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EFFICACY OF PROPARACAINE VERSUS LIDOCAINE – PRILOCAINE MIXTURE AS LOCAL ANESTHETIC FOR MYRINGOTOMY :*A PROSPECTIVE STUDY**

FRANCIS CAESAR B. ADRE, MD**

ABSTRACT

OBJECTIVES:

1. To determine the efficacy of Proparacaine (Alcaine) vs. Lidocaine – Prilocaine mixture (EMLA) as an anesthetic agent for myringotomy.
2. To determine the advantages and disadvantages of Alcaine versus EMLA as anesthetic agent for myringotomy.
3. To determine if there is a statistically significant difference between the alleviation of pain using Alcaine compared to EMLA for myringotomy

STUDY DESIGN: Prospective alternate randomized single blind study
SETTING: Tertiary hospital
PATIENTS: 28 patients diagnosed with bilateral Serous Otitis Media from March 2001 to August 2003
Conclusion: The efficacy of Alcaine anesthetic drops versus EMLA cream in the alleviation of pain during myringotomy was established by determining the severity using the Visual Analogue Scale. Statistical analysis was made using the Mann-Whitney or Wilcoxon Two-Sample Test. Patients exhibited a statistically non-significant pain alleviation in those subjected to Alcaine compared to EMLA.

INTRODUCTION

Abnormal function of the Eustachian tube (E.T.) appears to be the most important factor in the pathogenesis of middle ear diseases. Other contributory factors are infection of the respiratory mucosa, allergy, ciliary dysfunction and dysfunction of the tensor veli palatini muscle leading to middle ear diseases.

The incidence of Otitis Media in children and adults are noted to be increasing as a result of actual increase occurrence of the disease and vigilance in its diagnosis. Otitis media initially results in edema, capillary engorgement and polymorphonuclear leukocyte infiltration into the lamina propia of mucosa of the pneumatized spaces of the middle ear, with purulent exudates filling the spaces. Inadequately treated cases of acute otitis media (AOM) as well asymptomatic cases of Serous Otitis Media result into mild to moderate hearing loss which may affect speech development in children and may lead to other complications.

Serous OM unresponsive to recommended medical treatment warrants surgical intervention such as myringotomy with or without ventilation tube insertion.

Tube insertion has been shown to improve conductive hearing loss secondary to otitis media, helps in lowering irreversible damage to middle ear hearing mechanism as well as decreasing the money and time spent for the resolution of the infection. The rationale in performing this procedure is to facilitate evacuation of fluid and prevent further middle ear complication.

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OBJECTIVES

1. To determine the efficacy of Proparacaine (Alcaine) vs. Lidocaine – Prilocaine mixture (EMLA) as an anesthetic agent for myringotomy.
2. To determine the advantages and disadvantages of Alcaine versus EMLA as anesthetic agent for myringotomy.
3. To determine if there is a statistically significant difference between the alleviation of pain using Alcaine compared to EMLA for myringotomy.

PATIENTS AND METHODS

This is a prospective alternate randomized single blind study. Included in the study were 28 patients seen at the Out patient department of a tertiary hospital from March 2001 to August 2003. These included 20 males and 8 females, age ranged from 15 – 62 years old. All patients were diagnosed to have or bilateral serous otitis media using the following parameters:

a. Air – fluid level and or presence of bubbles with an intact tympanic membrane on Otoscopy (Figure 1)
b. Non compliant tympanic membrane on Pneumatoscopy
c. Type B Tympanogram
d. Mild to moderate conductive hearing loss on Pure Tone Audiometry.

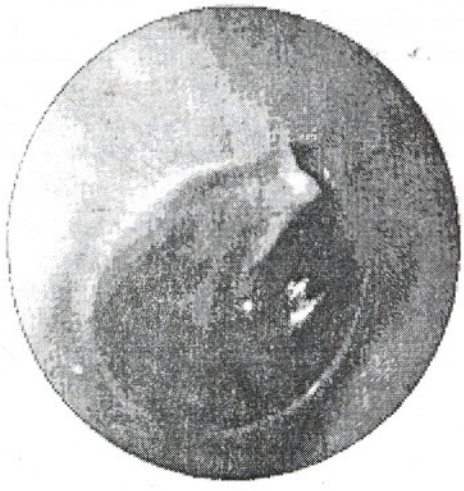


Figure 1: Tympanic membrane retracted with presence of thin, serous effusion

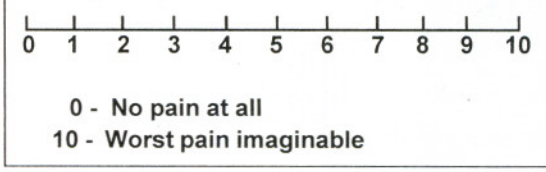
All subjects in the study were unresponsive to four – week course of recommended medical management which included four-week course of first line oral antibiotics, 5 days on oral decongestants and 2- week course of oral antihistamine if with allergic component.

Exclusion criteria included patients with 1. known hypersensitivity to xylocaine derivatives, 2) previous history of tympanic membrane perforation, 3) pregnant or lactating women, 4) patients with other systemic conditions and cannot tolerate the procedure under local set-up (i.e. hypertensive patients, history of cardiac disease), 5) uncooperative patients, and lastly, 6) those diagnosed with nasopharyngeal tumors that require ventilation tube insertion. There were 28 patients diagnosed with bilateral serous OM. Alcaine was used on one ear and EMLA on the other with the pain graded separately on which the procedure was done on one ear initially and the other after 24 hours. Anesthetic efficacy was measured using Visual Analog scale (VAS) for pain. VAS consists of 10 cm line anchored at one end by a label 0 such as no pain and at the other end by label 10 such as the worst pain imaginable. Scoring was accomplished by having the patient mark the line to indicate the pain intensity on a scale from 0-10 (Figure 2). The results were analyzed using Mann- Whitney or Wilcoxon Two-Sample test.

For the EMLA group, the procedure entailed application of the said anesthetic approximately ½ inch thick coating the entire TM and part of the external auditory canal. After 60 minutes, EMLA was suctioned out, and myringotomy was done on the anteroinferior portion of the TM for aeration and drainage purposes (Figure 3). To determine the efficacy of the anesthetic agent, the subjects were then shown the Visual analog scale for pain for recording of graded response according to severity.

For patients under Alcaine group, 5-10 drops of the anesthetic were instilled enough to flood the external auditory canal with their head flexed laterally and waited for 5 minutes for the drug to take effect (Figure 4). Myringotomy were performed on the same site as in EMLA group and same procedure followed to evaluate the graded response.

Figure 2: Visual Analogue Scale used as indicator of Pain State



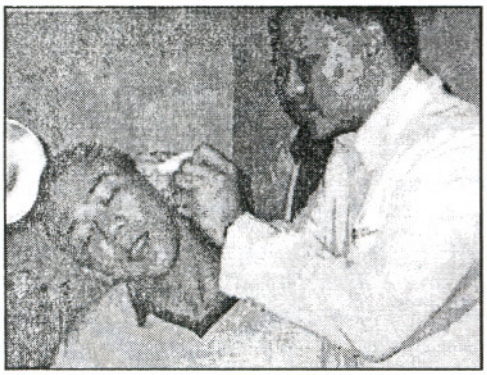


Figure 3: Myringotomy performed

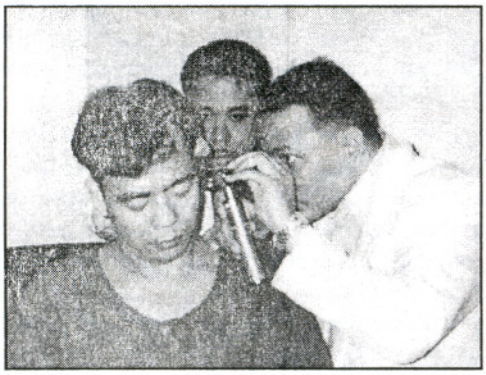
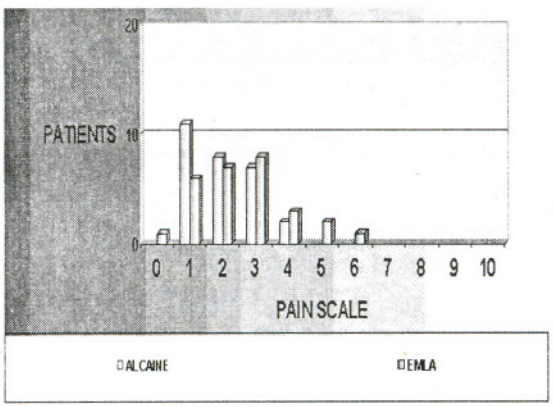


Figure 4: Instillation of Alcainé local anesthetic drops

RESULTS

Twenty eight patients were included in the study and among them 20 (71.42%) were males and 8 (28.57%) were females. The majority of patients (23= 89.2%) who were subjected to the test belong to 21-60 age group for both males and females. Patients were mostly military personnel and their dependents. Each patient with bilateral serous OM were given Alcaine drops on one ear and EMLA on the other side.

Figure 5: Responses of Patients according to pain severity using the Visual Analogue Scale.



The graded response based on the severity of pain using Visual analogue Scales were compared using the Mann-Whitney or Wilcoxon Two-Sample test. Data showed that patients who were subjected to Alcaine had no significant decrease in pain response as compared to the EMLA group (Figure 5) . Of the patients instilled with Alcaine, 11 responded with pain scale of 1, eight with scale of 2, seven, with scale of 3, and, two with scale of 4. (Table 3)

Of the patients instilled with EMLA, one responded with scale of 0, six with scale of 1, seven with scale of 2, eight with a scale of 3, three with a scale of 4, two with a scale of 5 and one with a scale of 6. (Table 3).

The response of patients subjected to Alcaine anesthetic was found to not significantly lower pain grading as compared to EMLA group with a mean difference of 0.571 and p value 0f 0.122. (Table 4)

Table 1: Distribution of patients seen according to sex and laterality of ear pathology

CASES	Male	Female	Total
Bilateral Serous OM	20	8	28

Table 2: Number of patients given Alcaine and EMLA anesthetics

Observations	Alcaine Group	EMLA Group	
Bilateral - 28 patients (56 ears)	28 patients	28 patients	
Total	**28**	**28**	**56**

Table 3: Responses of patients according to pain severity using the Visual Analogue Scale. (Figure 1)

PAIN SCALE	ALCAINE GROUP (Group 1)	EMLA GROUP (Group 2)	TOTAL NO. OF RESPONSES
0	0	1	1
1	11	6	17
2	8	7	15
3	7	8	15
4	2	3	5
5	0	2	2
6	0	1	1
Total Observations	**28**	**28**	**56**

Table 4: Comparison of the mean and standard deviation of pain in Alcaine and EMLA groups

Group	Observations	Total	Mean	Variance	Standard Deviation
1(Alcaine)	28	56	2.000	0.963	0.981
2(EMLA)	28	72	2.571	2.032	1.425
		Difference	**-0.571**	**P value**	**0.122**

DISCUSSION

Serous Otitis media is a non-bacterial accumulation of clear, sometimes cloudy, straw-colored serous or mucoid fluid in the tympanic cavity as a result of ET occlusion often with allergic basis. Myringotomy may be indicated both for diagnostic and treatment purposes. Diagnostic myringotomy for possible serous otitis media should be considered whenever there is conductive hearing loss and thickened tympanic membrane preventing otoscopic visualization of a fluid level or when otoscopy reveals a straw-colored fluid with chalky white manubrium. Tympanometry aids in the diagnosis of fluid in the tympanum.

In the present study, Proparacaine Hydrochloride (Alcaine) was used. It is known to be used in ophthalmic cases such as corneal anesthesia for 1) tonometry, 2) gonioscopy, 3)removal of foreign bodies and 4) conjunctival procedures. It is a rapidly acting topical local anesthetic wherein the onset of anesthesia begins within 30 seconds and induced anesthesia lasts for approximately 10-20 minutes. No available clinical studies both locally and abroad can be gathered with the use of Alcaine in minor otologic surgeries. Based on clinical studies available, in ophthalmic surgeries, it occasionally causes stinging, burning, and conjunctival redness. There are no cases of stinging or burning sensations in the ears noted during the application of Alcaine. Though it requires further investigation to support the findings in our study. Alcaine also causes allergic contact dermatitis resulting in fissuring of the fingertips.

A study was conducted by Bartfield JM et al comparing the pain on instillation and duration of activity of Alcaine with another eye anesthetic (8) It showed that Alcaine hurt less upon application and lasted longer for an average of 10.7 minutes, validating that its properties make it preferable to other ophthalmic preparations.

However, an Alcaine product monograph published in 2003 warned that prolonged use for topical ocular anesthesia may produce permanent opacification with accompanying loss of vision which may possibly delay wound healing. Oguz E et al investigated the antibacterial effect of proparacaine on conjunctival flora (7). Results revealed that proparacaine significantly reduced the number of culture positive eyes for coagulase-negative Staphylococci demonstrating that it also has antibacterial effects.

The main site of anesthetic action is the nerve cell membrane where proparacaine interferes with the large transient increase in the membrane permeability to sodium ions that are normally produced by a slight depolarization of the membrane. As the anesthetic action progressively develops in a nerve, the threshold for electrical stimulation gradually increases and safety factor for conduction decreases. The limitation of sodium ion permeability through the lipid bilayer results into a change necessary for generation of action potential.

EMLA cream is an emulsion in which the oil phase is an eutectic mixture of lidocaine (2.5%) and prilocaine (2.5%) in a ratio of 1:1 by weight. It can be applied to intact skin under occlusive dressing, thereby providing dermal analgesia by the release of the cream into the epidermal and dermal layers of the skin and accumulating in the dermal pain receptors and nerve endings. It stabilizes neuronal membranes by inhibiting the ionic fluxes required for the initiation and conduction of impulses, thereby affecting local anesthetic action. The onset, depth and duration of dermal analgesia provided depends primarily in the duration of application. Satisfactory dermal analgesia is achieved 1 hour after application, reaches a maximum at 2-3 hours and persists for 1-2 hours. However it causes transient, local blanching followed by transient local redness and erythema.

Koutnouyan HA et al investigated the efficacy of EMLA in minor otologic procedures (5). They reported that the use of EMLA cream is safe, well tolerated and preferred for performing minor otologic surgeries. In another study conducted by Bingham B et al , they mentioned that the use of EMLA for myringotomy and ventilation tube insertion were well tolerated, safe and effective (3) . In the same study, patients with experience of previous tympanic membrane anesthetic techniques preferred EMLA cream over other local anesthetics. It also reported that no patient complained of postoperative vertigo and tinnitus and audiometric studies, revealed that there was no evidence of ototoxicity. In our study, one patient who was subjected to myringotomy using Alcaine complained of vertigo described as swirling sensation immediately after the procedure. It was associated with nausea and vomiting. However, the swirling sensation spontaneously resolved after 30 minutes.

According to Timm MS et al, EMLA was shown to be very effective, safe and convenient for use in outpatient otological procedures in cases such as electrocochleography, myringotomy and grommet insertion(6).

CONCLUSION

The efficacy of Alcaine anesthetic drops versus EMLA cream in the alleviation of pain during

myringotomy was established by determining the severity using the Visual Analogue Scale. Statistical analysis was made using the Mann-Whitney or Wilcoxon Two-Sample Test. Patients exhibited no statistically significant difference in pain alleviation in those subjected to Alcaine compared to EMLA.

