells in countless crucial moments in the emergency room. It is also the plastic rod of life for the anesthesiologist in the operating room, as intubation is indispensable in general anesthesia. However, out of all this good, bad can still happen. Intubation can result in mild to severe acute or chronic laryngeal trauma. Intubation is commonly done almost everyday in a hospital. Hence it is vital for us to be aware of its possible complications, and the diagnosis and management of these complications.

This case is presented to illustrate an extremely rare complication of intubation resulting in an unnecessarily prolonged tracheostomy. Other causes of the dyspnea were also considered since the patient's medical history presented other possible etiologies, primarily recurrent laryngeal nerve paralysis. At present, there are several available diagnostic methods such as Fiberoptic laryngoscopy, Electromyography, MRI and CT scan. Recognition and early diagnosis of laryngeal injuries is then important in order to facilitate the proper treatment.

CASE REPORT

The patient is a 28 year old female who was admitted because of progressive difficulty of breathing aggravated by lying down, exertion and deep inspiration.

The condition started 14 years PTA, when the patient was admitted and diagnosed to have rheumatic heart disease (RHD). She had severe mitral valve stenosis necessitating an open mitral valve commossurotomy (OMC) and then emergency mitral valve replacement the next day because the commissurotomy ruptured. On the 8th post-op day, extubation was done but progressive dyspnea and laryngeal stridor prompted reintubation after 6 days. A tracheotomy was eventually done. A year after discharge, the tracheostomy tube was accidentally removed, was not reinserted, but the tracheostome was left open. It was closed after 5 years per patient's request. Two to three years after closure, there was persistent progressive dyspnea, easy fatigability and throat discomfort. The Patient was also hospitalized for Pleural Effusion secondary to pneumonia. In 1992, she was again admitted because of pneumonia and tuberculosis. Anti-TB therapy was given for 6 months.

A few weeks prior to admission, the patient was admitted at a private institution because of dyspnea increasing in severity. Flexible fiberoptic laryngoscopy was done under local anesthesia. On introduction of the scope, she developed severe stridor prompting an emergency tracheostomy. The patient was stabilized and eventually transferred to our institution for rigid suspension laryngoscopy and arytenoidectomy and possible vocal cord lateralization.

The past medical history revealed rheumatic fever at the age of 9 years. The rest of the personal and social histories were unremarkable.

On admission, the tracheostomy was intact and the vital signs were: Blood pressure - 80/70 mmHg; Heart rate - 75/min; Respiratory rate - 28 cycles/min; and

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temperature - 36.7 C. The vocal cords could not be visualized on indirect laryngoscopy because of the overhanging hyperemic epiglottis. The rest of the head and neck findings were unremarkable. Chest and lung examinations revealed ronchi on both lung fields. Precordium was adynamic. Apex beat was at the 5th intercostal space, midclavicular line. Cardiac rate was irregularly irregular. Other physical examination findings were unremarkable.

COURSE IN THE WARD

Arytenoid dislocation was the admitting impression. The 12 lead EKG showed atrial fibrillation with rapid ventricular response, right axis deviation, poor R wave progression in V1 - V3, rule out inferior wall ischemia.

Direct rigid suspension laryngoscopy was done on the second hospital day under general anesthesia. Clear visualization of the larynx using a Zeiss operating microscope with a 400 mm lens revealed a swollen right arytenoid mound overriding the left, infolding anteriorly covering the glottic chink (see Fig. 2, appendix). A 5 mm transverse incision was made along the horizontal axis of the arytenoid cartilage. The arytenoid mound was grasped with the suction tip and moved but no corresponding movement of the vocal cord was noted. Using laryngeal microscissors, sharp and blunt dissection was done to expose the cartilage (Fig. 3,4). Findings revealed a fracture with concomitant displacement of the vocalis process of the arytenoid cartilage. The fractured segment was about the size of a chili pepper seed, was grasped and removed using the laryngeal microforceps. Upon delivery, with the rest of the arytenoid cartilage intact, the arytenoid mound slipped back to a normal position. The incision was not sutured anymore and hydrocortisone was injected into the right arytenoid mound. Anesthesia was lightened and the vocal cords were observed to be mobile. Decannulation was succesfully done on the 8th post-op day. The patient was discharged the next day with a normal voice.

DISCUSSION

Airway compromise in a patient with a history of emergency mitral valve replacement, intubation, laryngeal stridor on extubation necessitating a tracheostomy, pneumonia and tuberculosis could be secondary to an injury (RLN). Traumatic mechanical injury to the RLN could happen but an arytenoid dislocation, fracture, or subluxation was highly considered.

Laryngeal trauma was primarily considered in this case since the patient had a double open heart surgery, with the second one on an emergency basis necessitating an emergency bedside endotracheal intubation. Laryngeal trauma could be from external sources, surgical manipulation or intubation. There are two types of intubation injuries, acute and delayed. Acute injuries such as edema, laceration, hematoma, vocal cord avulsion, vocal cord paralysis and arytenoid cartilage dislocation or subluxation. All these could result from intubation by an unskilled person, repeated intubations, improper use of an introducer, or inherent anatomical abnormalities. In this case the patient was subjected to an emergency bedside intubation when her commissurotomy ruptured a day post-op, and she had to undergo an emergency mitral valve replacement. On fiberoptic laryngoscopy, the right arytenoid was noted to be swollen and overriding the left, and almost covering the glottic chink.

The cricoarytenoid joint allows the arytenoid cartilage a wide degree of mobility. This, plus its anatomic location makes its dislocation, fracture or subluxation as an isolated acute intubation injury extremely rare. More so if it is on the right because on intubation, the endotracheal tube is inserted through the right side of the mouth, with the tube tending to be directed to the left. The biomechanics on pathogenesis of arytenoid displacement or dislocation is not definitely identified, and there are a number of mechanisms postulated. Most reports of arytenoid subluxation following intubation describes anterior positioning of the displaced arytenoid. Forces applied directly to the arytenoid in a posterior - to anterior direction from an endotracheal tube or laryngeal blade have been listed among the causes for such displacement or dislocation. The stretching of the aryepiglottic fold that occurs upon elevation of the supraglottis with insertion of the direct laryngoscope has been proposed as a manner that may comprise the stability of the joint and predispose it to subluxation. So if we can reconstruct what happened 14 years prior to present admission, perhaps, during the emergency intubation, the endotracheal tube was directed lower and too posteriorly towards the esophagus, and as it was redirected to the glottic chink, the right arytenoid was hit, pressed fractured and displaced (fig.5). Other factors could be: a) a posterolateral force applied to the arytenoid from the convex curvature of the distal third of the endotracheal tube as it is inserted, or b) secondary to withdrawal of an endotracheal tube with a balloon that is partially deflated.

The incidence of arytenoid subluxation, dislocation or fracture, following intubation trauma, is not known. A low incidence is suggested by a prospective study of 1,000 patients in whom laryngoscopy after short term intubation uncovered only one case of subluxation.

Physical findings that suggest acute arytenoid subluxation or displacement include reduced vocal cord mobility, arytenoid edema, voice change, dyspnea, pain (during the first few days), and odynophagia if with a laryngeal fracture. In this patient, the right arytenoid mound appeared edematous, swollen, and hyperplastic on fiberoptic laryngoscopy. The right vocal cord also had impaired mobility but moved after the partial arytenoidectomy.

Clinically it is quite difficult to differentiate a recurrent laryngeal nerve paralysis (RLNP) from an arytenoid dislocation, subluxation or fracture. All could present with dyspnea, laryngeal stridor, hoarseness,throat discomfort and pain, odynophagia and or dysphagia.

Recurrent laryngeal nerve paralysis was also considered because of the medical history of the patient. Prior to the open heart surgeries, the patient had an enlarged left atrium and ventricle by echocardiogram. Hoarseness in RHD with MS is usually attributed to compression of the RLN (Ortner's Syndrome). This was ruled out since the echocardiogram a month and a half post op, revealed a significant decrease in the left atrium and ventricle. Other possible etiologies of RNLP were: surgical manipulations during the extensive open heart surgeries; pneumonia; and tuberculosis (no ulcerations were noted). The pneumonia and tuberculosis were probably only complications since any existing injury or laryngeal abnormality could predispose to recurrent respiratory tract infections, which also aggravate the dyspnea. A RLNP without complete transection of the nerve, would usually resolve after 6 - 12 months. In this patient the vocal cords moved after the partial arytenoidectomy.

Delayed intubation injuries like stenosis, edema, arytenoid joint dysfunction, granuloma formation, interarytenoid adhesions, ulcerations fibrosis and webs could also be considered. In this patient, the injury happened several years ago, hence fibrosis or granuloma formation in the area of injury, could have formed. However, to establish these occurences would just be an academic exercise.

Diagnosis of laryngeal injuries and RNLP has become more accurate with the aid of several available diagnostic procedures such as: Direct suspension laryngoscopy, fiberoptic laryngoscopy, Electromyography, Magnetic Resonance Imaging (MRI) and Computed Tomography scan.

In this case, an arytenoid dislocation was considered, rule out a RNLP, on fiberoptic laryngoscopy. However, on microscopic visualization intraoperatively, the arytenoid was not dislocated nor simply subluxated. It was fractured, with the fractured segment displaced anteriorly. Despite the minute size of the fracture it was enough to cause airway obstruction, and also it mechanically partially restricted normal vocal cord mobility. The right vocal cord was midline and immmobile. Current literature regards fracture of the arytenoid as a concomitant injury in severe laryngeal and neck trauma; rarely as an isolated injury. Most studies reported dislocation or subluxation.

There are several methods advocated by different authors for the management of vocal cord and arytenoid cartilage injuries. Approach could either be endolaryngeal (first described by Thornell, 1948) or extralaryngeal (posterior approach by Woodman and a thyrotomy approach). An extralaryngeal approach is Teflon injection, a time-honored method of medialization of vocal cord under local anesthesia.

However, accurate displacement of the Teflon injection is difficult and it may migrate as well as alter the characteristic of the vibrating free segment of the vocal cord. Another method which can also be done under local anesthesia is Thyroplasty, and inaccurate placement of the silicon could be immediately corrected even intraoperatively since the patient can be requested to talk. Vocal cord medialization with a laryngeal framework is used for arytenoid subluxation with no chance for return of normal arytenoid mobility with closed reduction. Another technique is the nerve-muscle pedicle transposition described by Tucker.

In this patient, lateralization of the vocal cord was no longer necessary as mobility was good after removal of the fractured segment. Lateralization is usually sacrificed. Lateralization and arytenoidectomy are necessary before decannulation can be done. Compared to extra-laryngeal techniques, intra-laryngeal arytenoidectomy more consistently preserves voice quality and avoids the complication of aphonia. The partial arytenoidectomy done in this patient still provided attachment for the abductor and adductor muscles of the vocal cords, thus preserving voice quality. The natural airway was restored and the patient was weaned from a tracheostomy.

SUMMARY

A 28 year old, female status post open mitral valve commissurotomy and mitral valve replacement secondary to a severe mitral stenosis from RHD, initially presented with severe dyspnea and laryngeal stridor on extubation, necessitating a tracheostomy 14 years ago. Tracheostome was closed after 5 years, but a few weeks PTA, another tracheostomy was done. With the presenting signs and symptoms of dyspnea, dysphonia, swollen arytenoid mound, and an immobile vocal cord, the final diagnosis was arytenoid fracture with displacement.

This case illustrates a rare complication of intubation. Awareness of this complication and other larygneal trauma brought about by intubation is vital to lessen morbidity and mortality. It is difficult to accurately diagnose and differentiate an arytenoid displacement from other injuries such as RLNP. However there are several diagnostic tools presently available, such as rigid suspension laryngoscopy, EMG, CT scan and MRI.

Treatment done in this case was partial arytenoidectomy via an endolaryngeal approach, facilitated by rigid laryngoscopes and an operating microscope. The procedure restored the natural airway, preserved the voice quality, offered the patient freedom from a tracheostomy, and thus a better quality of life.