The patients under Alcaine group required shorter time to anesthetize the ears providing adequate analgesia after 5 minutes, easier to instill to fill the entire EAC, easier to remove prior to myringotomy and is commonly available. The disadvantages of Alcaine are the following, 1) short acting lasting for 10-15 minutes before it wears off, 2) needs a more precise movement in doing the procedure as the external auditory canals were sometimes not well anesthetized and 3) being a liquid, there is tendency that it will reach the nasopharynx and tasted by the patient.

In patients under EMLA group, it required longer time to anesthetized the patient however the effect was longer lasting for 1-2 hours and covered the skin of the EAC. It was tedious to apply and sometimes TM were not equally anesthetized.

RECOMMENDATIONS

This study was done to investigate the efficacy of Alcaine as local anesthetic for myringotomy comparing it with EMLA. A limitation of the study is that no available literature review on the use of Alcaine for minor otologic procedures exists. Therefore, we recommend the following:

1) Similar study conducted on a larger population to evaluate the reproducibility of the results.
2) To study the possible adverse reaction of Alcaine on the tympanic membrane, middle ear and inner ear structures.
3) Further investigate the optimum time for Alcaine to reach its maximum effect
4) Investigate its possible use in myringotomy with ventilation tube insertion

BIBLIOGRAPHY

1. Cumming CW, Fredrickson JM, Harker LA, Krause CJ, Schuler DE. Otolaryngology- Head & Neck Surgery; 3rd Edition 1998
2. Glasscock M, Sahmbaugh G, Surgery of the Ear, 4th Edition, 1990
3. Bingham B, Hawke M, Halik J, Safety and Efficacy of EMLA cream topical anesthesia for myringotomy and Ventilation tube insertion. J Otolaryngology. 20 (3):193-5, 1991, Jun
4. Sirimanna KS, Madden GJ, Miles S. Anesthesia of Tympanic membrane: comparison of EMLA cream and iontophoresis. J Laryngology 104 (3): 195-6. 1990 Mar.
5. Koutnoouyan HA, Rasgon BM, Cruz RM, Efficacy of EMLA as a topical anesthetic in minor otologic procedures. Otolaryngol Head Neck surg. 121 (1):38—42, 1999 Jul.
6. Timms MS, Malley S, Keith AO. Experience with a new topical anesthetic in otology. Clin Otolaryngol 13 (6): 485-90, 1988 Dec
7. Oguz H, Oguz E, Karadede S, Aslan G. The antibacterial effect of topical anesthetic proparacaine on conjunctival flora. Int Ophthamol 23 (2): 117-20, 1999
8. Bartfield JM, Holmes TJ, Raccio-Robak N. A comparison of proparacaine and tetracaine eye anesthetics. Acad Emerg Med. 1 (4):364-7, 1994 Jul-Aug.

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THE EFFECT OF OXYMETAZOLINE HCL VERSUS 0.9 NaCl ISOTONIC SOLUTION ON NASAL MUCOCILIARY CLEARANCE IN ADULT FILIPINOS WITH RHINOSINUSITIS*

NOEL O. DE GUZMAN JR., MD**
EDUARDO C. YAP, MD, FPSO-HNS***
ELMO R. LAGO, MD, FPSO-HNS***

ABSTRACT

GENERAL OBJECTIVE:

To compare the effect of Oxymetazoline HCl versus 0.9 NaCl solution on nasal mucociliary clearance in adult Filipinos with rhinosinusitis

SPECIFIC OBJECTIVES:

1) to determine the effect of Oxymetazoline HCl on nasal mucociliary clearance
2) to compare the effect of Oxymetazoline HCl on nasal mucociliary clearance on patients with rhinosinusitis
3) to determine the effect of 0.9 NaCl on nasal mucociliary clearance
4) to compare the effect of 0.9 NaCl on nasal mucociliary clearance on patients with rhinosinusitis
5) to compare the effect of Oxymetazoline HCl versus 0.9 NaCl solution on nasal mucociliary clearance

DESIGN: Randomized, Single Blind, Clinical Trial

SETTING: ORL-HNS outpatient department. Government Tertiary hospital

PATIENTS: 60 adult Filipinos, both male and female, all residents of Makati, were randomly chosen to participate in the study. Chosen patients complained of nasal congestion or obstruction and diagnosed with either acute rhinitis, allergic rhinitis, acute sinusitis or chronic sinusitis. These patients were randomly allocated by alternately assigning them as they consult into either the Oxymetazoline treatment group (Group **A**) or the 0.9 NaCl isotonic solution group (Group **B**).

RESULTS: In the comparison of the mucociliary transport time in minutes in both the congested and decongested state (Group A) in table I, it was shown that the mucociliary clearance was significantly slower in the congested state than in the decongested state ($p < .05$, paired t-test) The mean value of the mucociliary transport time in the congested state is 15.63 mins while the mean value of the mucociliary transport time in the decongested state using Oxymetazoline HCl is 7.3 mins. The mucocilary clearance was more rapid in the decongested state using the topical nasal spray.

In the comparison of the mucociliary transport time in minutes using the 0.9 NaCl isotonic solution (Group B) in table II, it was shown that the difference in mean mucociliary transport times was statistically not significant ($p > .05$, paired t-test). There was no significant change in the mucociliary clearance using the 0.9 NaCl solution. The mean value of the mucociliary transport time using the 0.9 NaCl is 15.23 mins while without the solution is 15.5 mins.

Moreover, in the comparison of the mucociliary transport times between the Oxymetazoline HCl group (Group A) and the 0.9 NaCl solution group (Group B) in table III, there was a significant mean difference between the two groups ($p < .05$, independent t- test). The mucociliary transport time using the Oxymetazoline HCl was more rapid compared to the 0.9 NaCl solution.

CONCLUSION: This study showed that the used of Oxymetazoline HCl significantly shortened the mucociliary clearance in patients with rhinitis and sinusitis. It is likely secondary to the vasoconstrictive effect on the blood vessel of the nasal mucosa. On the basis of the results, Oxymetazoline HCl could be use as topical adjunctive agent in the therapy of rhinitis and sinusitis.

*Presented, PSO-HNS Analytical Researh Paper Contest, November 30, 2003, 47th PSO-HNS Annual Convention, Westin Phil. Plaza Hotel, Hotel

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INTRODUCTION

Nasal mucociliary clearance is the first line of defense of the respiratory system against inhaled particles. Foreign microbodies in inspired air are entrapped in the mucus blanket of the airway mucosa and transported with mucus by ciliary activity to the pharynx. This mucociliary transport function is one of the most important and indispensable protective mechanism of the airway against the atmospheric environment. (figure 1) Appropriate mucociliary clearance, however, is only possible in the presence of normal ciliary movement and adequate mucus blanket.[1]

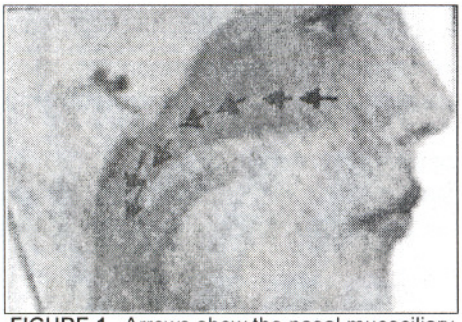

FIGURE 1. Arrows show the nasal mucociliary clearance. Mucus is transported by ciliary activity to the pharynx.

Mucociliary transit time is usually prolonged in diseases like rhinitis, sinusitis and upper respiratory tract infection brought about by the inflammatory process. Nasal topical decongestants usually combined with antibiotics have been used in various rates in the therapy of rhinitis and sinusitis. Oxymetazoline HCl, the active component in clinically used topical nasal decongestant act by constricting the vessels thereby resulting in decongestion.[2] (figure 2)

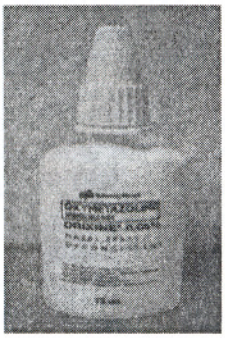

FIGURE 2. Oxymetazoline HCl, the active component in clinically used topical nasal decongestant

There have been studies conducted on the role of the topical nasal decongestants on patients with rhinosinusitis and results were positive. A number of foreign studies have also dealt on the status of nasal mucociliary clearance in particular, how it is affected in patients with rhinosinusitis. However, no local data have so far been available to support much less investigate the effect of topical nasal decongestant on nasal mucociliary clearance. This study was undertaken to establish the role of Oxymetazoline HCl, a topical decongestant, on mucociliary clearance among adult Filipinos with rhinosinusitis, comparing its effect with a 0.9 NaCl, a known isotonic solution.

The aims of the study were to 1) determine the effect of oxymetazoline HCl on nasal mucociliary clearance, 2) to compare the effect of oxymetazoline.

HCl on nasal mucociliary clearance on patients with rhinosinusitis, 3) to determine the effect of 0.9 NaCl on nasal mucociliary clearance, 4) compare the effect of 0.9 NaCl on nasal mucociliary clearance on patients with rhinosinusitis, and 5) compare the effect of Oxymetazoline HCl versus 0.9 NaCl solution on nasal mucociliary clearance.

MATERIALS AND METHODS

This study was a randomized single blind clinical trial conducted from April-September, 2003 at the ORL-HNS outpatient department, Ospital ng Makati. The subjects included 60 adult patients, from both sexes, and residing within Makati area with age range of 20-55 years . The sample size was computed based on statistical measurements. Informed consent was taken from each subject prior to the study.

Complete history and ENT examination were done on all these subjects. Patients included in the study were those complaining of nasal congestion or obstruction which may be associated with rhinorrhea , pruritus and sneezing. Included were patients with edematous/hyperemic turbinates and with or without purulent foul smelling discharge on nasal examination.(figure 3) These patients were diagnosed as either acute rhinitis, allergic rhinitis,

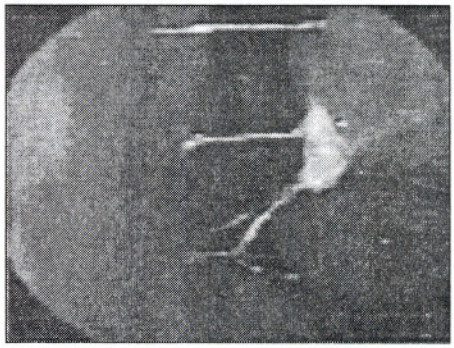

FIGURE 3. Shows an edematous/hyperemic turbinates in patients with acute sinusitis

acute or chronic sinusitis. Excluded were those patients with marked septal deviation, prior nasal surgery and with nasal polyps, grade 2 and 3 (nearly obstructing the nasal area). The mucociliary clearance is assayed with a test using a low calorie sweetener "Equal". The test agent is composed of lactose, Aspartame 36mg (a high intensity sweetener) and silicone dioxide. (figure 4)

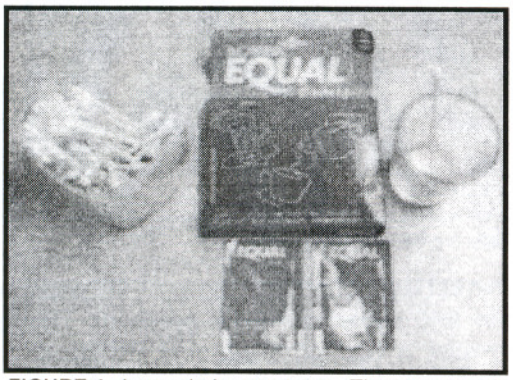

FIGURE 4. Low calorie sweetener. The test agent is composed of lactose. Aspartame 36mg (a high intensity sweetener) and silicone dioxide "Equal".

Patients were alternately allocated into two groups. 30 subjects formed the Oxymetazoline treatment group (Group **A**) and the other 30 subjects formed the 0.9 NaCl isotonic solution group (Group **B**). Both nasal cavities were tested for each subject.

A small amount of low calorie sweetener in powdered form is applied in the inferior nasal turbinate 1cm posteriorly from its anterior end using a cotton bud. (figure 5 & 6) After placement, the patient is told to avoid sniffing, bending or sneezing. The patient is instructed to swallow every 30 seconds and report any perception of sweet taste. The endpoint is the time at which the subjects become aware of the sweet taste. This is measured in minutes. The duration by which the particulate matter travels along the surface of the nasal cavity via

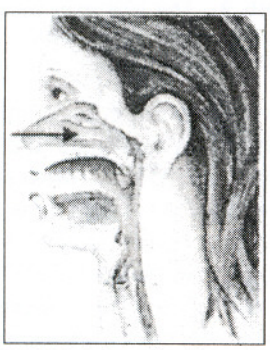

FIGURE 5. Arrow shows the site where the test agent is applied using a cotton bud. In the inferior nasal turbinate 1cm posteriorly from its anterior end.

FIGURE 6. Application of test agent

mucociliary transport referred to as mucociliary transport time (MTT). Next the patient is allowed to drink a glass of water then decongestion of both nasal cavities is done using Oxymetazoline HCl solution placed in a cotton and applied in the nasal mucosal turbinates. (figure 7)

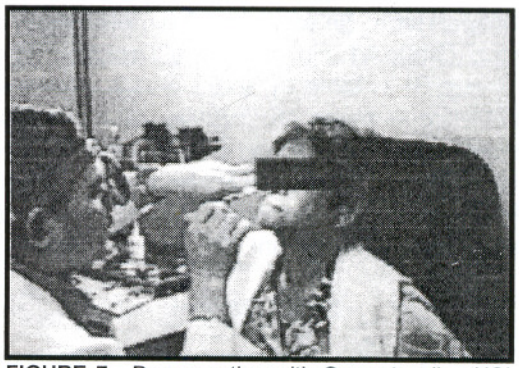

FIGURE 7. Decongestion with Oxymetazoline HCl soaked in a cotton and applied using a bayonet and nasal speculum.

After 15 minutes, application of sweetener was done followed by time recording of duration of the sweet taste. Both the results of the congested and decongested phase were compared in Group **A**.

For the Group **B**, a 0.9 NaCl isotonic solution was placed in an empty Oxymetazoline spray and labeled as the decongestive agent. The same procedure as previously applied in the Oxymetazoline treatment group was used in this group of patients. Both the mucociliary transport times with and without the isotonic solution were measured.

To determine the statistical significance, the nasal mucociliary transport times between the congested and decongested states using the Oxymetazoline HCl (Group **A**) were calculated and compared using the paired t- test. The nasal mucociliary transport times with and without the use of 0.9 NaCl solution (Group **B**) were also compared using the paired t- test. On the other hand, the nasal mucosal transport times between the use of Oxymetazoline and 0.9 NaCl solution were compared using the independent t-test.

RESULTS

In table I, the mean value of the mucociliary transport time in the congested state is 15.63 mins while the mean value of the mucociliary transport time in the decongested state by using the Oxymetazoline is 7.3 mins. The mucociliary clearance was significantly slower in the congested state than in the decongested state ($p < .05$, paired t-test). The mucociliary clearance was more rapid in the decongested state using the topical nasal spray.