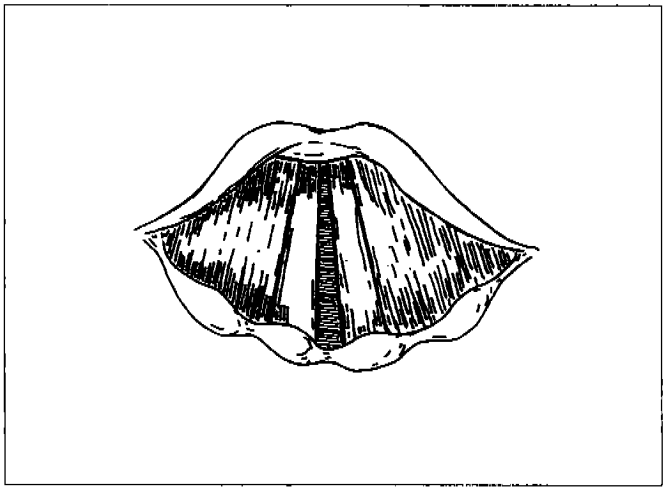

FIG. 1 - THE NORMAL ARYTENOIDS WITH THE VOCAL CHORDS IN PARAMEDIAN POSITION*

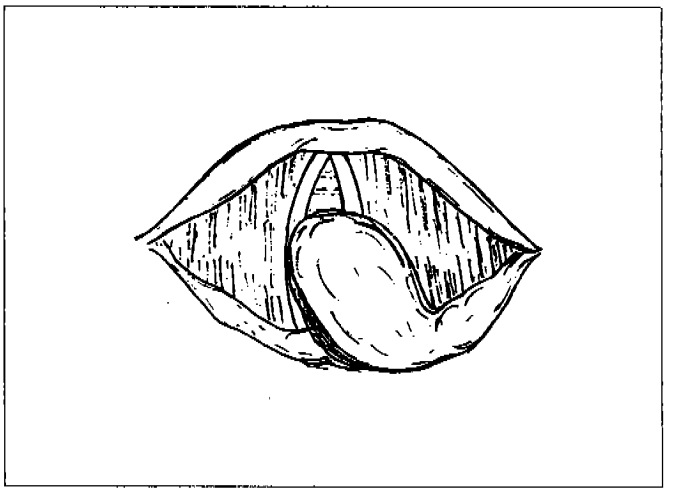

FIG. 2 - THE RIGHT ARYTENOID SWOLLEN AND DISPLACED ANTERIORLY

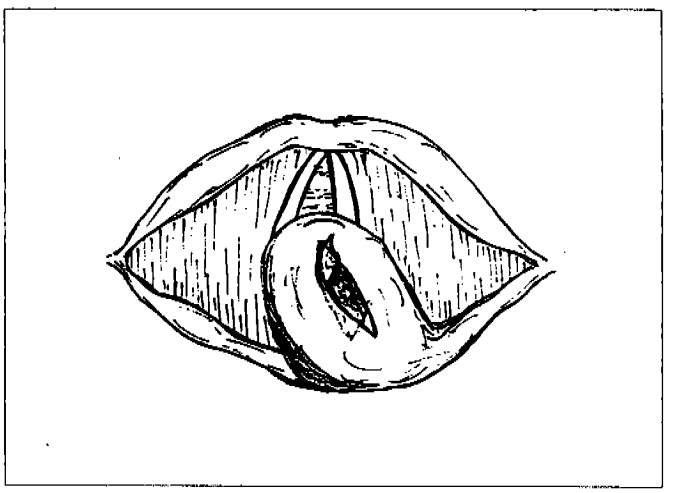

FIG. 3 - THE FRACTURED DISPLACED ARYTENOID CARTILAGE EXPOSED

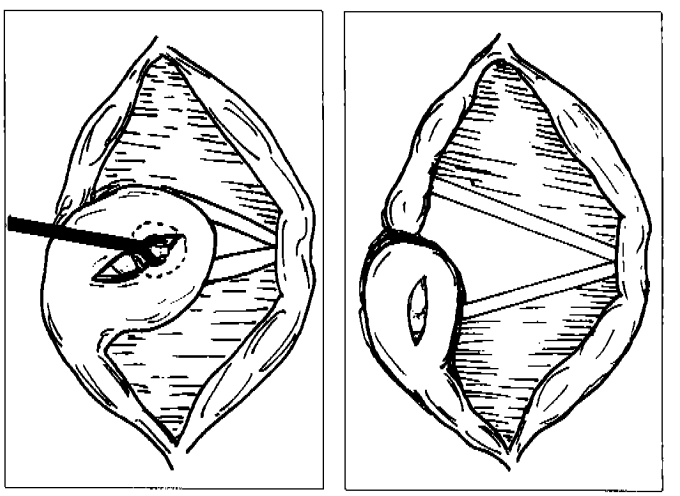

FIG. 4 - LEFT: FRACTURED SEGMENT OF ARYTENOID REMOVED
RIGHT: R ARYTENOID MOUND IN NORMAL POSITION

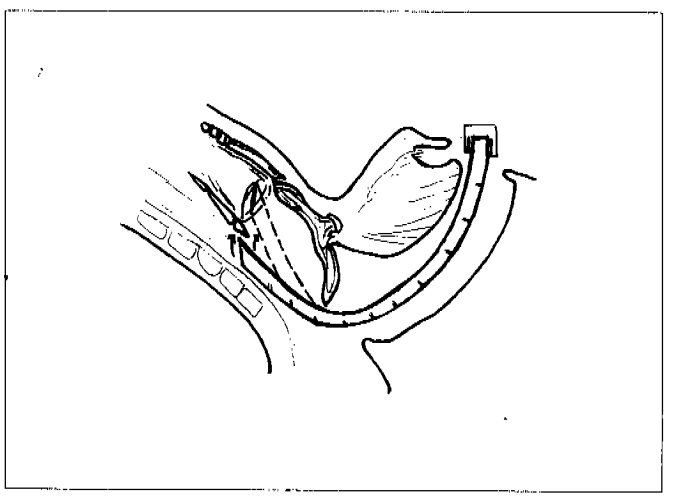

FIG. 5 - PROBABLE MECHANISM OF ARYTENOID FRACTURE AND DISPLACEMENT DURING INTUBATION

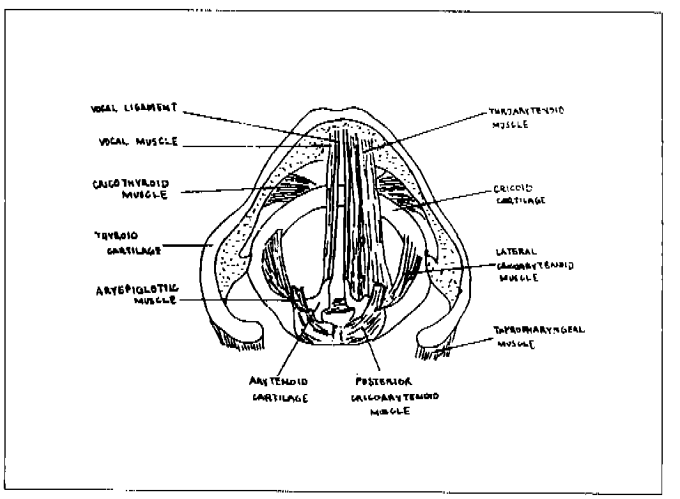

FIG. 6 - LARYNGEAL SECTION - HORIZONTAL VIEW SHOWING THE ENDOLARYNGEAL MUSCULATURE*

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EXPERIENCE ON THE STAGE CLOSURE OF COMPLETE BILATERAL CLEFT LIP

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ABSTRACT

From 1992 to 1993, in an on-going surgical mission, 15 patients with complete bilateral cleft lip had one stage closure of both clefts. Thirteen of these patients who had normal to slight protrusion of the premaxilla underwent myoplastic repair (Millard). Two patients with marked protrusion of the premaxilla underwent straight line closure of their defects.

Since these patients come from remote areas of the country, a one stage closure is a practical and cost-effective solution to their defects. In addition, these 2 techniques were analyzed, citing their strong and weak points in achieving the normal form and function of the upper lip.

INTRODUCTION

The bilateral cleft lip is one of the greatest challenges in the field of cleft surgery. The problems of severe tissue deficits and anatomical distortions often make ideal results difficult to achieve. The repair entails constructing a Cupid's bow and vermillion tubercle, completing the continuity of the interrupted orbicularis muscle and lengthening of the columnella This often requires that the surgeon accomplish the repair in two or more stages for repairing the lip and another operation for columellar lengthening. Moreover, the premaxilla, if protuding as it usually is, can distort skeletal support for the upper lip making repair without tension difficult and compromising the surgeon's ability to make aesthetic value judgements necessary for a satisfying result. Aside from possible surgical setback of the prottuding premaxilla, the surgeon has 3 choices; unilateral closure to be followed by closure of the remaining side at a later date, lip adhesion, or bilateral lip closure.

Cronin, in 1957 summarized the guiding principles of straight line closure, a one stage repair for the complete bilateral cleft lip. It was emphasized that the prolabium should form the full vertical dimension of the central portion of the repaired lip. Although the introduction of lateral vemilion was allowed, introduction of lateral skin into the prolabium which can appear minute but has a suprising ability to strech was discouraged. Adding skin to it tends to produce a long lip that is difficult to shorten and gives intrusive scars marring the hoped for illusion of a philtrum. Cronin's bilateral straight line repair although safe and simple, does not introduce orbicularis oris muscle into the prolabium, where muscle characteristically is absent in complete bilateral clefts. It does not deepen the labial sulcus nor does it shape the prolabium to mimic a philtrum and makes no special provision for subsequent columellar lengthening. Millard in 1971 described an operation derived from this straight line closure of Cronin but designed to correct problems the former operation ignores. The Millard operation does not lengthen the columella but provides for subseqeunt columellar lengthening without entry into the lip. It is applied best to ideal cases, particularly those in which excellent control of the protuding premaxilla has been achieved.

In an on-going surgical mission, where a good number of the patients come from remote areas of the country, a one stage repair of complete bilateral cleft lip is a welcome solution to help them acquire an acceptable appearance. Aside from being cost effective, morbidity and duration of hospital stay are lessened. Furthermore, experience with patients who have undergone repair of one side in one surgical mission and the other side in another surgical mission showed that the second surgeon usually had difficulty in repairing the second side. Millard's myoplastic repair was applied in 13 patients with good alignment of premaxilae enabling the orbicularis oris muscle to appose at the midline. Cronin's straight line closure was usedin 2 patients wherein difficulty in apposing the two ends of the orbicularis oris muscle was encounterd owing to the marked protusion and /or wideness of the premaxilla.

THE OBJECTIVES OF THIS PAPER ARE:

1. To cite the applicability and usefulness of a one stage closure of complete bilateral cleft lip in local surgical missions

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2. To give an account of the 13 patients where Millard's myoplastic repair and 2 patients where Cronin's straight line closure for complete bilateral cleft lip was applied.
3. To identify the operation's strengths and weakness in achieving the normal forms and function of the upper lip in relation to the previous anatomical abnormality in 5 of these cases.

SURGICAL TECHNIQUE

Myoplastic Repair for Normal to Slightly Protuding Premaxillae:

A. Incisions are made which narrow the prolabium to mimic a philtrum (flap A) and preserve the lateral excesses (flap C) as "whisker" flaps to be banked and used subsequently for columellar lengthening. The prolabial white roll is discarded by an incision that shapes the inferior margin of flap A into the central portion of the Cupid's bow. This incision must be shallow because the subcutaneous attachments of flap E to flap A must be preserved. The lateral vermillion flaps B carry white roll with them.

B. The prolabial flaps, A, C, and E are released en bloc from the underlying premaxilla by an incision placed in the rudimentary labial sulcus and shown as a dotted line along the inferior margin of flap E. This step allows the sulcus to be deepened at the time of lip repair and converts flap E to a subcutaneously based island pedicle.

C and D.

The lip then is repaired in three separately dissected layers. Lateral mucosa is closed in the midline if the sulcus is too deep, or to prolabial mucosa if not. Lateral muscle is closed to lateral muscle in the midline. If a slight protusion of the premaxilla prevents the lateral muscles from apposing at the midline, an adequate release of the orbicularis oris from its superior attachment may be needed. Skin is then draped for surface repair.

E. The completed repair shows the C flaps banked as "whiskers" in incisions made along the nostril sills; Cupid's bow effect created by the lateral B flaps, which include vermilion and white roll; and a tubercle effect created by flap E. The C flaps may be used subsequently for columellar lengthening by a modified flap technique.

Straight Line Closure for Markedly Protuding Premaxillae:

A. Incisions on the prolabium are gently curved medially to give a little extra length and to reduce the tendency of this repair to give circular prolabium with trapdoor puffiness.

B. The lip is sutured in three layers; mucosa to mucosa, lateral muscle to prolabial subcutaneous tissue, and skin to skin.

C and D.

The extremely thin vermilion of the prolabium is augmented by lateral vermilion flaps. The lateral flaps may be butted end on or interdigitated to create a vermilion tubercle.

E. An alternative is the sacrifice of the prolabial white roll and the creation of a Cupid's bow effect by interpolation of both lateral vermilion and white roll.

All operations were done under general anesthesia. Dexon or Vicryl 6-0 sutures were used for subcutaneous approximation and Nylon 6-0 sutures, which were removed one week postoperatively were used for the skin. All patients were given broad spectrum oral antibiotics for at least one week. Documentation was done preoperatively and 10 days postoperatively.

RESULTS

From 1992-1993, 15 patients with complete bilateral cleft lip and palate underwent one stage closure of both clefts (Myoplastic repair for 13 cases with normal to slightly protruding premaxillae) at an on-going surgical mission in a government hospital. Nine were male and 6 were female with their ages ranging from 9 months to 11 years.

A summary of the first 4 cases where myoplastic repair was used and the 5th case where straight line closure was used noting their pre- and post-operative descriptions of anatomical landmarks of the upper lip are given below.

CASE 1: MYOPLASTIC REPAIR

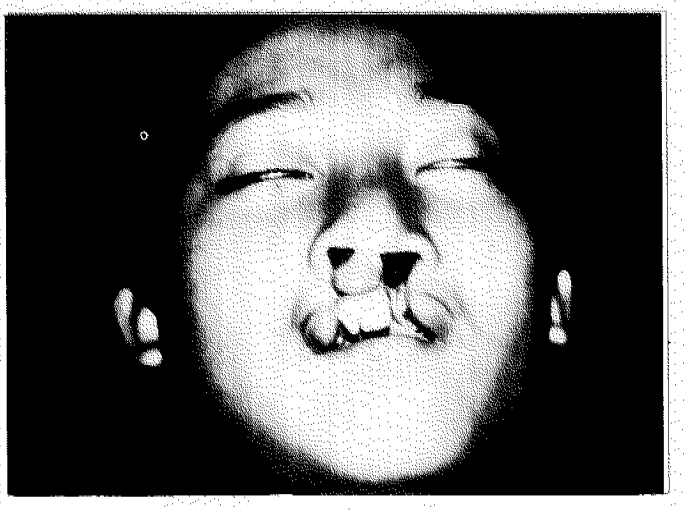
E., a 5 year old girl with a short columella, a wide and relatively short, superiorly based prolabium, a shallow labial sulcus and a slightly protruding premaxilla. Postoperative results show a poorly projecting nasal tip, short columella, intact nasal sill, whisker flap marks, philtrum, Cupid's bow, and a functional upper lip.

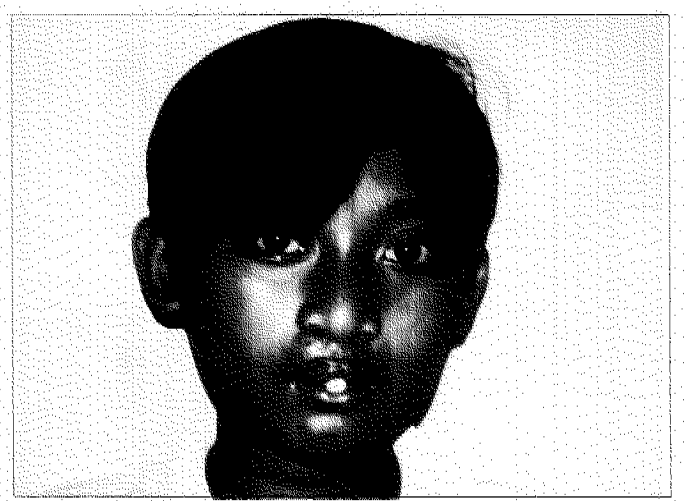
CASE 2: MYOPLASTIC REPAIR

J.M., is an 11 year old boy with widely splayed ala, short columella, small superiorly based prolabium, aligned premaxilla and bulky lateral elements. Post-operative results show a poorly projecting nasal tip, outward tilting of nostrils, short columella, intact nasal sill, whisker flap marks, philtrum, an ill-defined Cupid's bow, and a functional upper lip.

CASE 3: MYOPLASTIC REPAIR

J.M. is a 10 year old boy with widely splayed ala, short columella deviated to the right, smalll superiorly based prolabium deviated to the right, wider cleft on the left, slightly protruding premaxilla and asymmetric lateral elements. Post-operative results show a poorly projecting nasal tip, outwardly tilted nostrils, short columella deviated to the right, lateral whisker flap marks, intact nasal sill, a short wide philtrum, wide Cupid's bow, unequal lateral elements, and a functional upper lip.





CASE 5: STRAIGHT LINE CLOSURE

F.F. is an 18 month old boy with widely splayed ala, short columella, small superiorly based prolabium, shallow labial sulcus, markedly protruding and wide premaxilla, and symmetrical lateral elements. A straight line closure was used and post-operative results show outwardly tilted nostrils, short columella, intact nasal sills, an ill-defined philtrum and Cupid's bow on a short poorly functioning upper lip.

Length of Hospital Stay	# of Patients
3 days	4
4 days	4
5 days	2
6 days	1
7 days	2
8 days	8

DISCUSSION

The basic myoplastic repair is the current touchstone of bilateral complete cleft lip reconstruction. Its main advantages, as shown in the 4 cases, are: it creates an illusion of a philtrum, Cupid's bow, and repairs the defect in the nasal sill; it gives provisions for later columellar lengthening; with the use of the modified forked flap technique it may solve the problems of cleft lip nose such as the poorly projecting nasal tip and outwardly tilted nostrils; also, a functional upper lip is achieved with the repair of the orbicularis oris muscle. Its disadvantages are it is comlicated and may be difficult to the inexeprienced surgeon; it gives whisker flap marks at the area of the nasal sill; and it is limited to those cases with aligned to slightly protruding premaxillae with the help of adequate release of the orbicularis oris from its origin from its superior attachment.

For those with markedly protruding, and/or wide pre-maxillae which makes the midline apposition of the orbicularis oris impossible, the straight line closure was found to be more feasible. This method is simpler and produces an intact nasal sill and an upper lip which the patients found to be acceptable and which

CONCLUSION

The one stage repair of complete bilateral cleft lip if surgically feasible can be an economical procedure appropriate in local surgical missions. Aside from reducing the number of operations to be done and, therefore, cutting the cost of surgical procedures, medications needed, and hospital stay, it also reduces morbidity.

There are many variables and uncertainties present in the complete bilateral cleft lip which makes treatment as much as an art as it is a science. Wilson emphasized that each patient has a unique combination of deformities and just as the patients are diverse, the results are variable. Furthermore, Pruzansky pointed out that "even within a single cleft type there is sufficient variation between patients to affect prognosis. Bearing these in mind and with the experience gained in this on-going surgical mission, it appears the protrusion of the premaxilla is an important factor in deciding whether to do myoplastic repair or straight line closure. However there can be no definite rules in the repair of the complete bilateral cleft lip. Each case warrants a preoperative and intraoperative assessment which involves the surgeon's aesthetic judgement and experiences in lip repair and management may require the individual modification and combination of other techniques.

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A CORRELATION BETWEEN CLINICAL SIGNS AND SYMPTOMS AND CT SCAN FINDINGS iN CHRONIC TYMPANOMASTOIDITIS WITH INTRACRANIAL COMPLICATION*

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ABSTRACT

Eleven cases of chronic tympanomastoiditis with suspected intracranial complications were included in the study. The clinical signs and symptoms (neurologic and otologic) were gathered and correlated with the CT scan findings. Headache, fever, vomiting, and foul-smelling ear discharge were the outstanding clinical findings. Brain abscess, predominantly in the cerebellum, was the most common intracranial complication. More specific or localizing signs and symptoms that were expected were infrequent, if not absent. Cholesteatoma, granulation tissue and facial nerve dehiscence were prominent findings upon mastoidectomy.

INTRODUCTION

Chronic otitis media is a serious disease chiefly because of the potential intracranial complications - meningitis, brain abscess, extradural or subdural abscess, lateral sinus thrombosis, and otitic hyrdrocephalus - which may threaten life and health. A shocking revelation to patients and relatives is the fact that this silent state of chronic ear discharge could lead to very serious neurologic complications and even morbid events necessitating brain surgery. That is, like craniotomy with aspiration of abscess, venrtriculostomy, or ventriculo-peritoneal (VP) shunting. These possible consequences should heighten the vigilance of the ENT doctor.