In table II, the mean value of the mucociliary transport time using the 0.9 NaCl solution is 15.23 mins while without the solution is 15.5 mins. Paired t- test ($p > .05$) showed that this difference in mean mucociliary transport times was statistically not significant.

In the comparison of the mucociliary transport times between the Oxymetazoline HCl group (Group A) and the 0.9 NaCl solution group (Group B) in table III, there was a significant difference in mean mucociliary transport times between the two groups ($p < .05$, independent t-test). The mucociliary transport time using the Oxymetazoline HCl was more rapid compared to the 0.9 NaCl solution.

DISCUSSION

Mucociliary clearance has largely been responsible for the integrity of the entire respiratory tract. It serves as a protective mechanism against foreign bodies, dust particles, noxious substances and pathogenic organisms.

Rhinitis is nasal hyperfunction and tissue inflammation which leads to congestion, obstruction, pruritus and occasional sneezing. Nasal congestion arises from engorgement of blood vessels due to the effects of vasoactive mediators and neural stimuli. Rhinorrhea is due to hypersecretion of nasal glands leading to tissue transudate. Infection usually viral in etiology is the most common cause of acute rhinitis while allergy is the most common cause of chronic rhinitis.[3] The infection could last about a week, but in 5% to 10% of sufferers it can persist up to 3 weeks. Bacterial sinusitis follows a " cold" in about 0.5% to 10 % of cases.[4]

Sinusitis on the other hand is inflammation of the paranasal sinuses, the etiology of which includes both infectious agents and allergic mechanisms. Acute and chronic sinusitis refers to symptoms lasting < 4 weeks and > 3 months respectively [3].

Mucociliary clearance is normally 12-15 mins. This normal mucociliary transport tends to correlate with ciliary beat frequency between 10 and 20 times per second at a body temperature, yielding a flow rate of 6-7mm/min.(figure 8) The mucus blanket, which consists of 2 components:

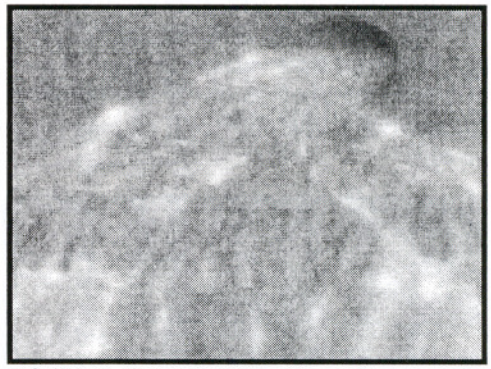

FIGURE 8. Tiny, brush like cilia easily sweeps the thin watery mucus through the nasal mucosa and into the back of the throat

a thin sol layer often referred to as the periciliary layer and superficial thick gel layer. This gel provides a continous blanket on top of the periciliary fluid, where the cilia extend during its motion. Together, the cilia and mucus blanket are responsible for trapping as much as 85-90% of particulate matter including viral particles. These infectious and inflammatory process can inhibit the normal ciliary beat by hypersecretion of mucus and inflammatory mediators released in response to the offending agents. The ciliary beat could decrease to < 300 beats/ min. (normally 700 beats/min), as a response to virus, bacteria or allergens.[5] (figure 9)

FIGURE 9. The cilia may become paralyzed by infectious and inflammatory process.

However, the mucociliary clearance noted in patients with rhinitis and sinusitis was improved using the topical nasal spray. The low calorie sweetener as a test agent fulfilled the outcome (inexpensive, easy to perform, pose no significant threat to the subject) for assessing mucociliary clearance. The endpoint was the time at which the subject becomes aware of the sweet taste.

The congestion of the nasal mucosa in these patients was due to vasodilation and

TABLE I

Comparison of the Mucociliary Transport time in Minutes both the congested and decongested state (using the Oxymetazoline HCl) in Group A

Patients	Diagnosis	Congested	Decongested
A. E 31/ M	Allergic Rhinitis	15 mins	8 mins
M.L. 26/ F	Acute Rhinitis	16 mins	7 mins
G.J. 21/F	Allergic Rhinitis	16 mins	7 mins.
A.L. 24/ F	Allergic Rhinitis	18 mins	5 mins
I.S. 49/F	Allergic Rhinitis	13 mins	10 mins
M.J. 41/ F	Allergic Rhinitis	14 mins	7 mins
R.M. 24/ F	Acute Rhinitis	12 mins	5 mins
L.K. 21/F	Allergic Rhinitis	16 mins	4 mins
B.C. 41/ F	Acute Sinusitis	18 mins	8 mins
C.F. 50/F	Allergic Rhinitis	17 mins	7 mins
S. J. 30/F	Acute Rhinitis	13 mins	5 mins
P.M. 20/F	Allergic Rhinitis	17 mins	8 mins
C.A. 21/M	Acute Sinusitis	18 mins	11 mins
J.P. 39/ F	Allergic Rhinitis	14 mins	8 mins
F.E 43/F	Acute Sinusitis	19 mins	6 mins
N. J. 20 /F	Allergic Rhinitis	11 mins	7 mins
C.F. 51/ F	Allergic Rhinitis	16 mins	8 mins
J.A. 46/F	Allergic Rhinitis	16 mins	9 mins
S.N. 35/ F	Allergic Rhinitis	16 mins	7 mins
B.G. 44/ M	Chronic Sinusitis	21 mins	11 mins
A.C. 20 /F	Chronic Sinusitis	17 mins	10mins
S.D .44/F	Allergic Rhinitis	15mins	8 mins
Q.D .41/ F	Acute Rhinitis	14 mins	7 mins
M.E.20/M	Acute Sinusitis	17 mins	6 mins
M.S.44/F	Acute Sinusitis	18 mins	7 mins
R.K. 43/F	Allergic Rhinitis	15 mins	5 mins
U.R.20/M	Acute Rhinitis	13 mins	9 mins
M.S. 43/F	Allergic Rhinitis	16 mins	7 mins
M. R. 29/F	Allergic Rhinitis	13 mins	7 mins
C.J. 32/F	Allergic Rhinitis	15 mins	7 mins
	Mean	**15.63 mins**	**7.3 mins**

TABLE II
Comparison of the Mucociliary Transport time in
Minutes using 0.9 nasal isotonic solution labeled as the decongestive agent in Group B

Patients	Diagnosis	Without	With 0.9 NaCl
DP.M.27/ M	Allergic Rhinitis	15 mins	14 mins
T.A. 55/F	Chronic Sinusitis	20 mins	19 mins
G.B. 32/M	Allergic Rhinitis	17 mins	17 mins
V.E.54/M	Chronic Sinusitis	21 mins	19 mins
M.J. 20/M	Allergic Rhinitis	15 mins	16 mins
A.M. 21/M	Allergic Rhinitis	14 mins	12 mins
U.J. 38/F	Allergic Rhinitis	17 mins	16 mins
D.S.43/F	Acute Sinusitis	18 mins	17 mins
N.J.25/F	Acute Sinusitis	16 mins	18 mins
D. H.38/M	Allergic Rhinitis	13 min	11 mins
W. M.36/F	Allergic Rhinitis	16 mins	17 mins
A. P.46/F	Allergic Rhinitis	15 mins	14 mins
L.L.49/F	Acute Rhinitis	13 mins	11 mins
I.B.47/M	Allergic Rhinitis	12 mins	14 mins
F.M.55/F	Allergic Rhinitis	14 mins	16 mins
B.N.54/F	Acute Rhinitis	13 mins	11 mins
P.E.46/F	Acute Sinusitis	16 mins	17 mins
M.E.25/F	Allergic Rhinitis	15 mins	15 mins
B.S.22/M	Acute Rhinitis	14 mins	12 mins
D.R.34/F	Allergic Rhinitis	17 mins	14 mins
B.J.27/M	Acute Sinusitis	17 mins	15 mins
E.N.40/F	Allergic Rhinitis	13 mins	16 mins
D.M.41/F	Allergic Rhinitis	16 mins	17 mins
A.R.55/F	Acute Sinusitis	17 mins	16 mins
F.R.31/F	Allergic Rhinitis	16 mins	15 mins
M.L.20/F	Allergic Rhinitis	13 mins	15 mins
P.L.28/F	Acute Sinusitis	16 mins	17 mins
A.T.44/F	Allergic Rhinitis	17 mins	16 mins
V. A.31/F	Allergic Rhinitis	15 mins	14 mins
D.M.28/F	Allergic Rhinitis	14 mins	16 mins
	Mean	**15. 5 mins**	**15.23 mins**

TABLE III
Comparison of the Mucociliary Transport time in Minutes using the Oxymetazoline HCl and 0.9 nasal solution

Oxymetazoline	0.9 Nacl
8 mins	14 mins
7 mins	19 mins
7 mins	17 mins
5 mins	19 mins
10 mins	16 mins
7 mins	12 mins
5 mins	16 mins
4 mins	17 mins
8 mins	18 mins
7 mins	11 mins
5 mins	17 mins
8 mins	14 mins
11 mins	11 mins
8 mins	14 mins
6 mins	16 mins
7 mins	11mins
8 mins	17 mins
9 mins	15 mins
7 mins	12 mins
11mins	14 mins
10 mins	15 mins
8 mins	16 mins
7 mins	17 mins
6 mins	16 mins
7 mins	15 mins
5 mins	15 mins
9 mins	17 mins
7 mins	16 mins
7 mins	14 mins
7 mins	16 mins
7.4 mins	**15.23 mins**

interstitial edema. The blood flow changes are important during infectious and other inflammatory conditions. Oxymetazoline HCL, a topical nasal decongestant decreases the local blood flow (vasoconstriction) ,thereby influencing changes in airflow and ciliary motility of nasal respiratory tract epithelium. Drugs interfering with blood flow like the Oxymetazoline HcL, modify the local defense reaction and potentially counteract adequate inflammatory response. In humans the duration of the effect is in the order of 6 hrs.[6] The mucociliary clearance was shortened as shown from this study using the topical nasal decongestant.

Moreover, there was no significant effect on the mucociliary clearance using the 0.9 NaCl solution. The 0.9 NaCl solution used for comparison is isotonic with no vasoconstrictive effect is a possible explanation.

CONCLUSION

This study showed that the mucociliary clearance in patients with rhinitis and sinusitis was significantly shortened using the Oxymetazoline HCl. It is likely secondary to the vasoconstrictive effect of the topical nasal decongestant.

On the basis of the results, Oxymetazoline Hcl could be recommended for use as topical adjunctive agent in the therapy of rhinitis and sinusitis.

RECOMMENDATION

The present study demonstrates the effect of Oxymetazoline HCL on nasal mucociliary clearance in patients with rhinitis and sinusitis. Knowing the fact that it increases mucociliary clearance, further studies should be made to determined the outcome of patients with rhinitis and sinusitis using Oxymetazoline Hcl as home medications.

BIBLIOGRAPHY

1. Sotelo, M. MD. et al. *Nasal Mucociliary Clearance: Its Status among Smokers and Non-smokers.* Philippine Journal of Otolaryngology Head and Neck Surgery. 1996
2. Inanli, S. M.D. et al. *The Effect of Topical Agents Fluticasone propionate, Oxymetazoline, and 3% and 0.9% Sodium Chloride Solutions on mucociliary clearance in the therapy of Bacterial Rhinosinusitis.* Laryngoscope 2002; 112: 320-325.
3. Jafek, B. M.D. et al. *Rhinitis and Sinusitis* ENT Secrets. 18: 86-90 ; 20: 96-102
4. Cummings, C. MD .et al. *Nonallergic Rhinitis and Infection. Otolaryngology head and Neck Surgery.* 3rd ed. Vol. 2, Chap.49. 1998. pp. 910-919
5. Ramos III, R. MD. et al. *A Comparison of the Mucus Transport Time between Filipinos Living in Urban and Rural areas.* Philippine Journal of Otorhinolaryngology Head and Neck Surgery. Vol. 14, No.3. July-September 1999. pp. 2-5
6. Akerlund, Anders MD, Bende, Mats,MD, Arfors, Karl-E, PhD, Intaglietta, PhD. *Effect of Oxymetazoline on Nasal and Sinus Mucosal Blood Flow in Rabbit as Measured with Laser-Doppler Flowmetry.* Annals of Otology, Rhinology and Laryngology Vol. 102. February 1993. pp. 123-126

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THE ACCURACY OF FINE NEEDLE ASPIRATION BIOPSY IN DIAGNOSING MALIGNANCY OF MAJOR SALIVARY GLAND TUMORS*

ROSARIO M. CRUZ, MD.**

ABSTRACT

OBJECTIVE:

General Objective: To determine the accuracy of fine needle aspiraton biopsy in diagnosing malignancy of major salivary gland tumors in a tertiary government hospital.

Specific: 1. To determine the sensitivity and specificity of fine needle aspiration biopsy as a diagnostic tool in major salivary gland tumors in this study.

DESIGN: Retrospective, cross-sectional study

SETTING: Tertiary government hospital

PATIENTS: Fifty two (52) patients with tumors of the parotid or submandibular Gland, diagnosed by FNAB, admitted and operated in the same Tertiary hospital.

RESULTS: The sensitivity, specificity and accuracy rate of fine needle aspiration biopsy of major salivary gland is 77.78%, 100.00% and 96.15%, respectively. Positive predictive value is 100%. The most common clinical parameters present in patient with high suspicion of malignancy is fixation of the tumor to adjacent structures (38.46%), followed by rapid growth (23.07%), very firm lesion (15.38%), tumor recurrence after surgery(15.38%) and enlarged lymph nodes(7.69%). No facial paralysis noted.

CONCLUSION:The accuracy of FNAB in the diagnosis of major salivary gland malignancy in a tertiary government hospital is found to be promising and comparable with other studies. However, it is only an adjunct to the management of salivary gland lesions but not a definitive diagnostic test, negative results do not exclude neoplastic diseases. Clinical aspects and risk factors should also be considered to support the validity of the diagnosis, especially in patients with high suspicion of malignancy.

INTRODUCTION

Suspicions of malignancy must always be ruled out in all patients presenting with a lump in the region of the major salivary gland. In order to achieve this, a good history and thorough physical examination, together with various diagnostic modalities, have been used. However in our local setting, wherein most of our patients came from low socio-economic income group, the most cost effective way is necessary.

At present, Fine Needle Aspiration Biopsy (FNAB) is widely used as the standard initial diagnostic tool. According to Califano, et al in 1999, FNAB of major salivary gland neoplasm has sensitivity of approximately 85-95% and specificity of 98%.[1] And in 1998, a study done by Khafajis, et al showed 84% accuracy rate of FNAB in diagnosing 154 parotid diseases.[2]

Despite these studies, favoring FNAB diagnosis remain controversial according to Thawley in 1999, especially in predicting malignancy.[3]

It is for this reason that the author ventured in determining the accuracy of FNAB in diagnosing malignancy in major salivary gland tumors and likewise, its role and contribution to the diagnostic evaluation process in the local set up of a tertiary government hospital.

MATERIALS AND METHODS

A total of 58 patients from 1997-2003 were admitted in the department of Otolaryngology-Head and Neck Surgery for surgical management of major salivary gland tumors. The medical records of these patients were reviewed for the purpose of this study.

Fifty two (52) patients had FNAB diagnosis made from the pathology section of one tertiary government hospital, which forms the basis of the study group.