The presence of intra-cranial complications can be inferred based on the neurologic examination of the patient. The brain, due to its inherent characteristic of compart-mentalized functions, gives a clue to the probable site of the lesion. The diagnostic tool to confirm this impression is the CT scan. It will be interesting to note how the different signs and symptoms and physical examination findings will compare with the ultimate findings on lesions detected by CT scan. Knowing the signs and symptoms, both neurologic and otologic, of chronic tympanomastoiditis (CTM) patients with intracranial complications will aid the otologists in training as well as the experienced practitioners in making an accurate specific diagnosis earlier by serving as predictors of these serious complications.

This paper aims to study the outstanding signs and symptoms in case diagnosed to have CTM with suspected intracranial com-plications and to compare these findings with the cranial CT scan findings.

In the course of this study, the intraoperative findings were evaluated to see which are the more common findings encountered.

METHODOLOGY

From the period of August, 1992 to August, 1994, thirteen patients with chronic ear discharge manifesting with signs and symptoms of possible intracranial involvement were admitted. A checklist of the pertinent neurologic and otologic signs and symptoms was used to assess the patient. Upon admission, the patients were started on IV Penicillin 12 to 20 million units per day and Chloramphenicol 2 to 6 grams per day. Routine blood examinations, mastoid series, G/S and C/S of ear discharge, whenever possible, were done. The necessary interdepartmental referrals to Ophthalomology, Neurology and Neurosurgery were made and, as deemed necessary by the Neurology service, a CT scan was ordered. The presence of intracranial complications were noted on CT scan, including the location and size of the lesion or abscess. Depending on the diagnosis, therapy was then instituted either by mastoidectomy, with or without neurosurgical intervention. The various intra-operative lesions on mastoidectomy were also noted.

The study then included 11 patients with an admitting diagnosis of CTM with a high index of suspicion for an intracranial complication who had undergone cranial CT scan. There were six males and five females with ages ranging from 4 years to 80 years with half of the cases within the second decade of life.

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RESULTS

Neurologic signs and symptoms:

Table I shows that 10 cases presented with moderate to severe headache on admission. Vomiting and fever was present in 8 cases. Seizures occurred in two cases, one of which presented with behavioral changes while the other presented with nuchal rigidity and dizziness. Papilledema in fundoscopy was present only in three.

Table I. Neurologic Signs & Symptoms

Signs & Symptoms	No. of Pts.	%
headache	10	90.9
vomiting	8	72.7
fever	8	72.7
behavioral change	2	18.1
seizures	2	18.1
dizziness	2	18.1
vertigo	1	9.1
neck rigidity	3	27.2
papilledema	3	27.2

Otologic signs and symptoms:

Table II shows that 10 cases presented with foul-smelling ear discharge on examination of the ear. Subperiosteal abscess requiring incision and drainage was present in four cases. On otoscopy, only 2 revealed a whitish mass indicative of cholesteatoma. An aural poylp occupying the external auditory canal was found in one patient.

Table II. Otologic Signs & Symptoms

Signs & Symptoms	No. of Pts.	%
foul smelling ear discharge	10	90.9
subperiosteal abscess	4	36.3
granulation tissue	4	36.3
otalgia	4	36.3
cholesteatoma	2	18.1
collapesed EAC	1	9.1
blood-tinged ear discharge	1	9.1
aural polyp	1	9.1

WBC Count:

The peripheral white blood cell count in eight cases ranged from 10,000-20,000 cells per cu. mm. (Table III)

Table III. WBC count

Range	No. of Pts.	%
less than 10,000	2	18.1
10,000 - 15,000	5	45.2
15,000 - 20,000	3	27.2
more than 20,000	1	9.1

Mastoid Series Results:

Table IV shows that cholesteatoma was seen on radiographic examination of the mastoids in four cases.

Table IV. Mastoid series findings

Findings	No. of Pts.	%
bil. mastoiditis, cholesteatoma unil	3	27.2
mastoidtis w/ cholesteatoma unil	1	9.1
mastoidits, bil	3	27.2
mastoidtis, unil	2	18.1
scelotic mastoid	1	9.1
paucity of air cells, bil	1	9.1

CT Scan Findings:

Intracranial complications were documented by CT scan in 8 cases: 6 brain abscess, one cerebritis and one meningitis as shown in Table V. The most common location of abscesses was the cerebellum.

Table V. CT scan findings

CT scan findings	No. of Pts.	%
brain abscess	6	54.5
temporal (2)		
cerebellar (3)		
fronto-cerebellar (1)		
meningitis	1	9.1
cerebritis	1	9.1
mastoidits/(-) brain pathology	3	27.3
TOTAL	11	

Treatment:

In all cases, mastoidectomy was contemplated. However, only eight underwent mastoidectomy. Three cases were treated only with IV medications because the patients absconded. Two had to undergo neurosurgical intervention through ventriculostomy, craniotomy and evacuation of abscess prior to mastoidectomy. (Table VI)

Table VI. Treatment/Operation performed

Treatment	No. of Patients
IV medications	3*
IV meds + mastoidectomy	6
IV meds + mastoidectomy + Neurosurgical intervention (VP shunting/evacuation of abscess)	2
TOTAL	11

* planned surgery patient absconded

Mastoidectomy Intraoperative Findings:

Table VII shows that cholesteatoma was the predominant intraoperative finding in seven out of eight cases. This was also true for granulation tissue. Facial nerve dehiscence and absence of ossicles were noted in five.

Table VII. Intraoperative findings of 8 patients

Findings	No. of patients
cholesteatoma	7
granulation tissue	7
post. canal wall break	4
remnant ossicles	4
dehiscent facial nerve	5
absence of ossicles	5
cortical break	3
foul smelling discharge	3

DISCUSSION

All too often, patients complaining of chronic ear discharge consult at the ER and have to be admitted because of the intracranial complications which are life threatening. This has been recognized from the ancient times when Celsus (25 A.D.) mentioned that the "the inflammation and pain of the ear sometimes led to insanity and death."

The pathology of otogenic intracranial complications has been described in the literature (Schambough, 1967). The spread of infection from the middle ear cleft to intracranial structures may occur as a result of bony erosion by osteitis or cholesteatoma; via preformed fractured track; via the labyrinth; by thrombophlebitis of vessels through intact bone; via the extradural, subdural or subarachnoid spaces; by thrombophlebitis of the intracranial venous sinuses or cerebral vessels; or by infection of the perivascular Virchow-Robin spaces.

In the five-year period preceding the introduction of antibiotics, approximately one in every 40 deaths in a large hospital was caused by an intracranial complication of otitis media (Wolfwitz, 1972). Twenty years later, there was a ten-fold decrease in this figure. Today, these dreaded complications are rare in so-called developed countries (Wolfwjtz, 1972).

Statistics in the pre-antibiotic era for the percentage of otogenic intracranial complication was at 4% at the beginning of the century and at 2.5% before the second World War (Nager, 1932). Later, Jeanes put the percentage at 0.15% and Fisch found that it was 1.2% (1952).

Compared with literature study, the percentage of CTM patients with suspected intracranial complications in this center is at 8%. This is expected as the Philippines is a thirld world country. The generally low socio-economic status of the society, as compared to developed countries, results in late consultation, incomplete antimicrobial therapy and poor patient follow up, all of which predisposes to the development of an acute or chronic otitis media and mastoiditis with suppuration which usually precedes intracranial complications.

Headache, vomiting and fever were the predominant complaints of patients in this study. Headache and fever were present in all the diagnosed cases of CTM with intracranial complications while vomiting was present in six. Other more specific and localizing signs and symptoms such as disturbances in gait, depression in the level of consciousness, meningeal signs, seizures, and focal deficits were looked for but were not as commonly found. Nuchal rigidity was present only in two cases - one case of left cerebellar abscess with secondary obstructive hydrocephalus and one case of meningitis. On the other hand, seizures also occurred in the same case of left cerebellar abscess mentioned earlier and in another case of right temporal abscess. Abnormal reflexes such as the Babinski's sign, Kernig's sign and Brudzinski's sign were not elicited from the patient suffering from meningitis. Similarly, clinical features commonly present in the manifest stage of brain abscess such as lethargy, visual field defects, aphasia, motor or sensory paralysis, and ataxia were absent in all the cases of brain abscess.

An otologic sign of foul smelling ear discharge was the outstanding feature seen in the patients studied. Brain abscess is commonly preceded by chronic otitis media and mastoiditis or acute coalescent mastoiditis while meningitis is commonly related to acute otitis media and mastoiditis. In this study, four out of six cases of brain abscess had chronic ear discharge ranging from one year to fifteen years in duration and two had subperiosteal abscesses. A single case of meningitis was preceeded by a two-week history of aural discharge which later became bloody while that of cerebritis occured in a patient suffering from an on and off aural discharge of eighteen years.

The diagnostic regimen consists of the CT scan. It willl demonstrate the earliest stage of cerebritis before the formation of a true abscess, and later,with contrast enhancement, will show loculation and multiple abscesses as well. (Check, 1989; Haines, 1990; Le Beau, 1973). In this study, the most common finding seen by CT scan were abscesses, followed by meningitis and cerebritis. Brain abscesses were also the predominant complication in the study by Wright & Grimaldi (1973). In contrast, meningitis was the most frequent complication (50%), followed by brain abscess (33.3%), extradural abscess (11.1%) and lateral sinus thrombosis (5.6%) in the study by Proctor (1966) and Fisch (1982). Since brain abscess is commonly related to chronic tympanomastoiditis, its predominance may be attributed to the high incidence of chronic otitis media in this country brought about by the prevailing low socio-economic condition as well as the indifferent attitude to a discharging ear simply because of the myth that it is a part of chilhood. Some form of host resistance in Filipinos against the development of meningitis in acute otitis media and mastoiditis can only be speculated on.

In a local study by Rama et.al. (1994), the specific location of otogenic brain abscesses in origin were predominantly the cerebellar area, temporo-parietal area, frontal and fronto-parietal area. This study shows similar results of cerebellar predominance in the location of abscesses. Otogenic brain abscesses predominantly originate from venous thrombophlebitis and not from direct extension through the dura (Hirsch et al., 1983). The predominance of cerebellar location of brain abscesses in this study suggests that the dura is frequently inflamed along the posterosusperior surface of the petrous bone which forms the anterolateral wall of the cerebellar or posterior fossa.

Retrograde thromphlebitis in the adjacent cerebellar veins rapidly extends into the small terminal veins in the

white matter resulting in a rapid spread of liquefication necrosis and, eventually, into an abscess formation.

Other CT scan findings on symptomatic patients only showed mastoiditis and no brain involvement (3/11). Interestingly, one patient presented with headache, vomiting, fever, nuchal rigidity and papilledema. CT scan done on the 19th H.D. was negative and it is possible that there had already been resolution of a previously existing meningitis because IV antibiotics and mannitol had been given continously since the day of admission. The vertigo and vomiting present in one patient could be a simple case of labyrinthitis while the headache and fever found in one patient can be explained by the presence of a subperiosteal abscess.

The definitive treatment for patients diagnosed to have CTM with intracranial involvement would depend highly on the diagnosis by clinical findings and CT scan findings. IV medications were given to all patients consisting of Penicillin and Chloramphenicol, combined with Metronidazole or Gentamycin in some of the patients. Mannitol and/or Dexamethasone were given to patients presenting with papilledema, nuchal rigidity or persistent vomiting. Mastoidectomy was planned for all patients. Only eight cases underwent mastoidectomy as the remaining three absconded. The timing of mastoidectomy in CTM patients with intracranial complications is still controversial in practice among otologists and neurologists. Mastoidectomy was performed anytime from the earliest of 4 days to as late as 26 days upon admission depending upon the date of CT scan. If obstructive hydrocephalus was present, emergency neurosurgical intervention consisting of craniotomy, evacuation of abscess and ventriculostomy were immediately done followed by mastoidectomy. This was the situation in two cases of cerebellar abscess, both of which measured around 4 cm. In all the cases, there were no postoperative morbidities nor mortalities and all were discharged with improved conditions at 2-24 days post-op.

The outstanding intra-operative findings on mastoidectomy were the presence of cholesteatoma and/or granulation tissue (7/8). Indeed, this signifies that the presence of cholesteatoma and granulation tissue with its concommitant bone erosion and chronic infection increases the likelihood of intracranial complications. Osteoclastic bone resorption was found to be adjacent to cholesteatoma matrix (Grippaudo, 1958; Follack, 1959) revealing its propensity to erode bone. However, it is said that granulation tissue is much more responsible for bone resorption than is squamous epithelium. Sade et. al. (1977) never found cholesteatoma matrix lying on bone lesion without granulation tissue, connective tissue, or both between the cholesteatoma matrix and bone. Its anatomic bulk reduces drainage and bone erosion as a consequence of the enzymes produced. In the five cases with intracranial complications, two had cholesteatoma alone and, one had granulation tissue alone.

The development of intracranial complications in such pathologic ears is primarily due to the long symptom-free interval between the first manifestation of middle ear pathology and the sudden onset of intracranial complication. These cases revealed patients complaining of on and off ear discharge at the shortest time of one year to as long as fifteen years. The complication may then occur with lightening speed in a patient who is neglectful of a more or less latent pathology of the ear. Indeed, the abrupt, unexpected onset of intracranial complications after a prolonged, symptom-free interval demonstrates why cholesteatoma and granulation tissue still remains a life-threatening disease in the post-antibiotic era.

Another frequent finding on mastoidectomy is facial nerve dehiscence (5/8), all along the mastoid segment. This finding should make the otologist more vigilant when operating on an ear fillled by cholesteatoma or granulation tissue for it increases the possibility of facial nerve injury. In all the mastoidectomies done, there have been no reports of facial nerve paresis or paralysis post-op.

Based on the results of this study, patients diagnosed to have CTM presenting with headache, vomiting, fever and foul smelling ear discharge would benefit the most from a CT scan to rule out the presence of a brain abscess, meningitis or other less common intracranial complication. The absence of more specific or localizing signs or symptoms, such as ataxia or Babinski's signs should not deter the clinician from suspecting an intracranial complication. As shown in this study, none of the cases of cerebellar abscess presented with these specific clinical features although a more extensive study is needed to make this conclusive. Suspicions of a cholesteatoma or granulation tissue are also very important otologic findings for they are important factors in the development of complications.

In a third world country where the logistics of indigent patients does not allow easy access to CT scan, this study demonstrates a more detailed guideline for the otologist on when to push for the documentation of intracranial complications by CT scan. While it is true that there has been a dramatic decrease in the rate of intracranial complications associated with CTM, however, there is still the great need for improvement in diagnosis and treatment. A study on the proper timing of mastoidectomy is further recommended.

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with a newly developed TM electrode **(Hearing Health Care 3M Co.)** showed that the newly designed system, intended to be placed directly on the tympanic membrane, provided much improved Ecog response. [9]

In the local setting, where the number of patients presenting with hearing problems is increasing steadily through the years, there is still a dearth of reports that make use of Ecog as an adjunct in the investigation of patients with neuro-otologic disorders. One limiting factor is the availability of these commercial electrodes. Also, silver wire which is the main component of these electrodes is not available in the local market such that fabrication of an electrode of the same type is not feasible.

Therefore, the aim of this study is to perform Ecog in a group of normally hearing individuals to demonstrate and evaluate visibly reliable Ecog waveforms among Filipino subjects using an imported TM electrode and compare such recordings with those recorded from a locally fabricated copper tympanic electrode in terms of the usual Ecog parameters.

METHODOLOGY

A. SUBJECTS

Ecog potentials were recorded from both ears of eleven normally hearing subjects. There were six(6) males and five(5) females with a mean age of 24 years, and mean threshold of 13 for frequencies 500 to 4,000 Hz.

B. ELECTRODES

The silver tympanic membrane electrode is a balltipped silver wire similar to the one described by Stypulkowski and Staller in 1986, and currently being used at the Sunny Brooks Health Science Center (Fig. 1). This small gauge silver wire measuring 17 cm. is protected with a silastic tube on its tipped end. The opposite end is attached to several finer silver wires intertwined and insulated with a transparent tube measuring 40 cm and attached to an adaptor that would fit the amplifier lead. The locally made electrode was a piece of small gauge (gauge 23) insulated copper wire (magnetic wire) also measuring 17 cm. The coating on one end was stripped off and was formed into a small loop on to which lead was soldered to form a ball tip with a diameter equal to that of the silver electrode, which is about 2 mm.. The tipped end was also protected with a small silastic tube. The other end was soldered to several finer copper wires intertwined and insulated with a rubber tube also measuring 40 cm. and soldered to an adaptor that would fit the preamplifier lead box (Fig. 2).

c. PROCEDURE

All subjects were tested in a noncommercial sound treated room while lying in a lateral decubitus position with the ear to be tested uppermost. Ear canals were all examined prior to insertion of the electrode. No ear canal preparation was needed. The order of presentation of the electrode (silver and copper) was randomized for each ear. A small amount of electrode gel was placed on the balltipped end to provide a conductive interface. Using an operating microscope, the electrode was gently inserted down the ear canal until it rested against the tympanic membrane at the posteroinferior quadrant area. After insertion, the electrode was gently bent inferior to the tragus and attached to the cheek with adhesive tape. A standard headphone was then gently placed onto the ear being tested.

The Ecog recording parameters used for this study are illustrated in Table 1. Ecog potentials were recorded between the active electrodes (silver and copper) resting against the tympanic membrane and the reference disk electrode on the opposite ear lobe with a forehead disk electrode serving as ground. Responses were amplified and averaged using a Nihon Kohden MEM 3202 with filters set at 500 to 3,000 Hz and the first ten(10) milliseconds averaged across 1,000 stimulus per trial. The stimulus used was a 100 microsecond broad band alternating polarity at a rate of 10/sec through a TDH 39 headphone. Initial responses were recorded at 90 dB HL. The stimulus was later reduced to 80, 60, 40 and 30 or until all responses were absent. Two trials were done for each subject so as to measure reliability. The wave tracings recorded by the examiner were analyzed and measured by two other independent examiners who were both unaware of the order of electrode presentation. The better looking waveforms were analyzed/measured using the following parameters; 1) AP amplitude distance between the prestimulus baseline and the maximum peak of the AP component and; 2) AP latency - the interval from the start of stimulus to maximal deflection of the action potential; 3) SP amplitude - height of the shoulder preceding the AP component; and 4) SP/AP amplitude ratio.

At the end of each session, repeat otoscopic examination were done and subjects were made to answer a questionnaire as to the presence of any discomfort or pain during and/or after the procedure.

Table 1. Ecog recording parameters

Electrode Placement	
Primary (Active)	Ipsilateral ear canal (TM)
Secondary (Reference)	Contraleteral earlobe
Ground	Forehead
Evoked Response System	Nihon Kohden Neuropak Acoustic Stimulator SSS-3200
Settings:	
Repetitions	1,000
Analysis time	10 msec
Filters	500-3,000 Hz
Stimulus	
Type	broad band alternating polarity clicks
Duration	100 usec
Sensation Level	90 dB HL then lower
Rate	10/sec
Transducer	TDH 39 headphone

RESULTS & DISCUSSION

The aim of this particular study is to demonstrate visibly reliable Ecog waveforms among normally hearing Filipino subjects using an imported newly designed TM electrode which was described earlier and to compare it with a locally fabricated counterpart in terms of the ability to pick up waveforms with SP and AP component. Initially, the plan was to fabricate a local electrode made of silver wire. However, the lack of this type of wire in the local market prompted the search for an alternative. The alternative wire should be relatively less expensive, readily available and yet comparable to silver particularly in terms of its conductive ability. The best candidate was copper which is commonly used as an electrical conductor. As shown in table 2, copper and silver, which belong to the same family of transition metals, share more or less the same physical and chemical properties; with silver having a slightly higher conductive ability (10).

Table 2. Physical and Chemical Properties of Ag and Cu

	Ag	Cu
Melting Point	962	1,084
Boiling Point	2,164	2,582
Density	10.5 gm/cm	38.92 gm/cm3
Resistance	1.629 uohm	1.724 uohm
Relative Conductivity at Cu=100	104	100

A set of comparative Ecog tracings recorded from the two electrodes (Ag and Cu) from a normal hearing subject is represented in Fig. 3. From an initial Ecog recording noted at 90 dB, all the responses showed the expected reduction of component amplitude and prolongation of N1 latency for both electrodes. Note also that tracings obtained from the silver electrode are very similar to those recorded from the copper electrode.

For both electrodes, the compound AP component was identified in 100% of ears tested at the maximum level of stimulus of 90 dB HL down to about 60 dB HL. Thereafter, as one approaches threshold, both electrodes showed comparable decrease in their ability to pick up an identifiable action potential (Fig. 2). Previous studies have reported Ecog to be a good predictor of behavioral threshold.[2,5,11] Thresholds to the click stimuli are said to be an indicator of the audiometric thresholds between 2,000 to 4,000 Hz. Hooper et. al, in their study showed that the best correlation between Ecog and pure tone is at 1,000 to 2,000 Hz.[5] Eggermont et. al., found tone bursts to produce better correlation to subjective audiograms at frequencies 1,000, 2,000 and 4,000 Hz.[12] All of these studies however employed transtympanic Ecog. Studies on threshold determination using ear canal electrodes showed that Ecog thresholds are elevated in comparison to behavioral threshold to the same stimulus. At best, they can predict behavioral thresholds within 15 to 20 dB.[5,11,13] If one is to define threshold as the lowest intensity of the click stimulus below which no identifiable potentials are recorded, then our threshold in this particular study would be somewhere between 40 and 60 dB HL in most of the ears tested for both electrodes. **Ferraro et. al. (1986)** showed similar findings and suggested that the ABR's wave V which persists longer correlates better with pure tone behavioral thresholds in the 2,000 to 4,000 Hz range.[13]

The mean amplitude across the subjects tested (22 ears) as a function of stimulus level for both electrodes is illustrated in Fig. 4. The function curves for the two electrodes appear to be very similar in shape and with the amplitude gradually increasing up to about 60 dB HL whereupon it begins to rise rapidly. The same trend was also seen from previous studies.[3,14] The mean amplitudes for the silver electrode as expected were slightly higher compared to that of copper (Fig. 5). As can be seen from the graph, the maximum mean amplitude at 90 dB HL was about 2.53 uV for the silver electrode and about 2.40 uV for copper. Using a paired t-test, this difference in mean amplitude is not significant ($p<0.05$). The same is true for all the other stimulus levels tested. It is also apparent from the data that the silver electrode recordings had larger variances as can be seen from their SD values. Considering that both electrodes were placed in the same area of the tympanic membrane (posteroinferior quadrant), one can assume that the distance between the generator source **(Cochlea)** and the electrodes is more or less the same. Amplitudes recorded from the silver electrode are expected to be larger by virtue of silver's relatively higher conductivity. Higher values on the other hand are expected to have higher variances. A more reasonable index of variability among measurements is the coefficient of variation which adjusts such variations to the size of the mean. By normalizing the standard deviation to the mean as seen in table 3, the values for both electrodes are made more comparable. This suggests that the AP amplitude can be determined with similar precision using either the silver or the copper electrode.

Table 3. Analysis of Action Potential Amplitude Measures

	Ag	Cu
90 dB HL (n=22)		
mean	2.53	2.40
SD	0.75	0.60
CV	0.30	0.25
	NS $p<0.05$ @	
80 db HL (n=22)		
mean	2.14	2.02
SD	0.58	0.50
CV	0.27	0.24
	NS $p<0.05$	

60 dB HL		
(n=22) mean1	.13	1.09
SD	0.33	0.46
CV	0.29	0.42
	NS p<0.05	
40 dB HL		
(n=22)*		
mean	0.58	0.55
SD	0.33	0.35
CV	0.56	0.63
30 dB HL		
(n=22)**		
mean	0.21	0.23
SD	0.31	0.28
CV	1.47	1.21

* AP component was identified in 80% of ears tested for both electrodes.
** AP component was identified in 40% of ears tested for both electrodes.
@ paired t-test
SD standard deviation
CV coefficient of variation

The Summating potential was noted in all the ears tested at maximum stimulus of 90 dB and 80 dB HL with mean values of 0.88 uV and 0.77 uV for silver and copper electrodes respectively (Fig. 6). Similar to the AP amplitudes, the ability of both electrodes to pick up this component tend to decrease as one approaches threshold. Unlike the AP potential which was identified at lower stimulus level, the SP component tends to disappear way above the threshold. In this particular study, no SP potentials were recorded below 60 dB HL. The silver electrode was able to record identifiable SP component in only 30% of ears tested, slightly higher than copper which was able to record SP component in 20% of ears tested. Similar results were obtained from previous studies showing that in majority of subjects, the SP component cannot be identified or not clearly evident at less that 70 to 80 dB SL.[11,15] The most likely cause is the limited resolution and the signal to noise ratio enhancement capabilities of the instrumentation used. Another observation is that unlike the AP potential, the mean SP amplitudes recorded in this particular study showed greater variability across the normal subjects tested as shown by their large

Table 4. Analysis of Summating Potential Amplitude Measures

	Ag	Cu
90 dB HL		
(n=22)		
mean	0.80	0.77
SD0.48	0.40	
CV	0.60	0.52
	NS p<0.05	
80 dB HL		
(n=22)		
mean	0.60	0.60
SD	0.34	0.31
CV	0.56	0.51
	NS p<0.05	
60 dB HL		
(n=22)*		
mean	0.80	0.77
SD	0.48	0.40
CV	0.60	0.52

* SP component was identified only in 7 ears tested with silver and 4 ears tested with copper.

absolute and normalized SD values (CV). This is one reason why others would argue about the potential usefulness of the absolute SP values in the diagnosis and monitoring of patients with Meniere's.[11] Although the difference among the mean SP amplitudes are statistically insignificant (p<0.05) between the two electrodes, the difference may be due at least in part to the difficulty in defining this particular parameter in the relatively smaller tracings obtained using the copper electrode (Table 4).

Because of the high SP amplitude variability and the possibility of having too much overlaps between normal and pathologic ears the usefulness of the absolute SP amplitude as a test for SP enlargement which is seen in Meniere's is being questioned by some groups.[11] Other groups suggested that normalizing the SP amplitude against the AP amplitude would significantly reduce variability across subjects, enough to provide a useful test for the presence or absence of SP enlargement. This is due to the fact that there is a strong tendency for SP to co-vary with the AP amplitude such that ears with large SPs tend to have large APs. So the concept of SP/AP ratio came about.

The mean SP/AP ratio for both electrodes is illustrated in Fig. 7, showing less variable results as compared to the mean SP amplitudes for both electrodes (Fig. 6). The SP/AP ratio as expected for silver is slightly lower that that of copper owing to the relatively larger AP amplitude values recorded from the silver electrodes. The difference between the mean SP/AP ratio of both electrodes is insignificant (p<0.05) (Table 5). It is interesting to note that similar to the mean SP amplitudes at 60 dB HL, SP/AP ratio at the same level of stimulus would have SD values greater than the mean values. This is so because the silver and the copper electrodes were only able to identify the SP component in 30% and 20% of ears tested, respectively.

Among the different Ecog parameters, the AP latency is the least studied. The latency which is defined as the time interval from the onset of the click

Table 5. Analysis of SP/AP Amplitude Ratio Measures

	Ag	Cu
90 dB HL		
(n=22)		
mean	0.32	0.33

SD	0.19	0.16
CV	0.59	0.48
	NS p<0.05	
80 dB HL		
(n=22)		
mean	0.27	0.29
SD	0.15	0.15
CV	0.55	0.51
	NS p<0.05	
60 db HL		
(n=22)*		
mean	0.12	0.06
SD	0.19	0.15
CV	1.58	2.50*
see analysis of SP amplitude		
40 db HL		
(n=22)*		
mean	2.29	2.16
SD	1.14	1.21
CV	0.49	0.56
	NS p<0.05	
30 db HL		
(n=22)**		
mean	1.31	1.44
SD	1.62	1.62
CV	1.23	1.10

* Action potential was measured in 80% of ears tested for both electrodes.
** Action potential was measured in 40% of ears tested for both electrodes

stimulus to the maximal deflection in the action potential is said to decease systematically from about 4 milliseconds near threshold to 1.5 milliseconds at high intensity.[2] From a maximal stimulus of 90 dB HL both silver and copper electrodes showed an increase in their latencies to about 2 milliseconds at 60 dB HL. Thereafter, there was an unexpected decrease in their mean latencies at 40 dB HL and 30 dB HL (Fig. 8). It is also apparent from the graph that the standard deviation has attained values larger than the mean latencies themselves. This can only be explained by the fact that both electrodes were not able to record the AP component in a larger number of ears tested, hence the misleading mean latency values and their standard deviation. It is expected that silver being a better conductor would tend to have lower latency values as compared to copper. The results were not conclusive. The difference between the mean AP latency for silver and copper was also not significant at $p<0.05$ (Table 6). Correlation studies between the AP latency and AP amplitude has been suggested, however, its clinical significance is still unknown, especially in extratympanic recordings.

Table 6. Analysis of Action Potential Latency Measures

	Ag	Cu
90 db HL		
(n=22)		
mean	1.46	1.47
SD	0.20	0.23
CV	NS p<0.05	
80 db HL		
(n=22)		
mean	1.63	1.61
SD	0.16	0.11
CV	0.09	0.07
	NS p<0.05	
60 db HL		
(n=22)		
mean	2.10	2.15
SD	0.53	0.27
CV	0.25	0.12
	NS p<0.05	

All of the subjects were asked whether any of the electrodes caused discomfort or any pain while being subjected to Ecog or after the procedure. Similar to the results of Stypulkowski and Staller,[9] none of the subjects reported any significant pain or discomfort for both electrodes. Three subjects, however, described a dull pain or pressure when the electrodes were dislodged and rested at the area between the annulus and the ear canal. This also resulted in poor tracings. Repositioning of the tip to rest against the tympanic membrane eliminated both problems. Repeat audiograms of the three subjects did not show any remarkable change. All of the subjects, when asked, were all willing to subject themselves to another Ecog test if the need arose.

CONCLUSION

After performing Ecog among normally hearing Filipino subjects, it appears that the imported tympanic membrane electrode (Sunny Brook Health Science Center) is capable of recording large and reliable waveforms with SP and AP components. The locally fabricated tympanic membrane electrode made from copper compared favorably with the imported TM electrode with respect to the parameters used in this investigation. Considering that copper is relatively inexpensive and is readily available in the local market, the locally fabricated TM electrode is potentially more suitable for extratympanic Ecog in the local setting. The potential application of the local electrode however, needs to be further elucidated in a larger clinical population.

NONINVASIVE EcochG AMONG NORMAL HEARING FILIPINO SUBJECTS: A COMPARATIVE STUDY USING SILVER AND COPPER TYMPANIC MEMBRANE ELECTRODES*

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ABSTRACT

Noninvasive extratympanic electrocochleography (EcochG) using silver and copper tympanic membrane electrodes was performed on 11 normal hearing Filipino subjects (22 ears). The purpose of the study was to demonstrate and evaluate visibly reliable EchochG waveforms with an imported silver electrode (Sunny Brooks Health Science Center) and compare such recordings with those recorded from a locally fabricated copper tympanic electrode in terms of the following parameters: AP and SP amplitudes, AP/SP amplitude ratios, and AP latencies. Mean AP amplitudes, Mean SP amplitudes, AP/SP amplitude ratios and Mean AP latencies for both electrodes showed no significant differences at $p<0.05$. The results indicate that both electrodes are capable of recording reliable EchochG waveforms. The fabricated copper TM electrode compared favorably with the silver electrode with respect to the parameters used in this investigation.