Histological confirmation was obtained. A correlation was established between the FNAB result and final histo-pathological report, being the gold standard in diagnosis (done in the same

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institution).

Fine Needle Aspiration Biopsy Technique

Fine needle aspiration was performed with a 10cc syringe attached to a gauge 23 needle using the standard technique. All specimens were obtained with no local anesthesia. The skin was cleaned with an antiseptic and the needle was introduced thru the skin in the region of infra-auricular, preauricular or submandibular mass. Suction was applied by withdrawing the plunger of the syringe and maintained using the extended thumb. The needle was advanced and withdrawn thru the mass, three or four times, at various angles. The suction is gently released by detaching the syringe from the needle. The specimen was obtained from the needle, and expressed into the glass slide to form a smear. Cytopathologists fixed the rest of the staining procedure.

The procedure was repeated several times depending on the adequacy of the cells obtained. Cytopathological diagnosis was grouped into benign and malignant (including atypical cells with high suspicion for malignancy). The permanent paraffin section result was also grouped into benign and malignant, and used as gold standard of the study.

The following parameters were analyzed:

1. Sensitivity - the proportion of patient with malignant salivary gland tumors and positive FNAB result.
2. Specificity – the proportion of patient without malignant salivary gland tumor and negative FNAB result.
3. False positive fraction – the probability of positive FNAB in a patient without malignancy.
4. False negative fraction – the probability of having a negative FNAB finding in a patient with malignancy.
5. Positive predictive value – the probability of having malignant salivary gland disease and positive cytologic findings.
6. Negative predictive value – the probability that a patient did not have malignancy in the presence of negative cytologic findings.
7. Accuracy index – the proportion of correct results (true positive and true negative) in relation to all cases studied.

Patient presenting with the following clinical parameters suspicious of malignancy were identified. These include very firm nodule, rapid tumor growth, fixation of the mass to adjacent structures, enlarged lymph nodes, facial paralysis and tumor recurrence after previous surgery.

RESULTS

The FNAB diagnosis in the study group of 52 patients (range= 13-79 y/o, average = 41 y/o), as shown in Table 1, reveals that salivary gland tumors are equally distributed among males and females. Eight patient presents with submandibular gland tumors and the rest, with parotid tumors. Of the patients diagnosed with malignancy, 13 years old female patient is the youngest and 79 years old male is the oldest. Seven out nine patients are diagnosed correctly by FNAB.

Table 2 shows the summary of FNAB result grouped into benign and malignant lesions versus the histo-pathological result also grouped into benign and malignant lesions. Of the nine malignant lesions, two lesions are diagnosed as benign by FNAB. Two lesions are of the submandibular gland and the rest is from parotid gland. This result gives a 77.78% sensitivity rate. All benign lesions on final histopath report are correctly diagnosed by FNAB, thus giving a 100% specificity rate. Accuracy rate of FNAB in this study is 96.15%.

Pleomorphic adenoma is the most common benign FNAB lesion followed by Warthin's tumor while mucoepidermoid CA is the most common FNAB diagnosed malignant lesion in this study. The same most common lesions are also found in the paraffin sections. The rest of the lesions are shown in Table 3.

The clinical factors of a patient presenting with a suspected malignancy are enumerated in Table 4. The incidence of cancer according to each clinical finding is also presented. The most reliable indicators of malignancy are very firm nodule, rapid growth, fixation of the mass lesion, enlarged lymph nodes and tumor recurrence of surgery. Some parameters overlap, as some patients had multiple indicators of malignancy. None of these patients had family history of cancer or previous history of irradiation to the head and neck area. However, this can be attributed to incomplete history taking. Two patient presents with painless and indolent tumor growth. These are incorrectly diagnosed by FNAB as benign Pleomorphic Adenoma. However, final histopathologic reports reveal Mucoepidermoid and Adenoid Cystic Carcinoma.

DISCUSSION

Fine needle aspiration biopsy has gained acceptance as a means of providing preoperative tissue diagnosis of salivary gland tumors, including parotid lesions. It provides beneficial

Table 1
The Fine Needle Aspiration Biopsy and Histopathologic Results
of Fifty-two Patients with Salivary Gland Tumors
Rizal Medical Center, 1997-2003

	DATE	AGE/SEX	FINE NEEDLE ASPIRATION BIOPSY	HISTOPATHOLOGIC REPORT
1	December, 1999	22/M	Pleomorphic Adenoma, Submandibular Gland, Left	Pleomorphic Adenoma, Submandibular Gland, Left
2	November, 1999	46/M	Pleomorphic Adenoma,Submandibular Gland, Right	Pleomorphic Adenoma, Submandibular Gland, Right
3	November, 1999	30/M	Mucoepidermoid CA, Parotid, Left	Mucoepdermoid CA, Parotid, Left
4	February, 2000	45/M	Pleomorphic Adenoma, Parotid, Right	Warthin's Tumor,Parotid, Right
5	June, 2000	47/F	Pleomorphic Adenoma,Parotid, Right	Lipomatosis,Parotid, Right
6	July, 2000	42/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
7	June, 2000	48/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
8	October, 2000	79/M	Adenoid cystic CA, Submandibular Gland, Right	Adenoidcystic CA, Submandibular Gland, Right
9	March, 2001	29/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
10	September, 2001	62/F	Mucoepidermoid CA, Submandibular Gland, Right	Squamous Cell CA, Submandibular Gland, Right
11	October, 2001	53/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
12	January, 2002	45/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
13	June, 2001	50/F	Pleomorphic Adenoma, Submandibular Gland, Right	Pleomorphic Adenoma, Submandibular Gland, Right
14	July, 2001	70/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
15	September, 2001	71/M	Pleomorphic Adenoma, Parotid, Right	Warthin's Tumor Parotid, Right
16	December, 2001	23/M	Pleomorphic Adenoma, Submandibular Gland, Left	Pleomorphic Adenoma, Submandibular Gland, Left
17	January, 2001	14/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
18	October,2001	53/M	Pleomorphic Adenoma, Parotid, Right	Warthin's Tumor Parotid, Right
19	October, 2001	38/M	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
20	April, 2000	68/M	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
21	August, 2002	57/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
22	July, 2002	23/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
23	July, 2002	22/M	Mucoepidermoid CA, Parotid, Left	Mucoepidermoid CA, Parotid, Left
24	July, 2002	33/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
25	April, 2002	57/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
26	March, 2002	36/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
27	January, 2002	45/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
28	January, 2002	23/F	Pleomorphic Adenoma, Parotid, Right	Myoepithelioma,Parotid, Right
29	September, 2002	37/M	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
30	August, 2002	28/F	Pleomorphic Adenoma, Submandibular Gland, Right	Pleomorphic Adenoma, Submandibular Gland, Right
31	August, 2002	22/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
32	January, 2003	52/F	Pleomorphic Adenoma, Parotid, Left	Adenoidcystic CA, Parotid, Left
33	March, 2003	40/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
34	May, 2003	48/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
35	July, 2003	50/M	Monomorphic Adenoma, Submandibular Gland, Left	Monomorphic Adenoma, Submandibular Gland, Left
36	August, 2003	13/F	Atypical Cells, Parotid, Left	Rhabdomyosarcoma, Parotid, Left
37	September, 1999	47/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
38	January, 2000	40/M	Adenoidcystic CA, Parotid, left	Adenoidcystic CA, Parotid, left
39	October, 2002	26/F	Atypical cells, Parotid left	Mucoepidermoid CA,Parotid, left
40	September, 2002	30/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
41	September, 1999	50/M	Pleomorphic Adenoma, Parotid, Right	Lipomatosis, Parotid, Right
42	August, 1999	72/M	Pleomorphic Adenoma, Parotid,Left	Warthin's Tumor, Parotid, Left
43	August, 1999	42/M	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
44	July, 1999	23/M	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
45	March, 1999	43/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
46	July, 1998	26/F	Pleomorphic Adenoma,Parotid Left	Pleomorphic Adenoma, Parotid, Left
47	June, 1998	14/F	Pleomorphic Adenoma, Parotid, Right	Mucoepidermoid CA, Parotid, Right
48	July, 1997	30/M	Pleomorphic Adenoma,Parotid, Right	Pleomorphic Adenoma, Parotid, Right
49	July, 1997	27/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
50	February, 1999	30/F	Pleomorphic Adenoma, Parotid, Right	Pleomorphic Adenoma, Parotid, Right
51	October, 1998	34/M	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left
52	October, 1998	35/F	Pleomorphic Adenoma, Parotid, Left	Pleomorphic Adenoma, Parotid, Left

TABLE 2
Comparison Between Fine Needle Aspiration Biopsy and Histopathologic Results (Malignant and Benign Lesions)
Rizal Medical Center, 1997-2003

	Histopathology	Histopathology	TOTAL
	Malignant	Benign	
FNAB: Malignant	7	0	7
FNAB: Benign	2	43	45
TOTAL	9	43	52

TABLE 3
Summary Distribution of Fine Needle Aspiration Biopsy Results of Salivary Gland Tumors
Rizal Medical Center, 1997-2003

FNAB FINDINGS	NUMBER OF PATIENTS	PERCENTAGE (%)
Pleomorphic Adenoma	44	84.61
Mucoepidemoid CA	3	5.77
Adeno CA	2	3.85
Monomorphic Adenoma	1	1.92
Atypical Cells	2	3.85
TOTAL	52	100

TABLE 4
Summary Distribution of Patients Presenting with Clinical Parameters of Malignancy
Rizal Medical Center, 1997-2003

CLINICAL PARAMETERS	NUMBER OF PATIENTS	PERCENTAGE (%)
Very firm nodule	2	15.38
Rapid grow th	3	23.07
Fixation of tumor	5	38.46
Enlarged lymph node	1	7.69
Facial paralysis	0	0
Recurrence	2	15.38
TOTAL	13	100

preoperative information that may play a significant role in determining the extent and nature of proposed surgery.[2]

This study reports the result of FNAB of major salivary gland tumors in a tertiary government hospital. The diagnostic accuracy of FNAB in this series is 96.75%, the sensitivity is 77.78% and the specificity is 100%. These results are nearly equal with other studies done under local and international set-ups. The results of the present local analysis are, therefore, promising. Especially in a government hospital setting wherein most of the patient cannot afford an expensive radiological studies. And most of the time, they cannot afford added expense of a frozen section intraoperatively. As a basis of solution for surgical operation of major salivary gland tumors, FNAB is a reliable diagnostic procedure in predicting malignancy.

However in cases wherein, there's a high clinical suspicion of malignancy, radiologic studies can be helpful (if the patient can afford). This is what we did with the 2 patients who presented with a few months history of preauricular mass with fixation to adjacent structures. We requested contrast enhanced Computed Tomography studies of the preauricular lesions. On FNAB, these lesions gave results with atypical cells, highly suspicious of malignancy. These diagnostics work-ups results helped us in planning our extensive surgery. Use of a combined clinical/ radiologic/cytologic "triple test" approach is advocated for minimum false negatives and false positive FNAB diagnosis of parotid masses.[2]

Fine needle aspiration is advantageous. It enables high accuracy in identifying the nature of a lesion and differentiates benign from malignant diseases. It is performed in an outpatient setting and immediate assessment of the material is usually possible within 15 minutes. This initial assessment is helpful in relieving the anxiety of the patient and aids in clinical decision-making.

When available, frozen section diagnosis, intraoperatively can be likewise beneficial when making surgical decisions especially in a medical center wherein pathologists have a great deal of experience in frozen section. However, frozen section may give inconclusive diagnosis as reported by many studies. A study of parotid gland neoplasm done by Hardillo, et al in 1996 showed that FNAB and frozen section have an accuracy rate of 90% and 96%, respectively[8]. Therefore when resources are scarce, FNAB can be an indispensable and reliable diagnostic modality especially in a government hospital.

However, diagnosis and treatment depend upon the experience of the surgeon and pathologist. Patient presenting with high clinical suspicion of malignancy must be properly diagnosed. In which case, FNAB plays a major role. A negative FNAB alone should not prevent surgical intervention when it is otherwise clinically indicated.[4]

CONCLUSION

The accuracy of FNAB in the diagnosis of major salivary gland malignancy in a tertiary government hospital is found to be promising and comparable with other studies. It is an adjunct to the management of salivary gland lesions but not a definitive diagnostic test, negative results do not exclude neoplastic diseases. Clinical assessment and risk factors should also be considered to support the validity of the diagnosis, especially in patients with high suspicion of malignancy.

BIBLIOGRAPHY

1. Rice, D: Malignant Salivary Gland Neoplasms. The Otolaryngologic Clinics of North America. 32:875-885, 1999.
2. Khafaji, B. et al: Fine Needle Aspiration of 154 Parotid Masses with Histologic Correlations. Cancer Cytopathology. 153-159, 1998.
3. Batsakis, JG: Tumors of the Head and Neck, 2nd Ed. Baltimore: Williams and Wilkins; 116, 1982.
4. Conley, J: Controversies Regarding Therapy of Tumors of the Salivary Gland. In: Thawley SF et al. Comprehensive Management of Head and Neck Tumors. 2:1120-1122, 1999.
5. Flor J, Cukingnan A, Lim E, Ejercito N: Needle Aspiration Biopsy. Philippine Journal of Otolaryngology. 55-58, 1981.
6. Batol W, Felicilda F, Chua A, et al: Non-aspirating Fine Needle Biopsy: The future standard in solid head and neck masses: A simplified technique. Philippine Journal of Otolaryngology. 4-9, 1992.
7. Ejercito N, Jardeleza T, Pontejos A: Tumor of the Major Salivary Glands: A Clinicopathologic Review of 203 cases. Philippine Journal of Otolaryngology. 129-133, 1982,
8. Hardillo A, Gloria-Cruz T, Lopea R, Hernandez J: Compression of FNAB and Frozen Section in the Diagnosis of Parotid Gland Neoplasms. Philippine Journal of Otolaryngology. 1996.
9. Villoria A, Cruz G, Angeny M, et al: Fine Needle Aspiration of Head and Neck Nodes (A Preliminary Report). 62-65, 1992.

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NASAL TOPICAL CORTICOSTEROID VERSUS ORAL ROXITHROMYCIN: *A comparative study in the initial management of nasal polyps in adults**

FERDNAND C. SUPNET, MD**

INTRODUCTION

Nasal Polyposis, one of the most disturbing illnesses in the nasal cavity and paranasal sinuses, is a condition characterized as benign smooth semi-transluscent, pale, white gelatinous growths and occurs as a result of a multifocal edematous degeneration which originates from an inflammatory mucosal reaction of the paranasal sinuses mostly the anterior ethmoids.[1] They have been recognized for thousands of years. Ancient Egyptian skulls have been found bearing the gross features of nasal polyps. Hippocrates (460-370) even described a method for their removal, using a piece of string passed through the nose to the post-nasal space.[2]

Over the past three decades, the principal approach to treating nasal polyposis has shifted from surgical intervention to medical management, with surgery used in adjunct when warranted. This transition was driven by the recognition that nasal polyposis is a recurrent condition for which surgery provides only temporary relief.[3]

Presently, inhaled corticosteroids are widely accepted medical management in the earlier stages of nasal polyps. Although usually used in nasal polyps, failure of nasal topical steroid may be due to uneven distribution of drug delivered to the nasal polyp, patient non compliance and a possible concomitant infection in the upper respiratory tract.[4] Oral corticosteroids are equally effective in early stages however this produces more systemic side effects compared to topical steroids.