Key Words:
Noninvasive EchochG,
silver TM electrode,
copper TM electrode

INTRODUCTION

Electrocochleography (EchochG) is an electrophysio-logical technique of recording stimulus-related responses of the cochlea and the auditory nerve by electrodes placed as close as possible to the cochlea.[1,2] In many studies, these stimulus-related potentials which include the *cochlear microphonic, the summating potential and the compound action potential of the auditory nerve* have been shown to be useful in: 1) the assessment of and monitoring of patients with Meniere's disease or endolymphatic hydrops; 2) enhancement of the Wave 1 of the auditory brainstem response in patients with substantial amount of hearing loss or patients tested under less optimal recording conditions and 3) in the intra-operative monitoring of the peripheral auditory structures at risk of permanent damage secondary to surgically induced trauma.[1,2,3]

The first recorded potential from the eighth nerve is attributed to **Wever and Bray** (1930).[6] **Saul and Davis (1932)** were able to separate the Electrocochleogram (Ecog) into its main components: the cochlear microphonic and the compound action potential.[4] In 1959, **Rubens** started to record human cochlear microphonics and auditory nerve action potentials routinely, obtained with an electrode placed directly on and through the round window membrane.[6] Other successful attempts to record responses from the human auditory periphery involved the placement of an electrode through the tympanic membrane either through a tympanotomy incision, through a pathologic membrane perforation or the ear canal skin near the tympanic membrane.[1]

Responses obtained with these types of electrodes are consistent and large or robust, however, their relatively invasive nature has limited their clinical application.[1,2] The development of non-invasive ear canal electrodes capable of providing responses that approximate responses obtained with the more invasive procedures has greatly increased the clinical practicality and thus popularity of Ecog among clinicians in the U.S. and Europe. Several authors have described different types of canal and tympanic membrane electrodes, some of which are commercially available.[7,8,9] The most commonly used extratympanic electrode is the one designed by **Coats** and currently being manufactured by **Lifetech Inc.** This silver ball electrode attached to a plastic V-shaped leaf is placed against the wall of the ear canal close to the tympanic membrane. The second most widely used, the **Axonics 3-M system** manufactured by the **Nicolet Instrument Corporation** utilizes a circumferential foam ear saturated with electrode gel with a central silver plated plastic horn used to deliver sound stimuli and which serves as an electrical conductor.[7,8,9] A study comparing these two commercially available electrodes

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OSTIOMEATAL COMPLEX OBSTRUCTION AND INFLAMMATORY SINUS DISEASE: A RADIOLOGIC CORRELATION*

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ABSTRACT

The coronal Computed Tomography scans of the sinuses of 110 patients, ages 20-73 years old (58 females; 52 males), with inflammatory sinus disease were reviewed. The presence of sinusitis, as well as specific radiologic changes were then correlated with OMC obstruction and posterior ethmoid sinusitis, to determine if inflammatory sinus disease is always associated with OMC obstruction. Results showed that sinusitis is not always associated with obstruction but statistically significantly correlated 9p = 3.073 x 10-6. The maxillary sinus was most frequently involved. Frontal and sphenoid sinusitis can occur with maxillary involvement, but with sphenoid, only with localized lesions, i.e. polyps, otherwise, it is part and parcel of pansinusitis which is always associated with OMC obstruction. Among the specific radiologic changes, soft tissue densities and air-fluid levels were mostly associated with OMC obstruction. With findings more indicative of chronicity, i.e. polyps, OMC obstruction was absent. Perhaps then, OMC obstruction is part of an inflammatory process rather than a permanent irreversible condition.

INTRODUCTION

The past years have witnessed significant changes in the management of sinusitis. The current trend in the treatment of chronic inflammatory disease of the sinuses have shifted to restoration of its function rather than the more radical form of surgical procedures. This is largely due to newer concepts in the pathophysiology of the disease. The focal point on the causation of sinusitis seem to be centered mostly on the ostiomeatal complex and the ethmoid sinuses, which can be evaluated clearly by a screening computed tomography of the paranasal sinuses. The narrowness, close proximity and labyrinthine structure of the ostiomeatal complex and ethmoids predispose this area to obstruction whenever there is anatomical or inflammatory abnormality. It is believed that obstruction in this area could lead to inflammatory conditions of the major sinuses. In the light of these presumptions, it is thus pertinent to ask the following questions: 1) Are inflammatory conditions of the paranasal sinuses always associated with inflammatory reactions in the OMC and ethmoids?; 2) Are all sinuses involved?; 3) Which sinuses are mostly affected?; 4) Is there an association between the inflammation in major sinuses to a particular entity in the OMC ethmoids? And to what degree is the association related?

Presented with these questions, this study was conceptualized with the following objectives: 1) To tabulate CT scan findings of patients presenting with a clinical diagnosis of sinusitis; 2) To discuss the significance of OMC obstruction on CT scan in relation with the pathogenesis of sinusitis; 3) To evaluate relative frequencies of sinus involvement and identify trends if any; and 4) To investigate the clinical significance and relevance of these radiologic changes.

METHODOLOGY

Cases with sinusitis on CT scan were reviewed and tabulated as mucoperiosteal thickening, poylposis, retention cysts, mucocoeles, air-fluid level and soft tissue density/haziness/ opacification. The STD (soft tissue density) was classified as minimal or mild (less than 50%), Near total or almost complete (greater than 50%), and Total or Complete. Findings for each major sinus were then correlated with OMC obstruction was also noted. Correlation was statistically tested using Chi swore test at $p<.05$ level of significance.

RESULTS

The results showed that although inflammatory sinus disease is not always associated with OMC obstruction, statistical analysis indicated a significant correlation at $p<3.073 \times 10^{-6}1$

In Table 1, the maxillary sinus is most frequently involved in sinusitis and the least is sphenoid. Then among the different combinations (Table 2), pansinusitis is most frequently and is always associated with OMC obstruction.

On the extreme, isolated posterior ethmoid sinusitis (Table 2) and sphenoid sinusitis with isolated localized

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lesions (Tab. 8), were not accompanied by OMC obstruction. When sphenoid sinusitis is associated with OMC obstruction, it is always part and parcel of pansinusitis. Frontal sinusitis, which was believed to exist only in association with maxillary sinusitis, was shown in this study to occur without maxillary involvement.

Radiologic changes of sinusitis seen on CT, especially with maxillary and frontal sinusitis, were statistically significant and correlated with OMC obstruction at p values of : $p= 1.045 \times 10^{-3}$ and $p=4.423 \times 10^{-4}$, respectively. Posterior ethmoid and sphenoid sinusitis were not significantly correlated with OMC obstruction with p values of: p=.0576 and p=.1841, respectively.

Among the specific changes of sinusitis seen on CT scan, air-fluid levels and soft tissue densities were most frequently and consistently associated with OMC obstruction. In four patients presenting with these findings, results of their plain x-ray, Water's view, also showed haziness or opacification in the sinuses involved, although of course, the OMC cannot be definitely visualized.

Radiologic changes indicative of chronicity such as polyps, retention cysts, and mucocoeles, and also mucoperiosteal thickening, were accompanied by OMC obstruction when associated with other sinus involvement. Otherwise, when existing as a localized isolated pathology, there was no OMC obstruction.

DISCUSSION

The present concepts on the pathophysiology, diagnosis and management of inflammatory chronic or recurrent sinus disease have been revolutionized with the advent of endoscopy and computed tomography (CT scan). CT imaging has provided us with an accurate and more complete picture of the PNS (paranasal sinuses) and especially the area of the anterior ethmoids and ostiomeatal complex (OMC). This area is composed of narrow channels serving as passages for ventilation and mucociliary drainage of the major sinuses. The close proximity of these structures would readily result in obstruction in the presence of anatomical and inflammatory pathology. The mucosa covering these structures bear the brunt of inspired airflow. Thus, obstruction in this area would result in changes in airflow, disruption of sinunasal drainage leading to retention of secretions, inflammation and infection. Hence, the importance of the middle meatus - anterior ethmoid complex in the pathogenesis of frontal and maxillary sinus disease led Naumann to describe the area as the ostiomeatal unit.

Based on the findings of this study, inflammatory sinus disease is not always associated with an OMC obstruction, but is significantly correlated ($p<3.073 \times 10^{-3}$).

Results showed that among the sinuses, the maxillary sinus is most frequently involved in sinusitis (tab 2), excluding the anterior ethmoids. The anterior ethmoids was not included since they are almost always affected with radiologic changes, even in viral forms of sinusitis. The data for this study confirms this, since sinusitis in the other sinuses were associated with involvement of the anterior ethmoids. Exceptions were the cases presenting only with isolated localized lesions, i.e., polyp/ retention cyst/mucocoele or mucoperiosteal thickening.

Frontal sinusitis would usually be associated with maxillary involvement, again except if it is only a localized lesion. A local study by Reyes, Jamir, Abes et.al, concluded that frontal sinusitis only occurs with a concomitant maxillary sinusitis. Likewise, sphenoid sinusitis would occur only in pansinusitis or polysinusitis. In this study, there were cases of isolated frontal and sphenoid sinusitis only, without an accompanying maxillary sinusitis. However, with sphenoid sinusitis, these were cases with localized lesions, i.e. polyp or mucoperiosteal thickening, consistent with a chronic condition (chronicity as defined by Smoker).

The frontal sinus develops from the anterior ethmoid air cells, of which the frontal recess is a part, serving as the drainage channel. The frontal sinus is frequently diseased compared to the sphenoid perhaps because of its normal physiology. It is the only sinus where there is a return flow in mucociliary clearance.

Specific CT scan findings of maxillary sinusitis, the biggest sinus, were then correlated with OMC obstruction and posterior ethmoids soft tissue density (Tab. 5). Results showed that maxillary sinusitis is not always associated with OMC unit obstruction. However, it is statistically significant ($p<1.045 \times 10\text{-}5$). There was only one CT scan with an air-fLuid level in the maxillary sinus that had no OMC obstruction, and no other abnormal CT scan findings even in the other sinuses. The air-fluid level was more than 50% and the patient presented with signs and syptoms of recurrent sinusitis despite treatment. FESS was done, and intraoperatively, the surgeon decided to do Caldwell-Luc. Findings revealed fungal infection, and not a simple case of sinusitis. The rest of the maxillary sinusitis with an air-fluid level were associated with anterior ethmoidal soft tissue density and OMC obstruction. Maxillary Sinusitis with minimal/ mild soft tissue density was not consistently associated with OMC obstruction. However, air-fluid level, near total/ almost complete and total/complete STD were consistently and significantly correlated ($p<1.045 \times 10\text{-}5$). This is important since a soft tissue density on CT scan is seen on plain radiographs (specifically Waters view) haziness or opacification, even if the area of the OMC and anterior ethmoids is not clearly defined. Thus, we can conclude that with a CT scan finding of air-fluid level, near total/ almost complete and total/ complete Soft Tissue Density of the maxillary antrum, there is a high probability that the OMC is obstructed. From these conclusions, we can perhaps infer that, if a plain x-ray of the PNS will show

the equivalent of these CT scan findings, then there is most probably a concomitant OMC obstruction and anterior or posterior ethmoid sinusitis.

Fortunately, four subjects also had plain x-ray plates available. Comparison of the plain radiograph findings with that of CT scan showed the obvious superiority of CT scan. However, with regard to opacification or haziness in the maxillary antrum on plain x-ray of two patients, it was noted and interpreted as soft tissue density on CT scan.

This is then clinically significant for otolaryngologists who would like to establish the presence of OMC obstruction in patients with sinus disease clinically and on plain radiographs.

Patients presenting with clinical signs and symptoms of inflammatory sinus disease despite medical treatment, would usually be radiologically evaluated. Before the advent of endoscopy and computed tomography, plain x-ray of the (PNS) Paranasal Sinuses was the standard used in definitive diagnosis of sinusitis. Plain radiographs of the PNS included Waters, AP-Lat, and Caldwell. These views would show signs of sinusitis in the frontal, maxillary, sphenoid and posterior ethmoids. The area of the OMC and anterior ethmoids is not clearly visualized in any of the x-ray views. Air-Fluid level can be seen in the frontal and maxillary sinuses with an upright Waters. Thus in the past, inflammatory sinus disease was primarily attested to these 2 major sinuses. Surgical management of patients not responding to medical treatment then entailed doing at least, a nasoantral window and flushing, or eventually a Caldwell-Luc. Antral washing would provide only a temporary relief and the recurrence rate, complication and failures of these procedures are quite significant. Studies on mucociliary flow and drainage of the sinus showed that normal flow is directed to the natural ostium. Thus despite the presence of a nasoantral window, drainage and ventilation is still inadequate. Nasoantral windows, originally intended to treat sinusitis by reoxygenating the diseased sinus and providing an accessory ostium for drainage may actually interfere with mucociliary clearance by blocking transport to the natural maxillary ostium. Only minor amounts of mucociliary flow may actually be transported out of the nasoantral window, the rest bypassing the window and being cleared to the natural os. Mucociliary flow would still be obstructed at the natural ostium and ventilation would still be poor since the area of the OPMC is still blocked. This area is then critical in the pathogenesis of inflammatory sinus disease. FESS is based on these concepts and aims to widen and open up the natural ostium, aside from opening up the ethmoid air cells. Hence, a CT scan is usually required before doing a FESS.

Among the radiologic changes evaluated in this study, air-fluid level and soft tissue density (STD), specifically near total and total, were most frequently and consistently associated with OMC obstruction (Tables 4,5,6,7). Perhaps, the reason behind this is that, these are radiologic manifestations of an acute stage of sinusitis. Being an acute process, there will be inflammation, edema and swelling, including the area of the OMC, creating a blockade. Then, as the condition becomes chronic, there is formation of localized lesions such as polyp or retention cyst. With the setting in of chronicity, OMC obstruction resolves and even-tually disappears. This is supported by findings in this study, wherein isolated radiologic findings of localized lesions such as mucocoele, retention cyst were not associated with OMC obstruction. Current published reports would tend to imply that OMC obstruction is a crucial event in the pathogenesis of sinus disease. While this may be true with acute sinusitis, radiologic changes indicative of chronicity as defines by Smoker, like polyps have been shown in this study to have no associated OMC obstruction. This being the case, the belief that OMC obstruction mandates a surgical intervention without prior adequate medical treatment, is now being questioned. The usual acute inflammatory response of swelling, congestion and edema, would result in the radiologic "illusion" of OMC obstruction. Is it not possible that this radiologic picture is just confined to the soft tissue in the acute stage of the disease, rather than a definitive irreversible bony phenomenon? A study of CT scan of patients receiving adequate treatment and eventually surgery would further clear the issue.

Results also showed that sphenoid and posterior ethmoid sinusitis are not significantly correlated with OMC obstruction, with $p>.1841$ and $p<.0576$, respectively. Perhaps the explanation for this is the anatomical location of these two sinuses, in relation with the OMC. The OMC is more anteriorly located, hence any blockage in this area, would naturally greatly affect the anterior group of sinuses rather than the posterior group. Thus, the maxillary sinus, whose natural ostium directly opens into the OMC, is mostly affected and the results of this study showed that it is the most frequently involved sinus. These are also the reasons why sphenoid sinusitis occurs only in pansinusitis, except if it is a localized isolated pathology, as previously described. With sphenoid sinusitis, posterior ethmoid sinusitis would most probably be present as well ($p< 1.071 \times 10\text{-}3$), again, since they are both located posteriorly and almost next to each other.

An incidental finding in this study was the presence of hypoplastic frontal sinus. There were 10 hypoplastic frontal sinuses noted. This radiologic finding on plain x-ray is most often ignored by the clinician to be of no clinical significance except as a manifestation of the development of the frontal sinus. In this study, the hypoplastic frontal sinus was always associated with an OMC obstruction. Could this be considered as a predisposing factor in the development of acute sinusitis? This is another question worth investigating in another study.

CONCLUSION

1. The CT scan findings of patients presenting with inflammatory sinus disease were tabulated and evaluated. Significant findings such as the most frequent and consistent radiologic changes associated with OMC obstruction were noted and discussed.
2. We need to further study the role of OMC obstruction in the pathogenesis of sinusitis since results obtained in this study would tend to show that it is just a radiologic transitory condition rather than a permanent irreversible phenomenon.
3. The maxillary sinus is most frequently involved in sinusitis. However, the previous contention that frontal sinusitis cannot exist without an associated maxillary sinusitis has been disproved. Likewise with sphenoid sinusitis. However, sphenoid sinusitis is almost always part and parcel of a pansinusitis, unless it is a localized lesion.
4. The possible clinical significance from this study would include the following: a) Sphenoid sinusitis without OMC obstruction and without involvement of the major sinuses would probably be a polyp, retention cyst, or mucocoele; and b) If on CT scan, there is mucoperiosteal thickening without OMC obstruction, and without involvement of the major sinuses, then most probably it is a sequelae of a chronic process. Other points of significance were already discussed.

RECOMMENDATIONS

1. A serial study CT scans of patients with sinusitis treated medically could be done to resolve issues regarding OMC obstruction.
2. Patients with an allergic component should be studied also since allergy is a chronic recurrent condition, wherein claims of sinusitis may not hold true. Hence a different management regimen may be required.