As researches continue regarding the medical management of nasal polyps, a recent study by Nonaka et al showed that a macrolide antibiotic, Roxithromycin aside from its anti-bacterial properties, has been found to have an effect on fibroblasts in nasal polyps which result in shrinkage of the lesion.[5]

This preliminary study is aimed to determine the effect of Roxithromycin as treatment for nasal polyposis among adults as compared to nasal topical corticosteroids. Specifically, this paper aims to determine the effect of roxithromycin in resolving rhinitis and obstructive symptoms compared to nasal topical corticosteroids. Furthermore, to determine the effect of Roxithromycin in decreasing the size of the nasal polyps as compared to nasal topical corticosteroid.

PATIENTS, MATERIALS AND METHODS

Patients:

In this study, there were forty seven patients seen at the out patient department of 2 tertiary hospitals in Metro Manila from January 2001 to August 2003. Included in this study are male or female aged 20 to 80 years of age with a diagnosis of nasal polyps which was graded accordingly based on Mackay's grading[6] on endoscopic visualization (Fig 1). Grade 0 denotes the absence of polyp. Grade 1 polyps are found behind the middle turbinate. Grade 2 polyps are those found beyond the level of the middle turbinate which may or may not obstruct the nasal cavity. Those with Grade 3 polyp, i.e. polyps which totally obstruct the nasal cavity, were excluded in this study due to uneven distribution of the nasal spray to the large nasal polyp.

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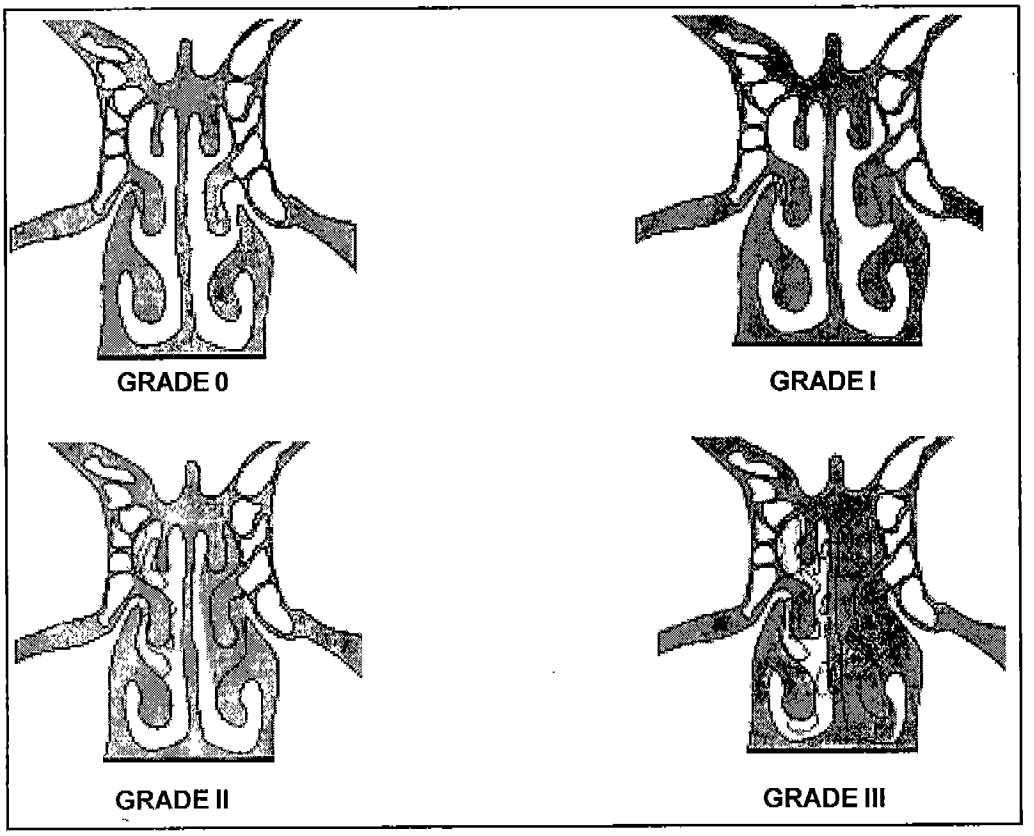


Fig 1: Grades of Nasal polyps (McKay, 1995)

Furthermore, those who were immunocompromised, had a known allergy to macrolides, and pregnant women were excluded in this study.

The sample size was computed based on the success rate of previous study on nasal corticosteroid and roxithromycin as treatment to nasal polyposis.

Methods:

All the patients were selected via random allocation. Each patient was examined and treated by the same physician and assistant for the duration of the study. Assessments were conducted at baseline and every week for 1 month. At each visit, the nasal function was checked on the basis of five criteria: nasal obstruction, rhinorrhea, loss or decrease in the sense of smell, sneezing, and facial pain. A questionnaire (see *appendix*) was accomplished every week by the patient whether there is presence or absence of aforementioned symptoms.

Endoscopic examination (30 degrees rigid optic) for measurement of polyp size was performed by the researcher initially prior to treatment and after the duration of treatment. Polyp size was rated on a three-point scale: Grade 0 - absence of polyps, Grade I – polyps which are confined to the middle meatus, and Grade II - polyps extending beyond the middle meatus but not completely obstructing the nasal cavity.

Each patient was given by the assistant either treatment regimen A or treatment regimen B as seen in Table 1.

Table 1: Treatment regimens

Treatment regimen **A**	Nasal topical corticosteroid **Momethasone Furoate 50 mcg** sprayed twice on each nostril once a day for 1 month
Treatment regimen **B**	Oral macrolide antibiotic, **Roxithromycin 300 mg** once a day for one month.

The study was terminated immediately in patients who appeared to be worsening in the succeeding follow-ups. At the end of the duration of treatment, all patients who are unimproved were given an option for surgical intervention.

Statistical Analysis

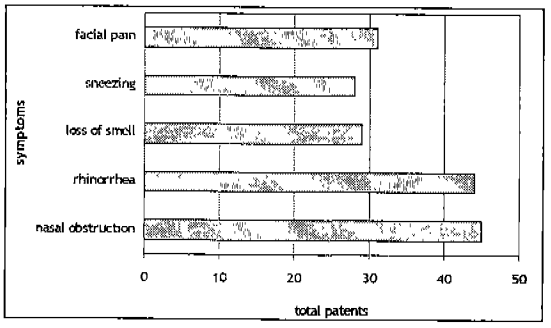
Statistical analyses were used as follows: McNemar Test for signs and symptoms within groups (1st week and 2nd week, 1st week and 3rd week, 1st week and 4th week); Wilcoxon Matched-pairs Signed Ranks test for size of the polyps within groups (Pre-treatment and post treatment). For differences of signs and symptoms and polyp size between groups, Chi square test or Fischer Exact Probability test and Mann Whitney test were used. A p value of < 0.05 was considered significant.

RESULTS

The study population had a mean age of 55.9 years old. The youngest was 20 years of age and the oldest is 78 years old. Fifty seven percent of patients were male and forty three percent were female.

The most common symptom (**Figure 1**) among patients regardless of grading is nasal obstruction (95.7%).

Figure 1: Frequency of Symptoms prior to treatment



This was followed by rhinorrhea (93.6%), headache or facial pain (65.9%), loss or decrease in the sense of smell (61.7%) and sneezing (59.6%). No differences in the baseline symptoms were observed between two groups.

Figure 2: Improvement from Nasal obstruction upon treatment

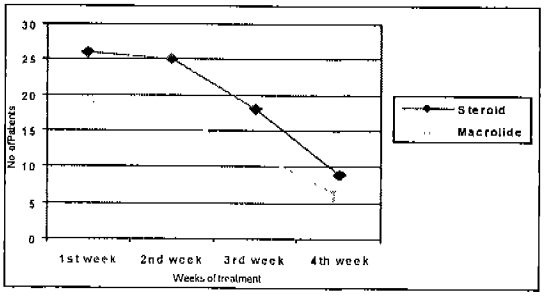


Figure2 indicates the course of the nasal obstruction alone from week 1 to 4 upon administration of nasal topical steroid compared with oral macrolide. Results show that from week 1 to week 2, there is no significant change in nasal obstruction upon giving nasal topical steroid (p-value – 1.000) and macrolide (p-value – 0.5). However, on week 3 significant decrease in rate of nasal obstruction with nasal topical corticosteroid (p value – 0.008) and with macrolide (p value - 0.016) was observed. There were however 9 cases with persistence of nasal obstruction after nasal topical steroid treatment and 6 cases after macrolide treatment for 1 month. The rates of occurrence of nasal obstruction in the two groups however were comparable in all observation periods.

Figure 3: Improvement from Rhinorrhea upon treatment

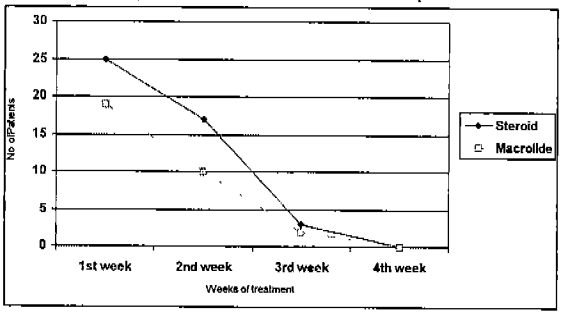


Figure 3 shows the course of rhinorrhea from week 1 to 4 upon administration of nasal topical steroid compared with oral macrolide. Results indicate that as early as week 2, rhinorrhea improved with administration of treatment of nasal topical steroid (p-value – 0.008) and macrolide group (p-value – 0.004). No differences were observed between the two groups in all observation periods.

Figure 4: Improvement from Loss or decrease in sense of smell upon treatment

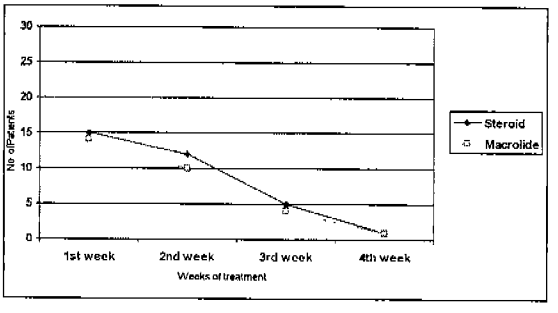


Figure 4 shows the course of sense of smell from week 1 to week 4 with administration of nasal topical corticosteroid and macrolide. Results indicate that on both topical steroid (p value – 0.002) and macrolide groups (p value –

0.002), there was significant improvement on the 3rd week in most patients. There was 1 case with persistent decreased smell after nasal topical steroid treatment and 1 case after macrolide treatment for 1 month. Comparison of the two groups did not show significant difference in all observation period.

Figure 5: Improvement from Sneezing upon treatment

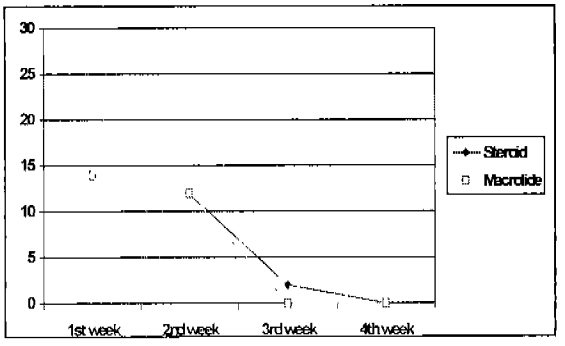


Figure 5 shows the course of sneezing from week 1 to 4 upon giving nasal topical corticosteroid and macrolide. Results indicate that there was a significant improvement from sneezing on the third week on both nasal topical steroid (p value - 0.0005) and macrolide (p-value -0.001) treatment. Again the two groups were comparable in all observation periods.

Figure 6: Improvement from Headache/Facial pain upon treatment

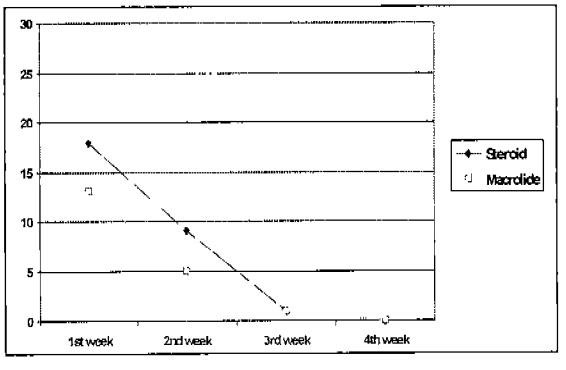


Figure 6 shows the course of headache or facial pain from week 1 to week 4 upon giving nasal topical corticosteroid and macrolide. Results indicate that on the 3rd week of treatment with nasal topical steroid (p value – 0.004) and macrolide (p value – 0.025), there was a significant improvement with regards to headache or facial pain. In all treatment periods the two groups were comparable.

Among the patients, 42.6% of patients had Grade I nasal polyps. 57.4% had grade II polyps prior to treatment (Figure 7).

Figure 7: Frequency of nasal polyp grade prior to treatment

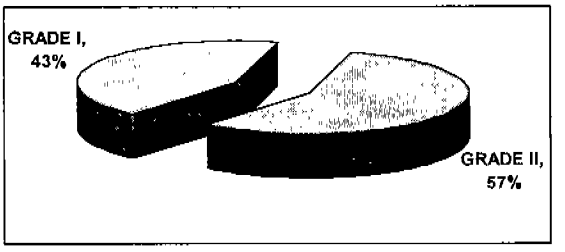


Table 2: Polyp Grade after Nasal Topical corticosteroid and Macrolide treatment

AVERAGE POLYP GRADET	STEROID	MACROLIDE
GR I TO 0	9	6
GR II TO I	11	9
IMPROVED		
TOTAL	**20**	**15**
Post treatment		
GR I TO I	3	2
GR II TO II	4	3
UNCHANGED		
TOTAL	**7**	**5**
P VALUE	.0.0001	0.0007
TOTAL	**27**	**20**

Table 2 shows the polyp grade after treatment with nasal topical corticosteroid and macrolide. Results indicate that there is a significant improvement with regards to polyp size after treatment of nasal topical corticosteroid (p value -0.0001) for one month. Similar improvement was also seen in the treatment of macrolide (p value – 0.0007) for one month. The two groups were however comparable in baseline and on the last assessment.

There were 3 patients in the nasal topical corticosteroid group and 9 patients in the macrolide group who dropped out due to failure to follow-up on the succeeding weeks. There were 4 patients from the nasal topical steroid group and 3 patients from the macrolide group who had no decrease in the size of the polyps and was advised surgery.

DISCUSSION

The etiology and management of nasal polyposis undoubtedly remains controversial for several decades up to the present times. Most authors however agree that polyposis management should be based primarily on medical approach to be completed by surgical failures only in cases of drug failure. The aims of medical treatment of nasal polyposis are to relieve rhinitis symptoms, restore nasal breathing and sense of smell, completely remove or reduce the size of the polyps and prevent recurrence.[1]

We have to know the possible etiology

in nasal polyps formation in order to understand the rationale for our treatment in nasal polyposis. Most theories consider polyps to be the ultimate manifestation of chronic inflammation, therefore conditions leading to chronic inflammation in nasal cavity can lead to polyp.[2]

In this study, we compared the effect of nasal topical corticosteroids with macrolide with regards to resolution of symptoms and reduction of nasal polyp size. It appears that with regards to symptom resolution, as early as 2 weeks, rhinorrhea and facial pain significantly improved on both groups. However, relief from nasal obstruction, loss or decrease in the sense of smell and sneezing was significantly evident on the 3rd week in both groups. There was no significant difference in improvement of symptoms between the nasal topical steroid group and the macrolide group. As for the polyp size, there was a significant decrease in the size from week 1 compared to week 4 in both groups. There was however no significant difference in shrinkage of polyp between the nasal topical steroid group and the macrolide group.

The use of nasal topical corticosteroids enhances the alpha adrenergic reactivity of smooth muscle cells of nasal blood vessels causing vasoconstriction, consequently increasing the nasal patency, relieving the patient from nasal obstruction and rhinorrhea and improving the sense of smell. This in effect improves drainage from paranasal sinuses decreasing facial pain. Moreover, nasal topical corticosteroids also reduce the non-specific reactivity of irritant receptors in the tracheobronchial tree decreasing sneezing attacks.[3]

In a study by Saunders in 1999, he demonstrated that apoptosis or programmed cell death in inflammatory cells is an important factor in resolution of inflammation which is induced in eosinophils in cell culture with nasal corticosteroid treatment.[4] This in effect decreases the size of nasal polyps.

In a recent study by Nonaka et al in 1999, he investigated the use of a 14-membered macrolide, roxithromycin in the treatment of nasal polyp. He demonstrated that roxithromycin directly suppressed nasal polyp fibroblasts proliferation indicating that this drug may result in shrinkage of nasal polyp size by inhibiting the development of fibrosis.[5] Suzaki in 2003 added that Roxithromycin decreases cytokine from inflammatory cells specifically interleukin 6 and 8 and RANTES (i.e. regulated on activation, normal T cell expreesed and secreted) which actively participates in the inflammatory process. Moreover, there is consequent decrease in lymphocytes and plasma cell infiltration upon roxithromycin treatment.[6] This in effect, decreased obstructive and rhinitis symptoms. In this study, both treatments exhibited significant improvement in symptom and polyp size.

CONCLUSION

Nasal topical corticosteroid and oral roxithromycin are equally effective in the medical management of nasal polyp with regards to symptom resolution and decrease in the size of polyps in early stages.

RECOMMENDATIONS

A follow up study is recommended in a multi-institutional set-up with more subjects and longer time frame. Time of recurrence from medical treatment must also be noted. A cost benefit study in long term effect of macrolide compared to nasal topical corticosteroids is further recommended.

Although the effect of nasal topical corticosteroids and macrolide is comparable in terms of improvement of symptoms and polyp reduction, cost minimization is not warranted in roxithromycin. It can be useful though in patients who have nasal polyps with concomitant upper respiratory tract infection and those who cannot tolerate topical corticosteroids.

BIBLIOGRAPHY

1. McClay J. MD Nasal Polyps , Department of Otorhinolaryngology, University of Texas, Dec 2001
2. Saunders M. MD et al, Do corticosteroids induce apoptosis in nasal polyp inflammatory cells? In vivo and in vitro studies, Laryngoscope 1999 May; 109 (5): 785-90
3. Suzaki H et al Influence of roxithromycin on inflammatory cytokine production from nasal polypfibroblasts in vitro; Acta Otolaryngol. 2003 Jun;123(5):637-42

APPENDIX

Sample Questionnaire

Name: **Age:** **Date:**

Please put a check on the space provided if it applies to you:
Pakilagyan ng ekis ang puwang kung ito ay angkop sa iyo

1st check up _____ **Follow-up** _____
unang bista ***sunod na bisita***

Signs and Symptoms	**Present** *Mayroon*	**Absent** *Wala*
Nasal obstruction **Nakabara sa ilong**	_____	_____
Rhinorrhea **May lumalabas na sipon**	_____	_____
Sense of smell **pang-amoy**	_____	_____
Sneezing *Pagbabahin*	_____	_____
Headache/facial pain *Sakit ng mukha o ulo*	_____	_____

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VALIDATION STUDY OF A LOCALLY DESIGNED, LOW COST, PORTABLE SOUND-TREATED AUDIOMETRIC BOOTH FOR HEARING SCREENING*

ERICK G. DUCUT, MD**
GENEROSO T. ABES, MD, MPH***

ABSTRACT

OBJECTIVE: To determine the attenuation of ambient noise level of a locally designed, low cost, portable sound-treated audiometric booth and to determine the reliability of hearing screening results when compared to the standard audiometric booth of a tertiary hospital. DESIGN: Experimental study.
SETTING: Tertiary hospital.
PATIENTS: A total of 32 volunteers were entered to the study with ages ranging from 21 to 33 years. All volunteers had normal pure tone results using the standard audiometric booth of a tertiary hospital as gold standard. Each volunteer underwent hearing screening using the designed portable audiometric booth in three tests areas with varying ambient noise levels.
RESULTS: Results showed that the portable audiometric booth was able to attenuate noise from 10.0 dB to 24.5 dB. Pure-tone screening using the portable audiometric booth showed that an increase in the ambient noise level would also lead to an increase in the pure-tone average. At an ambient noise level measured to be about 40dB (Test Area 1), there was no difference in the mean measurements of the hearing thresholds comparing the standard audiometric booth and the portable audiometric booth. In areas where the ambient noise levels were above 40 dB (Test Areas 2 and 3), results showed a statistically significant difference in the measurements between the standard and the audiometric booths. Volunteers reported minimum discomfort caused by humid conditions inside the booth. Since the screening only took a maximum of 3 minutes, the discomfort was deemed tolerable.
CONCLUSION: The designed booth for hearing screening was able to attenuate ambient noise levels up to 24.5 dB. Results of hearing screening using the portable booth showed no statistical significance when compared to the standard audiometric booth if the ambient noise levels did not exceed 40 dB. This is in agreement with the maximum permissible ambient noise level for audiometric booths for hearing screening set by the ANSI and ASHA.

INTRODUCTION

Hearing impairment can affect any person in any stage of his life. It can affect a person from birth, childhood, school age, adulthood and especially during old age. Effects of hearing impairment include a child unable to speak, a student with poor intellect, an adult with less productivity or an elderly who is considered a burden to those around him. Globally, it is estimated that 6-10% of the world population is suffering from various degrees of hearing impairment (1). The World Health Organization estimates that at present about 120 million people have disabling hearing difficulties. Locally, a study by Esguerra et al., has estimated that about 600,000 Filipinos are hearing impaired (2). A survey done by IMPACT UK in the Philippines on the hearing status of elementary school children showed that 11% of school children were hearing impaired (3). Another study by Ledesma and the Bureau of Elementary Education has shown that 20% of children tested suffered from a certain degree of hearing loss (4).

Hearing loss can be due to congenital disorders, infectious diseases, use of ototoxic drugs, trauma and exposure to excessive noise. Populations in which hearing loss is of major prevalence include young children and aging adults. For children, language and general reading are delayed even for mild hearing losses (5). A hearing-impaired child may appear socially withdrawn, and may be mistakenly categorized as less intelligent, shy, learning disabled or

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lacking in motivation. Hearing impairment therefore constitutes a particularly serious impediment to the optimal development and education of a child. For aging adults, hearing impairment may produce psychosocial and emotional changes (6). Since communication is very valuable to a person's social, intellectual and emotional well being, the isolation caused by their impairment may be unbearable to the hearing impaired elderly and may affect his health and mental state.

The World Health Organization recognizes the significant public health impact of hearing loss and thus calls on its member states "to prepare national plans for the prevention and control of major causes of avoidable hearing loss, and for early detection in babies, toddlers and children, as well as in the elderly, within the framework of primary health care (7)." Among the various forms of intervention for the prevention of hearing loss, early screening offers the best method of prevention and early rehabilitation.

Methods of hearing screening for children include the auditory brainstem response (ABR), the behavioral observation audiometry (BOA), the visual reinforced observation audiometry (VROA), play audiometry, pure tone audiometry and tympanometry. For adults, pure tone audiometry with speech testing and tympanometry are usually done. All of these tests are done in a hospital or clinic setting where a sound treated audiometric room is needed. Unfortunately, there is an apparent lack of screening audiometric booths and an audiometer in most regional hospitals thus early screening of the populations at risk is not possible. This has been addressed by coming up with various forms of screening tests for hearing impairment. Abes, et al. recommended the use of the 512Hz tuning fork for mass hearing screening (8). Martinez et al. came up with the Ballpen Click Test and claimed that when compared to conventional audiometry as the gold standard, the test had a sensitivity of 73%, a specificity of 98.6% (3).

Community screening for hearing loss is affected by many factors, which include the audiologist, the method of screening, the instruments used, and the testing environment. According to the American Speech-Language-Hearing Association (ASHA) and the American National Standards Institute (ANSI), the allowable room noise level for screening at 20 dB is 41.5 dB at 500 Hz, 49.5 dB at 1000 Hz and 54.5 dB at 2000 Hz (9). In most hearing screenings surveys done, majority conducted their tests in a relatively quiet room, which may have variable ambient noise throughout the day and may affect test outcome. Thus, the importance of a portable, low-cost form of sound treated booth where field hearing screening can be done, cannot be over emphasized. The question that needs to be addressed therefore is "Can a locally designed, portable, low-cost screening audiometric booth attenuate ambient noise level to less than 40dB and can it achieve equally reliable hearing screening results when compared to a standard audiometric booth?" If the portable, low-cost booth can be evaluated as acceptable compared to a conventional audiometric booth, and found to have stable attenuation of noise levels in different testing environments, it can be used in nationwide screening for hearing loss among school children and adults alike. Researchers and health care professionals may be able to do various demographic studies. Such prevalence studies will aid in the planning of health services and programs to address the problem of hearing loss in the country.

OBJECTIVES OF THE STUDY

General Objective

To determine the attenuation of noise level of the designed audiometric booth and to determine the reliability of hearing screening results when compared to the standard audiometric booth of a tertiary hospital.

Specific Objectives

To test the efficiency of the designed low-cost portable screening audiometer booth by measuring noise levels internal and external to the booth and comparing it using the same parameters, to the audiometric booth of a tertiary hospital

To test the reliability of the hearing screening tests results using the designed booth by comparing it to the results from the standard booth as gold standard

METHODOLOGY

Phase I: Design of the Booth

A low-cost, locally designed audiometric booth was made in consultation with the College of Engineering of a major university (Appendix A). The booth was designed to be collapsible and portable, composed of 10 panels, 2 panels per side and 1 each for the ceiling and floor. Glass panel was fitted for the door so that ambient room lighting could peer in and also to be able to view the subject. The panels were designed to fit in the rear compartment of any standard vehicle. Each panel was connected with another with the use of a twist-lock mechanism and lined by a

rubber stripping material to provide a good approximation of the edges. The floor was designed to have 4 caster wheels, which could aid the examiners in transporting the booth.

Factors that determined the type of material used included 1). the transmission loss coefficients of the materials, 2). availability, 3). weight and 4). cost. Each panel was made up of 3 layers of materials, namely, plywood, 1½" in thickness which comprised the outer part, followed by ¼" fiberglass and lastly ½" thick acoustical foam. Assuming that there will be minimal air gaps in the construction and assembly of the booth, a noise attenuation of greater than 20dB can be expected (Appendix B). It will take two people five minutes to assemble the booth (Appendix C). A patent for the sound-treated booth is presently pending.

Phase II: Evaluation of the Sound-Treated Audiometric Booth

I. Levels of Noise Attenuation

The booth was evaluated to determine if the calculated noise attenuation levels were achieved and if these levels were acceptable for standard audiometric screenings. Using the Rion NA-20® sound level meter, ambient noise levels outside the booth were recorded by placing the sound level meter 1 foot away from the booth. Noise levels inside the portable booth and the standard audiometric booth of a tertiary hospital were determined by placing the sound level meter at the location of the patient's head and away from the examiner's body (10). These measurements were repeated for each test environment.

II. Validity of the Audiometric Booth

A. Subjects

Volunteer subjects underwent preliminary screening using the standard audiometric booth and the Siemens SD 100® Audiometer and the SD 25® Portable Audiometer. Subjects were asked to answer a questionnaire regarding prior history of ear discharge, tinnitus, intake of ototoxic drugs, co-existing medical illness, family history of deafness, vertigo, hearing loss, trauma or exposure to loud sounds. Each subject underwent otologic examination to ensure absence of cerumen.

B. Screening

Each subject would then undergo pure-tone screening using the designed audiometric booth and the Siemens SD25® Portable Audiometer in three different test areas. Noise levels outside and inside the booth will be recorded prior to any testing as detailed previously.

To eliminate variability of measurements, the study will employ only one kind of audiometer (Siemens SD25® Portable Audiometer) to evaluate the portable booth in all three test areas, and only one audiometrician for the whole study.

C. Statistical Analysis

Results of the study were encoded using Microsoft Excel 2000 and underwent paired t-test analysis using the SPSS for Windows version 10 program (Chicago, Illinois).

RESULTS OF THE STUDY

Forty volunteers were entered into the study. Eight failed to finish the series of tests and thus were not included in the final analysis. The ages of the 32 volunteers ranged from 21 to 33 with a mean age of 26.2 years. There were 17 male and 15 female subjects. Three (9%) had a history of occasional mild tinnitus, 1 (3%) had a medical history of food allergy, and 9 (28%) had occasional exposure to loud noises. All of the volunteers had no history of ear discharge, intake of ototoxic drugs, hearing loss, vertigo, trauma or any family history of deafness. All had normal otoscopy findings at the time of screening.

Based on the pure tone audiometry using the Siemens SD1000® audiometer and the standard audiometric booth, all 32 volunteers had normal hearing thresholds from 250 Hz up to 8000 Hz. Pure tone averages (500, 1000 and 2000 Hz) ranged from 6.67 dB to 25.33 dB with a mean of 15.11 dB.

A comparison of the hearing thresholds using the standard audiometric booth but this time using the Siemens SD25® portable audiometer showed higher values compared to the Siemens SD1000®. Pure tone averages for the SD 25 ranged from 15.00 dB to 38.33 dB with a mean of 26.85 dB.

Using the portable audiometric booth, all volunteers were subsequently tested in three different areas with varying ambient noise levels to simulate various testing environments. Mean ambient noise levels internal and external to the portable booth were recorded using the Rion NA-20® sound level meter and shown in table 1.

Table 1: Comparison of Ambient Noise Levels (in dB)

	External Noise Level	Internal Noise Level	Level of Noise Attenuation
Standard Booth	40.5	29.0	11.5
Portable Booth - Area 1	40.5	30.5	10.0
Portable Booth - Area 2	65.5	48.0	17.5
Portable Booth - Area 3	78.5	54.0	24.5

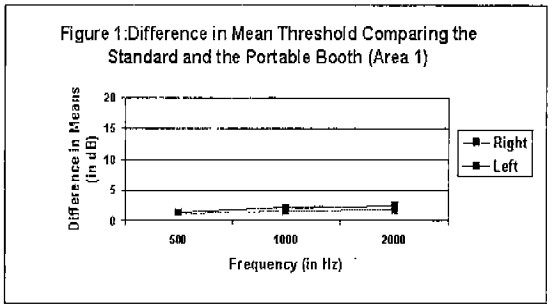
Results showed that the portable audiometric booth was able to attenuate noise from 10.0 dB to 24.5 dB. These measurements are in agreement to the estimated noise level attenuation of 20 dB based on the design and choice of materials for the portable booth.