DEFINITION OF TERMS

1. **Chronic or Recurrent Sinusitis**
   Persistent inflammation or repeated bouts of sinusitis manifesting as rhinorrhea, nasal congestion, frontal or interorbital headache, post-nasal drip, with radiographic or CT scan findings of polypoid mucoperiosteal thickening, sinus bony wall thickening, near total or total opacification or soft tissue density.
2. **Ostiomeatal Complex or Unit**
   Anterior Ethmoid - Middle Meatal Complex, through which the frontal, maxillary and anterior ethmoid sinuses drain and the area resposible for the mucociliary clearance from these sinuses to the nasal cavity. It is composed of the : maxillary sinus ostium and infundibulum; hiatus ethmoidal bulla; and frontal recess.
3. **Concha Bullosa**
   Pneumatized and usually enlarged middle turbinate thus, could compress the uncinate process to obstruct the middle meatus and infundibulum.
4. **Soft Tissue Density**
   Any haziness or opacification in the sinuses seen on CT scan. Could be Mild or Minimal (less than 50% of the area), near total or almost complete, or Total or Complete
5. **Polyp/Retention Cyst/Mucocoele**
   Any soft tissue density that has a rounded well defined border.
6. **Computerized Tomography Scan**
   Imaging used utilizing the coronal plane, to best demonstrate the ostiomeatal unit.
7. **Functional Endoscopic Sinus Surgery**
   Surgical technique designed and advocated by Messerklinger using endoscopes, and developed from the Messerklinger Concept on the Pathophysiology of mucociliary flow and pathogenesis of sinus disease.

		Number of CT Scan Plates
retrieved	:	110
Number of CT Scan Plates with signs of chronic or recurrent sinusitis	:	94
Number of Ct Scan plates without OMC obstruction nor signs of sinusitis	:	16

n = 110
Age range = 20 y/o to 70 y/o
Female = 52 Male = 58

KEY:

OMC	-	Ostiometal Complex
To	-	Total number of (+) and (-)
Subto	-	number of (+) and (-)
R	-	Right
L	-	Left
Min	-	minimal, also equivalent to Mild
Near Total	-	also equivalent to Almost Complete
Complete	-	also equivalent to total
STD	-	Soft Tissue Density
Max	-	Maxillary
F	-	Frontal
S	-	Sphenoid
P	-	Posterior Ethmoid
P/RC/MCC	-	Polyp/Retention Cyst/Mucocoele
MPT	-	Mucoperiosteal Thickening

Table 1

Sinus involved	OMC Obstruction		
	R	L	To
Maxillary	63	61	124
Frontal	20	19	39
Sphenoid			26
Posterior			
Ethmoids	49	43	92
Anterior Ethmoids	64	63	127

Frequency of specific sinus involvement.

Table 2

Sinuses involved	OMC Obstruction		
	(+)	(-)	To
Polysinusitis			
Max + F	5	1	6
Max + F + P	6	-	6
To	11	1	12
Pansinusitis			
Max + F + S	2	-	2
Max + S + P	9	-	9
Max + S	4	-	4
Max + S + F + P	8	-	8
To	23	-	23
(+)Frontal (-) Maxillary	2	1	3
(+)Sphenoid (-)Max (-)F	2	1	3
(+)Posterior Ethmoid (-)S (-)M (-)F	0	3	3

Frequency of the different combinations of sinusitis

Table 3

Sinus involved		OMC Obstruction			P STD		
		+	-	To	+	-	To
FRONTAL	R	6	1	7	5	2	7
	L	5	-	5	4	1	5
	Bilateral	13	-	13	13	1	14
MAXILLARY	R	13	13	26	9	17	26
	L	15	9	24	14	10	24
	Bilateral	37	4	41	28	13	41
SPHENOID	R	1	1	2	1	1	2
	L	4	0	4	3	1	4
	Bilateral	18	1	19	15	4	19
POSTERIOR ETHMOIDS	R	29	2	31			
	L	4	6	10			
	Bilateral	9	1	10			

Correlation between sinusitis and OMC obstruction and F, M, and S sinusitis and Posterior Ethmoids sinusitis

	OMC Obstruction	P.E. STD
Chi(2)	45.790	18.557
D.F.	11	8
P	3.073 x 10(6)	.0178

Table 4

POSTERIOR	OMC Obstruction						
	(+)			(-)			
	R	L	SubTo	R	L	SubTo	To
STD							
Minimal	10	14	24	7	2	9	31
Near Total	14	13	27	2	3	5	32
Total	8	8	16	0	0	0	16

Correlation between posterior ethmoids sinusitis and OMC obstruction.

Chi^2 = 5.708 D.F. = 2 p = .0576

Table 5.1

Maxillary	OMC Obstruction						
	(+)		SubTo	(-)		Sub To	To
	R	L		R	L		
MPT	3	4	7	2	4	6	13
Polyp/RC/MCC	7	5	12	6	7	13	25
Air Fluid	5	5	10	0	0	0	10
STD Min	13	11	24	7	7	14	38
Near Total	13	21	24	2	1	3	27
Complete	12	7	19	0	0	0	19

Correlation between maxillary sinusitis and OMC obstruction.

Chi^2 = 30.667 D.F. = 5 p= 1.045 x 10^5

Table 5.2

Maxillary	Posterior Ethmoids Soft Tissue Density							
	(+)		SubTo	(-)		Sub To	To
	R	L		R	L		
MPT	4	4	8	1	4	5	13
Polyp/RC/MCC	5	3	8	8	9	17	25
Air Fluid Lev.	4	3	7	1	2	3	10
STD Min	10	7	17	10	11	21	38
Near Total	13	13	26	2	10	12	38
Complete	10	6	16	2	1	3	19

Correlation between maxillary sinusitis and Post. Eth. STD.
Chi ^{2} = 17.295 D.F. = 5 p = 3.972 x 10^3

Table 6.1

Frontal	OMC Obstruction						
	(+)		SubTo	(-)		SubTo	To
	R	L		R	L		
MPT	-	-	-	-	-	-	
Polyp/RC/MCC	-	-	-	-	-	-	
Air Fluid Lev	0	1	1	1	0	1	2
STD Min	10	9	19	0	0	0	19
Near Total	3	2	5	0	0	0	5
Complete	5	6	11	0	0	0	11

Correlation between frontal sinusitis and OMC obstruction.
Chi^2 = 17.986 D.F. = 3 p = 4.423 x 10^4

Table 6.2

Frontal	Posterior Ethmoid Soft Tissue Density						
	(+)		SubTo	(-)		Sub To	To
	R	L		R	L		
MPT	-	-	-	-	-		
Polyp/RC/MCC	-	-	-	-	-		
AirFluidLev.	0	0	0	1	1	2	2
STD Min	6	5	11	4	4	8	19
Near Total	2	1	3	1	1	2	5
Complete	5	5	10	0	1	2	5

Correlation between frontal sinusitis and Post. Eth. STD/
Chi^2 = 7.423 D.F. = 3 p = .0596

Table 7.1

Sphenoid	OMCObstruction						
	(+)		Sub To	(-)		Sub	To
	R	L		R	L		
Polyp/RC/MCC	3	2	5	0	0	0	5
AirFluidLev	1	2	3	0	0	0	3
STD Min	6	8	14	0	0	0	0
Near Total	7	6	13	2	1	3	16
Complete	4	5	9	0	0	0	9

Correlation between sphenoid sinusitis and OMC obstruction.
Chi^2 = 6.209 D.F. = 4 p = .1841

Table 7.2

Sphenoid	Posterior Ethmoids Soft Tissue Density					
	(+)		SubTo	(-)		SubTo	To
	R	L		R	L		
Polyp/RC/MCC	2	0	2	1	2	3	5
AirFluidLev	2	1	3	0	0	0	3
STD Min	4	2	6	2	6	8	14
Near Total	8	7	15	1	0	1	16
Complete	5	5	10	0	0	0	10

Correlation between sphenoid sinusitis and Post. Eth. STD.

Chi^2 = 18.314D.F. = 4 p = 1.071 x 10^3

Table 8

Isolated Localized Lesion	OMC Obstruction (+)	(-)	Total
MPT Maxillary	2	8	10
Frontal	-	-	-
Sphenoid	-	-	-
Polyp/RC/MCC			
Maxillary	10	0	None
Frontal	-	-	
Sphenoid	-	-	

Association of Isolated localized lesion and OMC obstruction.

Table 9

Localized Lesion With STD		OMC Obstruction (+)	(-)	Total
MPT	Maxillary	3	0	3
	Sphenoid	-	-	-

Association between Localized lesion with STD, with OMC obstruction.

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USE OF THE BALLPEN CLICK AS A TOOL FOR HEARING SCREENING IN PRIMARY HEALTH CARE*

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ABSTRACT

A hearing screening program proposed for health workers using indigenous materials (i.e. ballpens, wristwatches, finger snap and the human voice) was conducted in 1992. The ballpen was chosen among the materials used in Phase O of this study because of its practicality. The objectives of this study are: to conduct a field trial of the initial phase of this study, to test the practical application and ease of its performance, and to make recommendations on its importance in Primary Health Care. Each subject was asked a set of questions from a prepared checklist and tested individually. The ballpen click was presented at a distance of 2-3 cm from the test ear while the non-test ear is occluded.

Likewise, pure tone average was taken for each ear. All the subjects underwent otoscopic examination. A diagnosis was given based on the audiometric result, clinical history, and otoscopic findings. A total of 1,626 ears were tested. Tests of validity and agreement comparing otoscopic findings and the ballpen click test as against audiometric results were used and showed a higher positive predictive value, negative predictive value, better accuracy and agreement for the latter. The study showed the applicability of the ballpen click test in a field study, practical and easy to perform, and the materials used for testing were readily available.

INTRODUCTION

For thousands of Filipinos, life is but a visual spectacle immersed in the stillness of absolute silence. Sadly, a majority of the causes of hearing impairment are found to have been preventable. Previous studies have shown that reasons for this oversight range from ignorance ("Akala ko luga lang", I thought it was merely an ear discharge) to the outrageous ("Wala kaming panahon", We simply don't have time). A local study conducted in Las Pinas among 1,373 first graders showed that 98% had varying degrees of hearing impairment, while a national survey conducted in 1979-1981 by the Bureau of Elementary School reported only 0.504% hearing impairment. Because of the disparity in values, the need for an accurate hearing screening was inevitable to arrive at a more dependable data. Up to now, there have been no data on the prevalence rate of deafness and hearing impairment in the country.

Compounding this seemingly insurmountable problem is the adverse maldistribution of ear doctors. Ideally, one ENT specialist should serve a population of 30,000. However, statistics show that for every ENT specialist, there are 385,542 people, and that most of these have a proclivity to practice in Metro Manila (population: 8,000,000 or a ratio of 1:72,727 population), while an ear doctor in the province has to serve a whopping 1,000,000 of the population.

In 1992, a group of medical interns embarked on a project to take the first step towards finding the key to this national problem. The project: to propose a hearing screening program by instructing community health workers to use readily-available and indigenous materials (such as ballpens, wristwatches, finger snap and the human voice), thereby addressing the problem of oversight while providing access to primary health care. The ballpen was chosen among the materials used in the Phase I of this study, because it was inexpensive, readily available, and could be easily standardized.

The objectives of this study are threefold: (1) to conduct a field trial of the initial phase of this study, (2) to test the practical application and ease of its performance, and (3) to make recommendations on its importance in Primary Health Care (PHC) based on the results of this study.

METHODOLOGY

SUBJECTS

A total number of 1,626 ears from 813 subjects, 443 (54%) of whom were females and 370 (46%) males, with ages ranging from 5 to 85 years old, from six different barangays (Philippine local communities) representing each town of Marinduque, Philippines were seen. Participation in this study was on a voluntary basis. An initial briefing was conducted to explain to the Barangay Health Workers (2 from each community) the

* GLAXO TRAINING AWARD DELIVERED AT THE MANILA HOTEL, DEC. 1, 1994
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purpose and procedure of the study. The community selection was based on the industry that each community represented: mining, fishing, agricultural urban, rural and a randomly chosen community in the immediate vicinity of the provincial airport.

Materials and Methods

The sound stimulus used in this study was the click of a ballpen. Thirty (30) Paper mate brand Kilometrico" press type ballpens were used, with the intensity measured at 33 + 5 decibels (dB), and the frequency ranging from 500-2000 hertz (Hz) of each pen calibrated on a 215-45 Quest sound level meter with narrow band filter by a duly certified technician in a 2 x 2m^2 sound-treated room at the Manila Hearing Aid Office. Six pure-tone diagnostic audiometers were likewise calibrated by the same individual.

The ballpen click and air-conduction hearing threshold tests were carried out in sound untreated quiet rooms. Subjects were instructed to keep the noise level to a minimum. The room measurement averaged 4x 3 m2, and measured noise levels did not exceed the maximum allowable frequency-specific limits for ambient noise proposed by the American Speech and Hearing Association (ASHA). Ambient noise level were defined using the handheld Quest model 215-45 sound level meter (table I).

The subjects were each asked by the Barangay Health Workers (BHW) a set of questions from a prepared checklist and were tested individually (Appendix A). Each subject was tested by the BHW and was initially guided by an otolaryngology resident. They were asked to close their eyes and mask the non-test ear by finger pressure over the tragus, thus occluding the external auditory canal. The ballpen click was presented at a distance of 2-3 cm from the test ear. When a sound was perceived, they were to immediately raise their hand on the same side of the tested ear. Subjects who could hear the ballpen click were labeled "Normal", while those subjects who could not perceive the sound stimulus were labeled "Abnormal".

After the audiometric test, each subject was seen by a different group of six otolaryngology residents who filled-up a check list of otologic history and did otoscopic examination (Appendix C). All otoscopic examinations were done using six Welch Allyn model no 2000 3.5v otoscopes. Final diagnosis was given based on the audiometry result, clinical history, and otoscopic findings.

RESULTS

One thousand six hundred twenty-six (1,626) ears from 813 subjects were tested. Age ranged from 5 to 85 yeras old. There were 32% (258 of the subjects) from the 5 - 15 age range, 16% (128) were from 16-20 age range, 26% (210) from 31-45 age, 18% (149) from age 46-60 and 8% were from the 60 and above age range (Table III).

A total number of 1,346 (83%) tested ears responded with the ballpen click test. While the remaining 280 (17%) tested ears failed to hear the ballpen click and were thus labeled as "Abnormal".

Of the 1,626 tested ears, 1,024 (63%) were within normal threshold. There were 602 (37%) tested ears with increased threshold level (30 dB and above) and were considered abnormal. Of the 602 abnormal, 429 (71%) ears had mild, 139 (23%) with moderate,23 (4%) with severe and 11 (2%) had profound hearing impairment (Table IV).

The otologic history and otoscopic examination were carefully carried out and recorded with the aid of a prepared checklist. Otoscopic examination was normal in 1,232 (76%) ears, and abnormal otoscopic findings were noted in 394 (24%). Among the abnormal ears, impacted cerumen was the most common abnormality, seen in 100 (25%) ears. There were 77 (20%) ears with either tympanic membrane perforated, 52 (13%) had otorrhea, while 67 (17%) ears were noted to have a bulging tympanic membrane. The rest of the otoscopic findings are shown in Table V.

Test for the validity of otoscopic findings when compared to standard audiometry showed a sensitivity of 68.9%, a specificity of 73.2%, a positive predictive value of 45.2%, a negative predictive value of 88.9%, and an accuracy of 72.14% (Table VI). The validity indices for the ballpen click when compared with standard audiometry, on the other hand, revealed a sensitivity of 44.35%, a specificity of 98.7%, a positive predictive value of 95.4%, a negative predictive value of 75.1%, and an accuracy of 78.7%. The Kappa test for the otoscopic findings and ballpen click as against audiometry was 0.53 and 0.66 respectively (Table VII). The Kappa test result indicate moderate agreement between otoscopy and audiometry and good agreement between ballpen click and audiometry.

DISCUSSION

In 1985 a World Health Organization (WHO) study estimated hearing impairment to afflict about 42 million individuals above the age of three worldwide. A recent estimate, on the contrary, has placed the majority of people with deafness and hearing impairment to live in developing countries, and thus a more realistic global figure is over 150-250 million.

The impact on socioeconomics is significant. The disability affecting all ages may not be immediately apparent, but these people (deaf and hearing impaired) can suffer in many ways. Normal education and job

opportunities may be denied them as they require special education, special placement and vocational training. Apart from causing a great deal of distress, deafness is sometimes the root of psychiatric problems.

The importance of conducting this study may be summarized in the words of Dr. Suchitra Prasansuk: "Primary ear care is essential in ear and hearing care made universally accessible to all people, using scientifically sound and socioculturally acceptable methods and provided at a cost which is affordable for individuals, families, communities, and the nation." That otitis media is the number one cause of deafness is what prompted us to engage in this study. Added to this is the fact that otitis media is preventable by providing the necessary information, education, early diagnosis and prompt treatment. This dictum provided the essence for utilizing Barangay Health Workers (BHW) and using readily available/and or indigenous materials.

Among the brands of ballpens which were sent for calibration, the authors chose the Paper Mate brand "Kilometrico" press type pen to be used for this study. The average calibration of all 30 ballpens was 35 dB and was more or less 5 dB above threshold. The pen is readily available in almost any store nationwide.

Clinical applicability is noted in the predictive values of the test when utilizing the results of the tests for validity. A test with higher Positive Predictive Value (PPV) and Negative Predictive Value (NPV) determine the probability that the patient has the disease or not, respectively. As evident in the results upon comparing otoscopic findings and the ballpen click test, the latter showed a higher positive predictive value, with almost equivocal negative predictive value for both (Table VIII).

The Kappa test demonstrated in this study that the ballpen click test has a much better agreement against the otoscopic findings utilizing audiometry as the gold standard with an accuracy and predicability of 78.7% versus 72.1% respectively.

Based on the results of the test of validity and agreement, it would now appear that the ballpen click test as a method for hearing screening is a good preliminary test prior to an actual audiometry or in the absence thereof. It should be stressed, however, that the test is not meant to replace the standard audiometer, but rather may prove to be an invaluable tool among non-ENT specialists, especially in the early detection and prompt management of hearing loss.

It is important to remember that two-thirds of all hearing impaired persons live in the developing world where they have no facilities.

In closing, "to achieve the goal of primary ear care at primary health care level, one has to keep in mind that it has to be people-oriented at the grass roots. Program implementation should be technically sound and, above all, socially acceptable: simple, economical and practical. It should be financially feasible for each country, with full participation by the people themselves. This is the way to success."

CONCLUSION

1. A field trial was conducted among the people of Marinduque. The pens facilitated the detection of hearing loss for a study of this magnitude executed in a limited span of time.

2. The test was practical and easy to perform.

3. Applicability of the ballpen test in a field study was demonstrated by a moderate to high test of agreement as compared to audiometry as gold standard.

RECOMMENDATIONS

1. As recommended by the first phase of this study, it is likewise recommended that "this hearing screening test be implemented and validated in all private and public schools, especially in areas where audiometric centers and audiologists are scarce". Further, this test should be performed on a broader scale. That is, it be implemented on a nationwide status.

2. The BHW's should be tapped in initiating the first step in the chain of administration of primary care. The BHW's are held responsible for conducting the screening test and for recommending subsequent referral to an ENT specialist once an abnormality is detected.

3. Family care physicians may include this in their routine physical examination and make their own referrals to an ENT specialist.

4. A nationwide hearing screening using the ballpen click test be implemeted to provide a reliable baseline data on the prevalence of hearing impairment.

Table I. Maximum allowable limits for ambient noise in Audiometric testing as proposed by ASHA *(Katz, 1985)

Frequency (Hz)	Maximum limit for ambient noise (dB)
500	46
1,000	50
2,000	58
4,000	76

Table II. Classification of hearing handicap based on the WHO Criteria with correction factor of +5 dB for sound untreated rooms

Classification Category	Hearing Treshold
Normal	0-30
Mild impairment	31-44
Moderate impairment	45-64
Severe impairment	65-84
Profound impairment	85 and above

Table III. Age distribution of subjects

Age range (years)	Total
5-15	258 (32%)
16-30	128 (16%)
31-45	210 (26%)
46-60	149 (18%)
60 and above	68 (8%)

Table IV. Audiometry results

	RIGHT	LEFT	BOTH
NORMAL	507(62%)	517(64%)	1024(63%)
MILD	223(27%)	206(25%)	429(26%)
MODERATE	66(8%)	73(9%)	139(9%)
SEVERE	11(1.3%)	12(1.4%)	23(1.4%)
PROFOUND	6(0.7%)	5(0.6%)	11(0.6%)
TOTAL	813	813	1,626

Table V. Otoscopic Findings

	Right Ear	Left Ear	Both Ear
Normal	616	616	1,232
Atresia	1	0	1
Bulging	32	35	67
Discharges	24	28	52
Dull	2	2	4
Foreign Body	2	0	2
Fungi	14	16	30
Hearing Aid	0	1	1
Impacted	51	49	100
Inflamed EAC	0	3	3
Perforation	39	38	77
Retained	19	12	31
Retracted	4	5	9
Scars	9	7	16
s/p Mastoidectomy	0	1	1
Total	813	813	1,626

Table VI. Otoscopy vs the Standard Audiometry

		Audiometry		
		Abnormal	Normal	Total
Otoscopy	Abnormal	272	330	602
	Normal	123	901	1,024
	Total	395	1,231	1,626

Sensitivity: 275 ÷ 395 = 68.9%
Specificity: 901 ÷ 1,231 = 73.2%
Positive Predictive Value: 272 ÷ 602 = 45.2%
Negative Predictive Value: 901 ÷ 1,024 = 88.0%
Accuracy: 272 + 901 ÷ 1,626 = 72.1%
Kappa Test: = 0.53

Table VII. Ballpen Click Test vs Standard Audiometry

		Audiometry		
		Abnormal	Normal	Total
Ballpen Click Test	Abnormal	267	13	280
	Normal	335	1,011	1,346
	Total	602	1,024	1,626

Sensitivity: 267 ÷ 602 = 44.4%
Specificity: 1,011 ÷ 1,024 = 98.7%
Positive Predictive Value: 267 ÷ 280 = 95.4%
Negative Predictive Value: 1,011 ÷ 1,346 = 75.1%
Accuracy: 267 + 1,011 ÷ 1,626 = 78.7%
Kappa Test: = 0.66

Table VIII. Comparison of test of validity between otoscopy and ballpen click when compared with audiometry as gold standard

VARIABLE	OTOSCOPY	BALLPEN
Sensitivity	68.9%	44.35%
Specificity	73.2%	98.7%
Positive Predictive Value	45.2%	95.4%
NegativePredictive Value	88.0%	75.1%
Accuracy	72.14%	78.7%
Kappa Test	0.53	0.66

Figure 1. Distribution of Subjects according to age

APPENDIX A

FORM FOR BARANGAY HEALTH WORKERS (BHW)

Survey Form for 5 years and above
Pagsusuri sa 5 taong gulang pataas

Name _____ Age _____ Sex _____
Pangalan Edad Kasarian

Check the answer on each box of the person being interviewed.
Pakilagyan ng tsek ang kahon ng sagot ng ini-interview

1. Are you hard of hearing?
   Nahihirapan ka bang makarinig?
   ❑ Yes (Oo) ❑ No (Hindi)

2. Do you have any hearing problems in the family?
   Meron bang problema sa pandinig ang ibang miyembro ng inyong pamilya?
   ❑ Yes, who?
   Oo, sino?
   ❑ Father (Tatay) ❑ Mother (Nanay) ❑ Sibling (Kapatid) ❑ Grandfather (Lolo) ❑ Grandmother (Lola)
   ❑ None?
   Wala?

3. May problema ka ba sa pagsasalita?
   ❑ Yes (Oo) ❑ No (Wala)

Measurement of hearing:
Pagsukat ng Pandinig:

INSTRUCTIONS:
PANUTO

1. Test for the right ear first.
   Unahing sukatin ang kanan na tainga.
2. Instruct the person to cover the left ear hole by inserting a finger.
   Sabihin sa ini-interview na takpan ang kaliwang tainga, sa pamamagitan ng pagpasok ng daliri sa butas.
3. At a distance of 2-3 cm position the ballpen on the side of the right ear.
   Sa layo na 2-3 cm itapat ang ballpen sa kanyang kanan na tainga.
4. Press the head of the ballpen and check the corresponding response.
   Pindutin and ulo ng ballpen; lagyan ng tsek ang resulta.
5. Repeat the procedure on the left ear.
   Ulitin ang pagsusuri sa kaliwang tainga.

	Right Kanan	Left Kaliwa
Can hear nakakarinig	❑	❑
Cannot hear Hindi nakakarinig	❑	❑

APPENDIX B

FORM OF AUDIOMETRY

NAME	AGE	SEX

PROCEDURE:

Explain to the Respondent that he/she will hear a tone/sound. Instruct him/her to raise his/her **right hand** if he/she hears the sound in his/her **right ear** and to raise his/her **left hand** if he hears it in his/her **left ear.**

To familiarize the respondent with the sound and procedure:

1. The initial intensity of the sound is **40 dB** in **1,000** Hz for 1-2 seconds.
2. If respondent does not respond, increase by **5 dB** steps until sound is audible.
3. If respondent responds, decrease by **10 dB** steps until sound is inaudible.
4. Record the intensity on the table provided below.

N.B. The test should be carried on in the following sequence of frequencies:
1,000 Hz, 2,000 Hz, 4,000 Hz, 1,000 Hz (again), 500 Hz

Intensity (dB)

Frequency (Hz)	R	L
4,000 Hz		
2,000Hz		
1,000Hz		
500 Hz		

APPENDIX C

*adapted from the World Health Organization/Prevention of Hearing Impairment and Deafness Ear Examination Form

FORM FOR EXAMINER

CENSUS

Code		Date		Country No.	
Strata No.		Cluster No.		Household No.	
Name		Age		Male	Female
Occupation		Exam. Status			

BASIC EAR EXAMINATION	R	L
Normal Findings	☐	☐
Abnormal Findings (Mark all which apply)		
Auricle	☐	☐
inflammation	☐	☐
malformation	☐	☐
Ext. Ear Canal	☐	☐
Occluding wax	☐	☐
Foreign body	☐	☐
Otorrhea	☐	☐
Inflammation	☐	☐
Fungi	☐	☐
Atresia	☐	☐
Ear Drum		
Perforation	☐	☐
Scars	☐	☐
Dullness	☐	☐
Retraction	☐	☐
Bulging	☐	☐
Middle Ear		
otorrhea	☐	☐
effusion	☐	☐
granulation/polyp	☐	☐
cholesteatoma	☐	☐
ossicular defect	☐	☐
Others	☐	☐

ANATOMICAL CLASSIFICATION (To be accomplished in case of hearing impairment)	R	L
Auricle		
Malformation	☐	☐
Others	☐	☐
Ext. Ear Canal		
Wax	☐	☐
Otitis Externa	☐	☐
Foreign Body	☐	☐
Atresia	☐	☐
Others	☐	☐
Middle Ear		
Accute Otitis Media	☐	☐
Chronic Otitis Media	☐	☐
Active	☐	☐
Inactive	☐	☐
Cholesteatoma	☐	☐
Otitis Media w/ Effusion	☐	☐
Others	☐	☐
Inner Ear		
Severe Hearing Impairment with normal ext. and mid ear	☐	☐
Central Nervous System		
Severe hearing impairment w/ normal ext. & mid ear & other CNS disturbance	☐	☐
Uncertain (Condition does not fit above)	☐	☐

OTHER RELATED CONDITION		
Previous Surgery	☐	☐
Mastoid	☐	☐
Cleft Palate	☐	☐
Nasal Discharge/ Obs.	☐	☐

PRINCIPAL DIAGNOSIS
Right
Left

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HEARING ASSESSMENT TEST (HAT): A HEARING ASSESSMENT TEST FOR PRIMARY EAR CARE

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ABSTRACT

Hearing Loss is one of the most common of all physical impairments, but physicians seldom screen adults for it, and patients overlook or deny hearing problems. The HAT is a set of 15 questions in Filipino related to daily activities which aims to assess individuals who warrant a referral to an ENT specialist. Theoretical and practical considerations which influenced the design of the HAT and the method of the study are discussed. Seven hundred fifty volunteers with a mean age of 40 years were included. Statistical analysis revealed a significant relationship between the total HAT score and audiometric results. In the study, a score of 20 points had a sensitivity of 88% and a specificity of 74%. This may therefore be a valuable screening tool which is accessible, simple and cost effective in non-specialist situations, thus, making an early detection and prompt rehabilitation of impaired hearing possible. However, a refinement of the scale and further validity and reliability testing is required.

INTRODUCTION

Hearing loss is one of the most common of all physical impairments, but physicians seldom screen adults for it and patients often overlook or deny hearing problems. This being the case, a conscious effort should be made to improve people's health thereby decreasing the number of morbidity of disabled persons.

Clinical approaches to people's illnesses have severe limitations especially in the context of poverty. The initial step to reduce health risks is proper education and basic health care delivery.

While the United Nations estimates that there are 450 million disabled persons living today, the World Health Organization (WHO), recognizes that 10% of the worlds population are hearing impaired with hearing loss striking about 70 million people. In the Philippines alone, Sergia G. Esguerra Foundation Inc. (SEFI) quotes a statistical approximation of 600,000 deaf Filipinos as of the year 1991.

With the WHO aim of "Health for All by the year 2000" in mind, drastic and concerted efforts should be undertaken to decrease the prevalence and incidence of impaired hearing. It must be noted that though hearing impairment is a fast growing problem, it presents a new challenge in the area of health services, research and provisioning. Needless to say, efforts today should entail modifying "Primary Health Care" to include "Primary Ear Care" by adopting new approaches to meet hearing care promotion through hearing screening programs.

It is important in studies such as this that in order to establish a detection programme for a particular disease, it is necessary to develop a tracking system (a process which is applicable to a great number of persons with tests that are easy, fast, cheap and capable of identifying, with great probability and diagnose accurately the pathology concerned). The phenomenon to be studied should be as frequent as possible that one can identify it in relative frequencies that the diagnosis should yield as result for prevention and treatment. The cost, however, should be reasonable enough in relation to the benefits obtained by the persons detected. The test should be comparable somehow in their result with the regular diagnostic modalities and should be precise and specific.

The primary purpose of any hearing screening program is the identification of hearing loss. Pure tone threshold audiometry has become the standard behavioral procedure for describing auditory sensitivity. In the Philippine setting, however, the audiometer is a scarce resource in the rural otoaudiologic scene. More so, the limited number of ENT specialists and audiometric centers are concentrated only in Metro Manila and other urban centers.

The Hearing Assessment Test (HAT) is a set of questions related to hearing impairment of an individual. It is the result of creative and imaginative thinking which are an initiative to turn challenges into actions which is accessible, scienti-fically sound, socioculturally acceptable and cost effective for everyone. Two hearing loss questionnaires were validated by Smith in 1992 but neither of the questionnaires where clinically sensitive to be recommended for use. Other studies utilized a set of specific questions to detect hearing loss among nursing home residents. Until now, no similar study has yet been done in the Philippines.

* GLAXO TRAINING AWARD, PRESENTED AT THE MANILA HOTEL, DEC. 1, 1994
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The study was designed to construct a hearing test questionnaire that would approximate the hearing function of an individual using a scoring system. The vast majority of hearing impaired people live in rural areas where poverty, malnutrition, poor hygiene and infection proliferate. It is in the light of this concept that this study was conceived.

OBJECTIVES

1. To construct a Hearing Test Questionnaire (in the vernacular Filipino) that identifies hearing function of a patient.
2. To determine if there is a correlation between Hearing Assessment Test scores, Pure Tone Audiometry results, otoscopic findings and otologic history.
3. To determine the sensitivity, positive and negative predictive values, accuracy and prevalence of the HAT.
4. To determine a HAT cut-off score among Filipinos that will correctly segregate patients to be referred to an ENT specialist.

METHODOLOGY

A. POPULATION

A total of 750 volunteers were seen in two urban communities in Metro Manila and six communities in Marinduque, an island at the southern tip of the Luzon island. All volunteers were fluent in Tagalog (Filipino) with ages ranging from 15 to 90 years, with or without otologic symptoms (i.e. otalgia, otorrhea, hearing loss, tinnitus or vertigo), and with or without significant otoscopic findings. The purpose and the procedure of the study were explained. Participation was completely voluntary and an informed consent was obtained at the time of interview and were assured that all chosen answers were neither right or wrong.

The study sites were chosen on the basis of the diverse communities they represent: farming/agriculture, fishing, airport vicinity, urban, rural, urbanized rural, factory/ industrial sites and mountain/ forestry areas.

B. GENERAL DATA/OTOSCOPY

The general data sheet consisting of age, sex, previous and present occupation; a checklist of otologic history and symptoms were also taken by the author. The subjects were then asked to fill up the HAT questionnaire. Otoscopic examinations were performed on all volunteers using the Welch Allyn model no. 20000-Halogen 3.5 v otoscope. (Appendix A)

A significant otologic history includes the presence of any or a combination of the following symptoms: otalgia, otorrhea, hearing loss, tinnitus and vertigo. The presence of otorrhea and/or perforated tympanic membrane were likewise considered as abnormal otoscopic findings.

C. LOCATION

The study was conducted in sound untreated though relatively quiet rooms. Each room measured approximately 4 x 3 meter square and ambient noise levels were defined using the handheld Quest model 215 sound level meter. The location was found to be appropriate for audiometric testing since the measured noise levels did not exceed the maximum allowable frequency specific limits for ambient noise proposed by the American Speech and Hearing Association (ASHA). (Appendix D)

D. HEARING ASSESSMENT TEST

The HAT questionnaire is a set of 15 questions written in Filipino (Tagalog). The questions were related to common daily activities of an individual. Fourteen questions were to be answered by the volunteer and one question to be answered by a companion in the house. This has been patterned after the American Academy of Otolaryngology-Head and Neck Surgery: The Five Minute Hearing Test. However, there were revisions made in the questions.