Pure tone averages using the Siemens SD25® portable audiometer in different areas are shown in Table 2. Results showed that the pure tone averages generally tend to increase as the ambient noise levels increase.

Table 2: Distribution of Mean Pure Tone Thresholds (in dB) Across 500, 1000 and 2000 Hz According to the Type of Booth and Test Areas

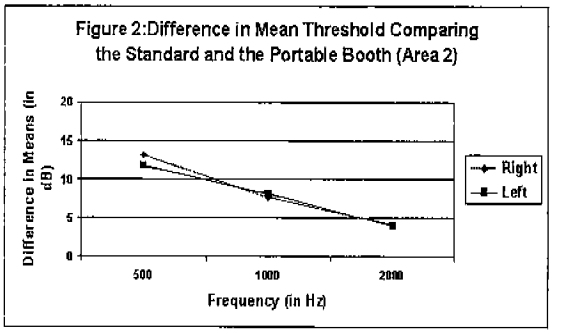
	Right Ear	Left Ear
Standard Booth	27.40	26.30
Portable Booth – Area 1	28.91	28.33
Portable Booth – Area 2	35.68	34.22
Portable Booth – Area 3	39.27	35.42

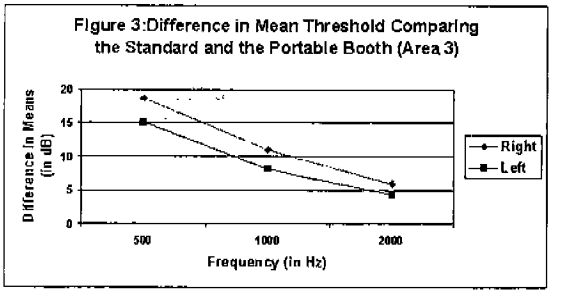
Figure 1 shows the difference of means of the hearing thresholds comparing the standard audiometric booth and the portable audiometric booth done in Test Area 1 where the internal ambient noise level was measured to be about 30 dB. Results showed that at this ambient noise level, there was no significant clinical difference (< 5dB) between the measurements using the standard booth and the portable booth.



Figures 2 and 3 show the difference of means of the hearing thresholds comparing the standard audiometric booth and the portable audiometric booth done in Test Area 2 and 3, respectively. Internal ambient noise levels in both test areas were above 40 dB, which exceed the maximum permissible ambient noise levels for audiometric test booths. Both results showed a clinically significant difference in the measurements (> 5dB), with Test Area 3 having a higher difference in means. It should also be noted that an increase in the ambient noise level significantly affects the hearing thresholds in the lower frequencies first.

Volunteers reported minimum discomfort caused by humid conditions inside the booth. Since the screening only took a maximum of 3 minutes, the discomfort was deemed tolerable.





DISCUSSION

According to the field guide for audiometric test booth certification released by the United States Navy Environmental Health Center for Hearing Conservation, the validation study should be conducted during external noise conditions, which are representative of the anticipated testing conditions (10). This study employed screening using the designed portable audiometric booth and subjecting the booth to varying ambient noise levels. The booth was subjected to a maximum ambient noise level of 78.5 dB and was able to attenuate the noise level by 24.5 dB. Maximum permissible ambient noise levels for audiometric test booths based on the guidelines of the American National Standards Institute (ANSI) and the American Speech-Language-Hearing Association (ASHA) are listed in table 3 (11). Note that the allowable noise level tends to increase as the frequency increases. Since the ambient noise level attenuation that can be provided by the designed portable booth is approximately 20 dB, external ambient noise levels during field-testing should not exceed 60 db for the booth to be acceptable on ANSI and ASHA standards.

Table 3: Maximum Permissible Ambient Noise Levels For Audiometric Test Booths for Screening at 20dB

	Allowable Noise Level (in dB)
500 Hz	41.5
1000 Hz	49.5
2000 Hz	54.5
4000 Hz	62.0

In order for the designed portable booth to be of significance when used for hearing screenings, it should be used in conditions similar to conditions at the time of validation (10). As previously mentioned, external ambient noise levels should not exceed 60 dB for the results of hearing thresholds to be acceptable. Ambient noise levels above 60 dB will yield higher thresholds, which may not reflect the true threshold of the patient. Measures to decrease ambient noise, especially in the low frequencies, include turning room fans and electrical lightings off when possible, checking for door seal problems, and assessing the jack panel which can be a source of recurring ambient noise interference. Providing chairs or stools of sturdy metal construction that will not squeak or make any other noise can also lessen noise internal to the booth. Additional carpeting or rubber mats can further dampen the internal noise. If these measures do not adequately reduce the ambient noise to allowable levels, another option is to relocate to another test area (10). A final option when the ambient noise levels exceed the ANSI and ASHA criteria are the use of insert earphones for pure tone screening (12).

The study was limited because of the sample size of available volunteers. Future validation studies should include more volunteers both with normal and abnormal hearing thresholds. Also, measurements of ambient noise levels should be done across all frequencies. This is to further evaluate the ability of the portable booth to attenuate sound per frequency level. Lastly, proper calibration of the Siemens SD25® portable booth should be made against the Siemens SD1000® so that results from the portable audiometer would approximate the true hearing threshold of the subjects.

The designed portable, low-cost audiometric booth was evaluated to be acceptable compared to a standard audiometric booth as long as the ambient external noise levels do not exceed 60dB. Using this booth, researchers and health care professionals may be able to do various demographic studies and nationwide screening for hearing loss among children and adults will be possible. There will be no more shortage of accurate epidemiological information on the prevalence, risk factors and costs of hearing loss in our country. Such prevalence studies will aid in the planning of health services and programs to address the problem of hearing loss in the country and to allow our fellow Filipinos to be truly productive citizens of our country.

CONCLUSION

The designed low-cost portable audiometric booth for hearing screening was able to attenuate ambient noise levels up to 24.5 dB. Results using the portable booth and the Siemens SD25® portable audiometer had no difference when compared to the standard audiometric booth if the ambient noise levels did not exceed 40 dB. This is in agreement with the maximum permissible ambient noise level for audiometric booths for hearing screening set by the ANSI and ASHA.

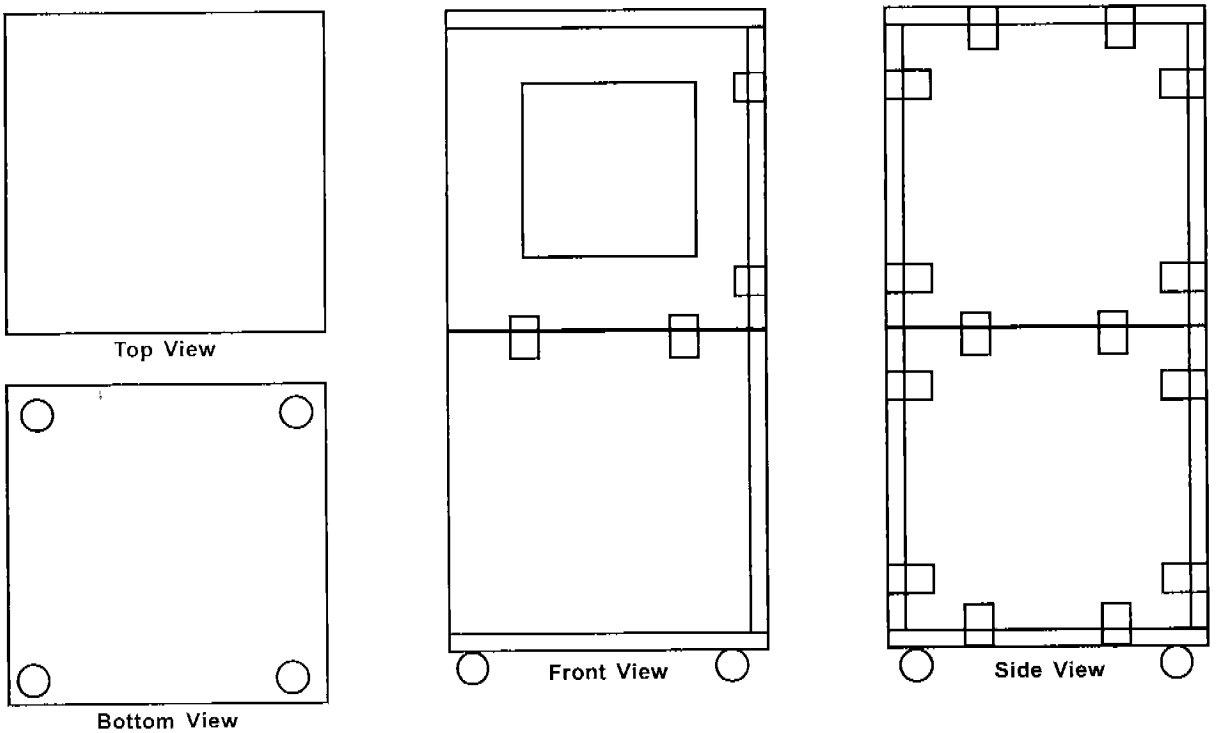
Future studies should include testing the portable booth in actual test sites (i.e. schools and factory buildings) to further evaluate its design and efficiency. It is also recommended that the portable booth be tested on patients with normal and abnormal hearing thresholds to assess its reliability in screening patients. Lastly, the design of the portable booth should be further evaluated. Alternative materials and design should be considered in order to come up with a more efficient and reliable audiometric booth for hearing screening.

BIBLIOGRAPHY

1. Noise-induced hearing loss. Healthlink Medical College of Wisconsin. Available from: URL: http://healthlink.mcw.edu/article/965928293.html.
2. Esguerra JL. Hearing impairment in Filipinos. Philippine Institute for the Deaf. Available from: URL: http://members.flash.net.ph/~pid/research.htm.
3. Martinez NV. Prevention of Deafness Program in the Philippines. Hearing and Deafness Center. Available from: URL: http://www.ifhoh.org/Filipino-2.htm.
4. Ledesma NR. Hearing loss: Silent epidemic in school. Ledesma Audiological Center, Inc. Available from: URL: http://www.ledesma.com.ph/newsart1.htm.
5. Northern JL and Downs MP. Hearing in children. 5th ed. Baltimore (MD): Williams and Wilkins; 2001
6. Alvord LS. Screening for hearing loss in the general population. Handtronix. Available from: URL: http://www.handtronix.com/webdat/pages/papers/screeningloss.htm
7. World Health Organization. Prevention of noise-induced hearing loss: Report of an informal consultation. Available from: URL: http://www.who.int/pbd/pdh/Docs/NOISE_Cover_sum.html
8. Abes GT. Accuracy and predictive values of the 512Hz tuning fork compared with screen-

ing and diagnostic audiometer for air conduction test. Ear Institute. Available from: URL: http://www.upm.edu.ph/earinstitute/abstracts.htm.
9. ANSI S3.1 (R1999). American national standard criteria for permissible ambient noise during audiometric testing. American National Standards Institute, New York.
10. Field guide to audiometric test booth certification. Navy Occupational and Environmental Medicine. Available from: URL: http://www.nehc.med.navy.mil/occmed/AUDIOMETRIC_TEST_BOOTH_CERTIFICATION.doc
11. Frank T. ANSI update: Maximum permissible ambient noise levels for audiometric test rooms. American Speech-Language-Hearing Association. Available from URL: http://www.asha.org/NR/rdonlyres/3CABA588-434D-4973-8885-A79FB-51EDAC5/0/2901_pdf.
12. Lankford JE and Hopkins CM. Ambient noise levels in nursing homes: Implications for audiometric assessment. American Speech-Language-Hearing Association. Available from URL: http://www.asha.org/NR/rdonlyres/74AFF14C-C6OA-432F-9C3F-CBA3933D7923/0/2884_1.pdf.

APPENDIX: A Schematic Diagram of the Audiometer Booth



APPENDIX B: Transmission Loss Coefficients of the Materials Used for the Design of the Audiometer Booth

Table 1: Transmission Loss Coefficient (TLC) for Plywood (1 ½ inch thick, 2lb/sq. ft)

Frequency	125	250	500	1000	2000	4000	8000
TLC (in dB)	24	22	28	25	27	35	25

Table 2: Transmission Loss Coefficient (TLC) for Fiberglass (1/2 inch thick)

Frequency	125	250	500	1000	2000	4000	8000
TLC (in dB)	23	29	33	34	36	38	31

Note: The booth will be using a thinner fiberglass (1/4 inch thick). Expect the TLC to decrease by about 3-6dB.

Table 3: Transmission Loss Coefficient (TLC) for Window Glass Plate (1/8 inch thick)

Frequency	125	250	500	1000	2000	4000	8000
TLC (in dB)	15	23	26	30	32	30	29

Note: The booth will be using a thicker glass plate (1/4 inch thick). Expect the TLC to increase by about 3-6dB.