There were four possible answers with corresponding scores: "palagi" (always) = 3 points, "madalas"(half the time)= 2 points; "minsan"(occasionally)= 1 point; and "hindi"(never) = zero. The highest obtainable score is 45 and the lowest is zero. (Appendix B)

E. PURE TONE AUDIOMETRY

Air conduction audiometry with pure tone threshold at 0.5, 1, 2 and 4 Khz were taken on both ears using the Screening Audiometer Model AS7. The audiometer was calibrated by a qualified electronics technician at the Manila Hearing Aid Office along Quezon Blvd., Quezon City.

The audiometric studies were done by the examiners without the knowledge of the HAT results. The subjects were instructed to raise the hand or finger on the side of the ear tested and to continue to respond as long as he detects the test signal. Pure tone audiometry results were plotted on the audiogram based on the hearing threshold level which is based as the lowest signal intensity (in dB) heard on three consecutive presentations.

All data were then collated for statistical analysis using Pearson correlates (Correlation matrix), chi square and tests of validity.

RESULTS

A total of 750 volunteers from the previously mentioned diverse communities were included in the study. Three hundred forty nine (47%)were males and 401 (53%)were females. Their ages were ranging from 15 to 90 years with a mean age of 40 years (Table I).

Most of the respondents claimed that they were able to answer the questionnaire easily and it took them around 3 to 4 minutes to get done. Forty two percent

(318) had normal audiometric results while the remaining 58%(432)had abnormal results which were commonly noted in the middle age group.

Of the previously mentioned 432 volunteers, 210 had mild hearing impairment wth profound hearing impairment(Table III). All patients underwent otoscopic examination 18% (134) of the total population had abnormal P.E. findings consisting of impacted cerumen, acute and acute and chronic otitis media (OME), otorrhea and tympanic membrane perforation). (Table IV) Forty two percent(318)Presented with normal otoscopic examination. One hundred fourteen(15%)had abnormal results both on otoscopic examinations and audiometry which may point to the volunteers having conductive type of hearing loss. (Table V) All patients were managed medically or referred to an Ear Center for surgery if necessary.

Correlation coefficient (Pearson r) showed that there was a high correlation between the mean audiometric results (AD and AS) as against the HAT scores. However, there was moderate correlation between audiometric findings and age with a value of r=0.47725. This may be taken into consideration since the person ages, abnormal audiometric findings may be found although correlation coefficient is not a measure of causality, but still causal relationships may exist. (Table VII). Of the different cut-off scores: 5, 10, 15, 20 and 25 points, the recommended score in this study is 20 since it has a sensitivity of 88.13% and a specificity of 73.77% which utilizes that the HAT is able to label positive those with hearing impairment, as such, the extent of having negative results can be avoided. (Table VIII)

Results of the validity tests revealed that there was a reasonable agreement between the HAT and audiometric test with a Kappa value of 0.69. Furthermore, based on the calculated positive predictive values with a HAT cut-off score of 20, a patient is labeled as having impairment by this screening test. Seventy six percent of the time then that this truly indicative of the presence of the disability while the negative predictive value is 86.53%.

DISCUSSION

The purpose of this study is to determine the correlation between the Hearing Assessment Test score to audiometric results obtained and to examine the test characteristics (i.e. sensitivity, specificity)using pure tone audiometry as criterion. More than 50% of the subjects were estimated to have some degree of hearing loss, yet many are still unsure about the need for amplification. In order to help the primary care physicians identify people with hearing impairment, this study aims to help them assess whether or not the patient will be referred to an ENT specialist.

Causes of hearing loss in adults include hereditary hearing loss with onset in adulthood. Several conditions fit these descriptions, the mode of transmission being x-linked, automosal dominant, or recessive. Otitis Externa, acute ototis media and chronic otitis media are important causes of hearing loss in adults as well as viral, bacterial, fungal helminth infections. Other causes are trauma, endocrine and metabolic disorders, specific organ hearing loss, neoplastic and other space occupying lesions, systemic immunemediated diseases, neurologic disorders, and other conditions associated with vasculopathy and vasculitis.

In this study, 15% of volunteers with high HAT scores presented with impacted cerumen and middle ear disease which were diagnosed as abnormal by otoscopic examination and having abnormal audiometric results.

Presbycusis is very common among patients >60 years old with no underlying cause. It is a symmetrical, progressive, and high frequency hearing defect. Findings in elderly volunteers and those belonging to the middle age group were comparable with presbycusis since 42% of them had normal otoscopic findings and abnormal audiometric results compatible with a sensorineural type of hearing loss. Noise exposure detected as a high frequency hearing loss may be an important cause of hearing impairment. This was observed from the volunteers in the industrial (mining mills) and living in the airport vicinity.

Nevertheless, some patients in whom the cause for hearing impairment cannot be elucidated by history and physical examination need sophisticated audiologic work up.

Over the years, many different clinical tests have been tried but have been less frequently used with the advent of pure tone audiometry in the 1940's. However, in screening for a disorder, simplicity is essential, free-field testing may be sufficiently accurate to identify those with impairment. This requires continual study and devotion of significant amount of clinical time to learn the techniques. However, for the sake of accurate diagnosis, the effort is well spent. Pure tone audiogram measures the loss of sensitivity and extent of hearing impairment. Threshold of hearing is variously defined but is often taken to be the lowest sound pressure or alternating force level at which under specified conditions a person given a predetermined percentage of a correct detection response on repeated trials. The stimuli used are calibrated on the hearing level scale which has been obtained from normalization studies involving large numbers of subjects. The standards are also specific to particular audiometric frequencies.

Hearing impairment or disability constitutes an important social, psychological health problem. There should be an acceptable and available procedure for those who are found to have impairment disability. Facilities for diagnosis and treatment should be available. The natural history of impairment should be adequately understood. As noted in the study, there was a moderate correlation between the audiometric test results and age because as the person ages abnormal findings may be found in the audiometric studies. The methods used for screening should be suitable and acceptable to a particular

APPENDIX A.

Area code:
Patient no.:
Date:
Name:
Address:
Age: Sex: M/F
Occupation:

I. HISTORY:

	YES	AD/AS	NO
Otalgia	( )	_____	( )
Otorrhea	( )	_____	( )
Hearing loss	( )	_____	( )
Tinnitus	( )	_____	( )
Vertigo	( )	_____	( )

Past Medical/Surgical History:

II. P.E.

A. Pinna, Auricle and External Auditory Canal
B. Otoscopy

Otorrhea	Present	AD/AS	Absent
Tympanic membrane	Intact	AD/AS	Perforation
Others:			

III. Audiometry

		AD (use o)				AS (use x)			
		.5	1	2	4	.5	1	2	4
(KHz)									
	0								
	10								
	20								
	30								
	40								
	50								
	60								
	70								
	80								
	90								
(dB)	100								

APPENDIX B. **HEARING ASSESSMENT TEST QUESTIONNAIRE:**	**PALAGI** **ALMOST ALWAYS**	**MADALAS** **HALF THE TIME**	**MINSAN** **OCCASIO-NALLY**	**HINDI** **NEVER**
1. Mayroon akong suliranin sa pakikinig sa telepono/radyo. *(I have a problem hearing the radio or over the telephone.)*				
2. Nagkakaroon ako ng problema sa pakikinig kung 2 o higit pa sa 2 tao ang nag-uusap ng sabay. *(I have trouble following the conversation when 2 or more people are talking at the same time.)*				
3. Nagrereklamo ang mga tao dahil ang TV ay nilalakasan ko ng todo. *(People complain that I turn the TV volume too high.)*				
4. Kailangan kong pakinggang mabuti ang usapan upang aking maunawaan. *(I have to strain to understand conversations.)*				
5. Nakakaligtaan ko ring pakinggan kung minsan ang karaniwang tunog gaya ng tunog ng telepono, katok sa pinto o doorbell. *(I miss hearing some common sounds like the telephone, knock on the door or doorbell ringing.)*				
6. Nagiging suliranin ko rin ang pakikinig sa mga usapan kung ang kapaligiran ay maingay lalo na sa mga pagtitipon. *(I have trouble hearing conversations in a noisy background such as a party.)*				
7. Nalilito ako kung saan nanggagaling ang mga tunog. *(I get confused about where sounds come from.)*				
8. Hindi ko naiintindihan ang ilang mga salita sa pangungusap kaya't kinakailangan ko itong ipaulit. *(I misunderstand some words in a sentence and need to ask people to repeat themselves.)*				
9. Lalong suliranin kong unawain ang mga salita ng mga kababaihan at bata. *(I especially have trouble understanding the speech of women and children.)*				
10. Nagtratrabaho ako sa isang maingay na kapaligiran (asemblea o samahan, mga pukpukan, ingay ng makina atbp.) *(I have worked in noisy environments.)*				
11. Karamihan sa mga taong aking nakausap ay parang nauutal o kaya'y hindi nagsasalita ng maliwanag. *(Many people I talk to seem to mumble or don't speak clearly.)*				
12. Naiinis ang mga tao dahil hindi ko maintindihan ang kanilang sinasabi. *(People get annoyed because I misunderstand what they say.)*				
13. Hindi ko maunawaan ang sinasabi ng iba kaya't hindi akma ang aking mga katugunan. *(I misunderstand what others are saying and make inappropriate responses.)*				
14. Iniiwasan ko ang mga pagtitipon o pulong-pulong dahil hindi ako lubusang makarinig at natatakot akong makasagot ng di tama. *(I avoid social meetings/activities because I cannot hear well and fear I'll reply improperly.)*				
15. (Dapat ay sagutin ng isang kasambahay o kaibigan.) Naniniwala ka ba na ang taong ito ay nawawalan ng pandinig? (To be answered by a family member or a friend.) Do you think this person has a hearing loss?				
Kabuuang Puntos: (Total Score)				

APPENDIX C

CLASSIFICATION OF HEARING HANDICAP BASED ON THE W H O CRITERIA WITH CORRECTION FACTOR OF +5 dB FOR SOUND UNTREATED ROOMS

CLASSIFICATION CATEGORY	HEARING THRESHOLD (dB)
normal	0-30
mild impairment	31-44
moderate impairment	45-64
severe impairment	65-84
profound impairment	85 and above

Quoted from Sir John Wilson (United Kingdom) at the 1st Asia Pacific Congress on Deafness, Hong Kong, 1986.

APPENDIX D

MAXIMUM ALLOWABLE LIMITS FOR AMBIENT NOISE IN AUDIOMETRIC TESTING AS PROPOSED BY ASHA*

FREQUENCY(HZ)	MAXIMUM LIMIT FOR AMBIENT NOISE
500	46 dB
1,000	50 dB
2,000	58 dB
4,000	76 dB

*American Speech and Hearing Association

Table I. SEX DISTRIBUTION

	n	%
MALE	439	(47)
FEMALE	401	(53)

TABLE II. AGE DISTRIBUTION

AGE GROUPS (YEARS)	N	(%)
15-30	244	(33)
31-46	251	(34)
47-62	161	(22)
63-77	74	(10)
78-90	20	(1)

Mean age in years: 40

TABLE III AUDIOMETRIC TEST RESULTS

	n	(%)
NORMAL	318	(42)
ABNORMAL	432	(58)

TABLE IV. OTOSCOPIC EXAMINATION

	n	(%)
NORMAL	616	(82)
ABNORMAL	134	(18)

TABLE V. OTOSCOPY VS AUDIO

	OTOSCOPY		
AUDIO	NORMAL	ABNORMAL	TOTAL
NORMAL	298	20	318
ABNORMAL	318	114	432
TOTAL	616	134	750

TABLE VI. AUDIO VS HAT

AUDIO
HAT SCORE
(AT DIFFERENT CUT-OFF SCORES)

	NORMAL	ABNORMAL	TOTAL
<5	221	50	271
>5	97	382	479
TOTAL	318	432	750
<10	288	135	423
>10	30	297	327
TOTAL	318	432	750
<15	306	232	538
>15	12	200	212
TOTAL	318	432	750
<20	311	299	610
>20	7	133	140
TOTAL	318	437	750
<25	317	347	664
>25	1	85	86
TOTAL	318	432	750

TABLE VII
CORRELATION MATRIX n=750

	AGE	SEX	AD(AUD)	AS(AUD)	HAT	P.E.
AGE	1					
SEX	-0.02	1				
AD(AUD)	0.45	-0.02	1			
AS(AUD)	0.43	0	0.85	1		
HAT	0.48	-0.11	0.76	0.74	1	
P.E.	-0.05	-0.01	0.21	0.22	0.2	1

CRITICAL VALUE (1-TAIL; .05)=+/- .06012
CRITICAL VALUE (2-TAIL; .05)=+/- .07160

AD (AUDIO) VS HAT
Pearson r + 0.750 (high correlation)

AS (AUDIO) VS HAT
Pearson r = 0.74 (high correlation)

TABLE VIII
COMPARISON OF TESTS OF VALIDITY
BETWEEN DIFFERENT CUT OFF SCORES

HAT SCORE	SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
5	40.67	98.36	96	63.15	70
10	64.6	93.44	90.47	50.83	79.16
15	79.66	80.32	79.66	80.32	80
20	88.13	73.77	76.47	86.53	80.83
25	98.3	62.29	71.63	97.43	80

NPV Negative Predictive value
PPV Positive Predictive value

approach. As D' Sonza indicated, one of the options which would supply the lowest number of false positives to the audiological services would be a two-tier screen. This part of the problem is not time consuming or expensive. It does not require excessive training or equipment.

Hearing impairment's care determinants are the same as those which primary health care programs aim to prevent e.g. inadequate maternal health care; lack of immunizations; prevalence of communicable and infectious diseases; poor personal and family hygiene practices; malnutrition, contaminated water supplies and improper sanitation. Yet health workers link these problems to numerous diseases and handicaps, how these factors can cause hearing loss, deafness even death remains pitifully silent. Even education materials on essential ear and hearing care is often neglected as a crucial part of an individual and a family's preventive health care behaviour. Hence, primary ear and hearing care needs to become an outspoken part of existing health communication strategies.

It would appear from this study that the proposed HAT may serve as an adjunct to the more sophisticated audiometer. The calculated sensitivity and specificity values showed its reliability. This may be a valuable tool in non-specialist situations thus making early detection and prompt rehabilitation of impaired hearing possible. Thus, as a realistic and primary ear care strategy, this simple test becomes attractive for several reasons: it is easy to use and answer since it utilizes questions related to normal daily living activities and is accessible, simple and inexpensive.

However, this simple screening method did have its fault. It is good to remember that false negatives could occur, so any subject who reports an impairment should be considered to have one until more formal audiometry could be carried out. Equally important are those with ear pathology which warrant referral for more intensive work-up.

The main constraints of this test would be the following: variations in regional dialects among Flipinos, patients literacy, questionable hearing threshold levels measured with ambient noise and the need for regular calibration of test materials.

CONCLUSION

1. Eighteen percent of the total 750 volunteers had abnormal otoscopic findings. These cases include those with impacted cerumen, acute otitis media and chronic otitis media.
2. Audiometric tests revealed that 432 (58%)of the volunteers had abnormal hearing threshold.
3. HAT scores correlated well with audiometric results having a high correlation coefficient of r=0.750 while otoscopic examination as against audiometric results has a poor correlation.
4. The accpetable levels of sensitivity, specificity, positive and negative predictive values obtained, showed that the proposed HAT score of 20 was reliable enough in labeling hearing threshold as normal and abnormal.

The Hearing Assessment Test does not attempt to replace audiometric procedures as a mode of hearing level determination. Further, it is recommended as a tool in the rapid initial assessment and serves as a screening test in the absence of an audiometer. What is essential is that a community-based program must satisfy the primary goal. In ideal situations, therefore, the audiometer will still be the gold standard.

RECOMMENDATIONS

1. The HAT must be conducted on a larger population.
2. To apply suitable community-based programs for early detection and management of the hearing impaired indivuduals using the HAT.
3. To determine its applicability and acceptability among the primary health care physicians and volunteer health workers.
4. To further test the validity of the questionnaire in homogenous and heterogenous group of individuals.
5. An educational campaign regarding awareness, complications and prevention of hearing impairment be facilitated for early diagnosis and treatment.
6. Further field testing of the HAT against the basic tuning fork test and speech reception threshold test results should be conducted.

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