APPENDIX D: Results of Statistical Analysis

Table 1: Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	R500	28.1250	32	5.92289	1.04703
	A1R500	29.3750	32	4.87753	.86223
Pair 2	R1000	28.7500	32	6.09071	1.07670
	A1R1000	30.3125	32	6.34206	1.12113
Pair 3	R2000	25.3125	32	7.17719	1.26876
	A1R2000	27.0313	32	6.82256	1.20607
Pair 4	L500	27.5000	32	6.47576	1.14476
	A1L500	28.9063	32	5.03766	.89054
Pair 5	L1000	27.1875	32	5.81121	1.02729
	A1L1000	29 3750	32	5.92289	1.04703
Pair 6	L2000	24.2188	32	6.10518	1.07925
	A1L2000	26.7188	32	6.79295	1.20084
Pair 7	R500	28.1250	32	5.92289	1.04703
	A2R500	46.8750	32	8.00705	1.41546
Pair 8	R1000	28.7500	32	6.09071	1.07670
	A2R1000	39.6875	32	6.46797	1.14339
Pair 9	R2000	25.3125	32	7.17719	1.26876
	A2R2000	34.3750	32	8.46831	3.61832
Pair 10	L500	27.5000	32	6.47576	1.14476
	A2L500	42.5000	32	7.62001	1.34704
Pair 11	L1000	27.1875	32	5.81121	1.02729
	A2L1000	35.3125	32	4.20013	.74249
Pair 12	L2000	24.2188	32	6.10518	1.07925
	A2L2000	28.4375	32	6.27816	1.10983
Pair 13	R500	28.1250	32	5.92289	1.04703
	A3R500	46.8750	32	8.00705	1.41546
Pair 14	R1000	28.7500	32	6.09071	1.07670
	A3R1000	39.6875	32	6.46797	1.14339
Pair 15	R2000	25.3125	32	7.17719	1.26876
	A3R2000	34.3750	32	8.46831	3.61832
Pair 16	L500	27.5000	32	6.47576	1.14476
	A3L500	42.5000	32	7.62001	1.34704
Pair 17	L1000	27.1875	32	5.81121	1.02729
	A3L1000	35 3125	32	4.20013	.74249
Pair 18	L2000	24.2188	32	6.10518	1.07925
	A3L2000	28.4375	32	6.27816	1.10983

Legend

R500, R1000, R2000	Mean thresholds per frequency for the right ear using the standard booth
L500 L1000, L2000	Mean thresholds per frequency for the left ear using the standard booth
A1R500, A1R1000,A1R2000	Mean thresholds per frequency for the right ear using theportable booth in Area 1
A1L500, A1L1000,A1L2000	Mean thresholds per frequency for the left side using the portable booth in Area 1
A2R500, A2R1000,A2R2000	Mean thresholds per frequency for the right ear using the portable booth in Area 2
A2L500, A2L1000, A2L2000	Mean thresholds per frequency for the left side using the portable booth in Area 2
A3R500, A3R1000, A3R2000	Mean thresholds per frequency for the right ear using the portable booth in Area 3
A3L500, A3L1000, A3L2000	Mean thresholds per frequency for the left side using the portable booth in Area 3

Table 2: Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	R500-A1R500	-1.2500	4.39941	.77771	-2.8362	.3362	-1.607	31	.118
Pair 2	R1000-A1R1000	-1.5625	3.46352	.61227	-2.8112	-.3138	-2.552	31	.016
Pair 3	R2000-A1R2000	-1.7188	4 68515	.82822	-3.4079	-.0296	-2.075	31	.046
Pair 4	L500-A1L500	-1 4063	4.44217	.78527	-3.0078	.1953	-1.791	31	.083
Pair 5	L1000-A1L1000	-2.1875	3.79675	.67118	-3.5564	-.8186	-3.259	31	.003
Pair 6	L2000-A1L2000	-2.500	4.39941	.77771	-4.0862	-.9138	-3.215	31	.003
Pair 7	R500-A2R500	-18.7500	9.41858	1.66499	-22.1458	-15.3542	-11.261	31	.000
Pair 8	R1000-A2R1000	-10.9375	7.66617	1.35520	-13.7014	-8.1736	-8.071	31	.000
Pair 9	R2000-A2R2000	-9.0625	8 61308	1.64391	-16.4943	-1.6307	-2.487	31	.018
Pair 10	L500-A2L500	.15.000	9 33257	1.64978	-18.3647	-11.6353	-9.092	31	.000
Pair 11	L1000-A2L1000	-8 1250	5 92289	1.04703	-10 2604	-5 9896	-7.760	31	.00
Pair 12	L2000-A2L2000	-4.2188	5.69513	1.00677	-6.2721	-2.1654	-4.190	31	.000
Pair 13	R500-A3R500	-18.7500	9.41858	1.66499	-22.1458	-15.3542	-11.261	31	.000
Pair 14	R1000-A3R1000	-10.9375	7.66617	1.35520	-13.7014	-8.1736	-8.071	31	.000
Pair 15	R2000-A3R2000	-9 0625	8 61308	1.64391	-16.4943	-1.6307	-2.487	31	.018
Pair 16	L500-A3L500	-15 0000	9.33257	1.64978	-18.3647	-11.6353	-9.092	31	.000
Pair 17	L1000-A3L1000	-8.1250	5.92289	1.04703	-10.2604	-5.9896	-7.760	31	.000
Pair 18	L2000-A3L2000	-4.2188	5 69513	1.00677	-6.2721	-2.1654	-4.190	31	.000

Legend

R500 R1000, R2000	Mean thresholds per frequency for the right ear using the standard booth
L500, L1000 L2000	Mean thresholds per frequency for the left ear using the standard booth
A1R500 A1R1000 A1R2000	Mean thresholds per frequency for the right ear using the portable booth in Area 1
A1L500, A1L1000, A1L2000	Mean thresholds per frequency for the left side using the portable booth in Area 1
A2R500, A2R1000, A2R2000	Mean thresholds per frequency for the right ear using the portable booth in Area 2
A2L500, A2L1000, A2L2000	Mean thresholds per frequency for the left side using the portable booth in Area 2
A3R500, A3R1000, A3R2000	Mean thresholds per frequency for the right ear using the portable booth in Area 3
A3L500, A3L1000, A3L2000	Mean thresholds per frequency for the left side using the portable booth in Area 3

Table 4: Acoustic Absorption Coefficient (AAC) for Acoustical Foam (½ inch thick, open cell)

Frequency	125	250	500	1000	2000	4000	8000
AAC	.35	.51	.82	.98	.97	.95	.82

APPENDIX C: Photos

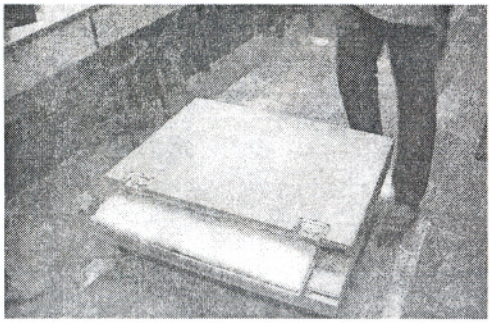


Photo 1: Lower Half of Booth, Unassembled

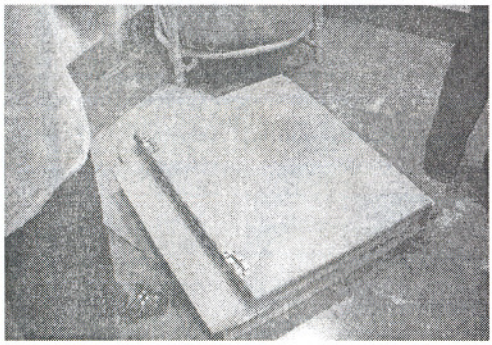


Photo 2: Upper Half of Booth, Unassembled

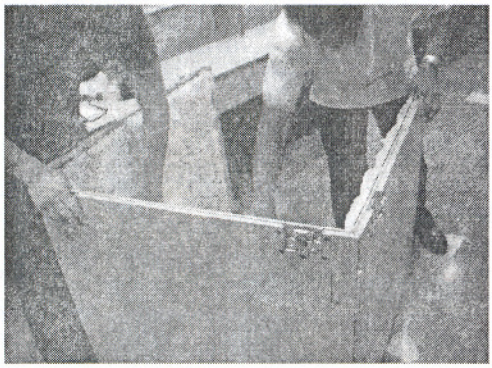


Photo 3: Lower Half of Booth being assembled

Photo 4: Upper Half of Booth being assembled

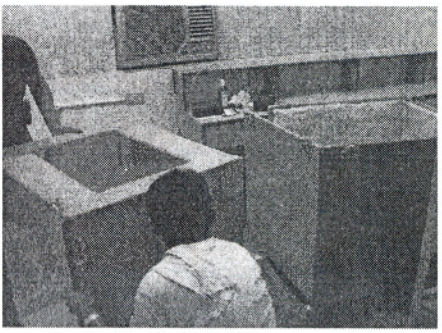


Photo 5: Both halves assembled

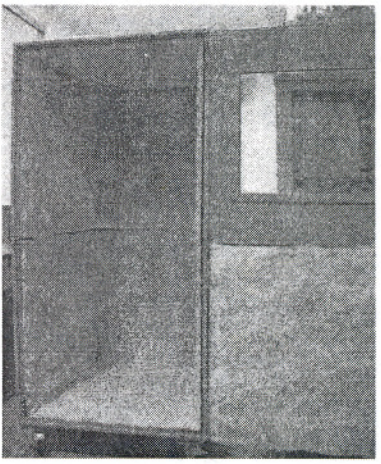


Photo 6: Completed booth with door open

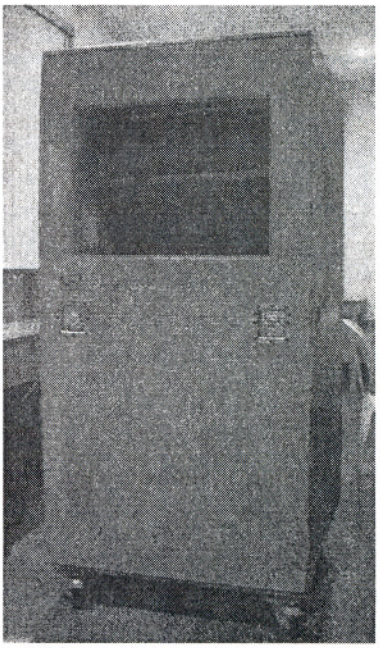


Photo 7: Completed booth with door closed

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A PRELIMINARY DESCRIPTIVE STUDY OF SUPRACRICOID LARYNGECTOMY WITH CRICOHYOIDOEPIGLOTTOPEXY (SCL-CHEP) AMONG LARYNGEAL CARCINOMA PATIENTS AT A TERTIARY HOSPITAL IN METRO MANILA FROM 1998-2002*

ERWIN M. ESLAVA, MD**
ALFREDO Q.Y. PONTEJOS JR., MD, FPSO-HNS***

ABSTRACT

BACKGROUND: Supracricoid laryngectomy with cricohyoidoepiglottopexy is a procedure that involves resecting the entire thyroid cartilage while preserving the cricoid cartilage, hyoid bone and at least one (1) arytenoid. The reserved hyoid bone is then approximated to the cricoid cartilage.
OBJECTIVE AND METHOD: In order to assess whether this procedure could successfully preserve laryngeal and esophageal functions, 9 patients with laryngeal cancers who underwent supracricoid partial laryngectomy with cricohyoidoepiglottopexy (SCPL-CHEP) in a tertiary institution from 1998-2002 were studied.
RESULTS: All laryngeal cancer cases investigated were squamous carcinoma by histology, 78% of which were well differentiated while the rest were moderately differentiated. Majority of the patients operated on were on Stage 2 of the disease and most of their lesions were confined to the glottic region. Only 22% underwent some form of neck dissection while the rest had none. All patients eventually resumed normal swallowing and satisfactory perceptible voice was achieved. Two patients had recurrences and one died of the disease.
CONCLUSION: Regardless of these setbacks, our results are very promising despite a limited number of patients. Postoperative responses among the patients proves that such a procedure could have satisfactory outcomes in terms of local control of the disease as well as in preserving laryngeal functions.

INTRODUCTION

Laryngeal cancer is one of the most common cancers in our country, ranking 4th among all cancers of the body. In fact, it is one of the most common malignant cancers in the head and neck region. Worldwide, it represents 1 – 2% of all cancers in the body. Local studies have reported that there is about 1:100,000 cases each year and the number has been increasing over the years due to the growing incidence of laryngeal carcinomas in women.

In 1998, our institution decided to treat selected cases of laryngeal squamous carcinoma with suprarcricoid laryngectomy with cricohyoidoepiglottopexy (SCL-CHEP). Ever since it was introduced by Mejer and Rieder in 1959 and as later refined by Piquet in 1974, SCL-CHEP has become a surgical alternative to the conventional partial laryngectomies (vertical and horizontal) and total laryngectomies for moderately advanced laryngeal carcinoma. It involves resecting of the entire thyroid cartilage, paraglottic space and pre-epiglottic space. The cricoid, hyoid bone and at least 1 arytenoid are spared. The reserved hyoid bone is then approximated to the cricoid cartilage as partial laryngeal resection of carcinoma in which the final

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reconstruction was accomplished by suturing the hyoid bone to the cricoid cartilage. (1)

Supracricoid laryngectomy with CHEP has been advocated in selected patients with supraglottic, glottic and transglottic carcinoma of the larynx to asses whether it could successfully reach local control and cure while preserving the voice and physiologic swallowing. (2,3) A number of retrospective studies have been established to assess oncologic efficiency in the treatment of laryngeal carcinoma. The European Otolaryngologist- Head and Neck surgeons have used this procedure since 1974 with good functional results and oncologic safety. (4)

The indications for the procedure has been established by Laccoureye et. al, which include the following (2,3): (1) T2 supraglottic lesions with paraglottic involvement; ventricle invasion, extension to a vocal cord or impaired vocal cord mobility; (2) T3 supraglottic and glottic lesions with vocal cord fixation and or pre-epiglottic space invasion; (3) T4 lesions limited to the thyroid cartilage and (4) anterior commissure lesions with pre-epiglottic space invasion (T3). If the indications are favorable, supracricoid partial laryngectomy with CHEP has a success rate similar to that of total laryngectomy while preserving speech and avoiding permanent tracheostomy.

SIGNIFICANCE OF THE STUDY

To date, there are no local studies to show the applications and success rate of such a procedure in the local setting. In order to assess whether supracricoid laryngectomy will provide eradication of the disease while preserving the voice in laryngeal cancer, we studied nine patients with squamous carcinoma of the larynx surgically treated with supracricoid laryngectomy with CHEP.

OBJECTIVES

General

1.To review the profiles of laryngeal carcinoma patients who underwent supracricoid partial laryngectomy at a tertiary hospital in Metro Manila;

2.To assess whether supracricoid laryngectomy with CHEP could successfully preserve laryngeal and esophageal functions of all post operative patients who underwent the procedure.

Specific

1.To describe the patients as to age, gender and risk factors;

2.To determine the clinical characteristics of the disease such as staging of the disease, histologic differentiation, site and extent of the lesion;

3.To determine the proportion of patients who underwent neck dissection and the duration of nasogastric tube and tracheostomy tube removal.

METHODOLOGY

This is a descriptive study (chart reviews) of 9 patients with laryngeal cancers, who were surgically treated between 1998 through 2002 at a tertiary institution.

RESULTS

The mean age was 62 yrs old (range 50 to 73). Seven patients were male and 2 were female. Eight of the patients were heavy smokers (~ 20-40 pack years) and only 1 patient was a non-smoker. The histologic findings in all cases demonstrated squamous cell carcinoma (SCCA) of various degrees of differentiation, majority of which were well differentiated SCCA (7 patients) and moderately differentiated SCCA (2 patients) (Table 1). Seven patients had their laryngeal cancers confined to the glottis while two patients had their tumor located in the supraglottic region. Review of the final official histopathology report revealed negative tumor margins in all the specimens received.

Table 1. Degree of differentiation for Squamous Cell Carcinoma

Histologic Differentiation	No. of Patients (n=9)	%
Well Differentiated	7	78
Moderately Differentiated	2	22

All patients were carefully evaluated before surgery. The decision to perform a supracricoid laryngectomy with cricohyoidoepiglottopexy was based on the location and extent of the tumor on initial laryngeal examination and on intraoperative findings during suspension laryngoscopy. The classifications on TNM Staging were based on the AJCC –1997. We classified 1 patient as T1bN0M0, 7 patients as T2N0M0 and 1 patient as T3N0Mx. (Table 2)

At the time of this study, the only patient with a T2 supraglottic carcinoma eventually underwent completion laryngectomy because of recurrent disease and was subjected to postoperative radiotherapy. Another patient had

unilateral nodal recurrences and underwent radical neck dissection.

Table 2.Site and Stage of Squamous cell carcinoma

Location	T1bN0M0	T2N0M0	T3N0M0
Supraglottic	-	1	1
Glottic	1	6	-

Two patients had unilateral selective neck dissections while the rest did not have any form of neck dissection. (Table 3)

Table 3. Proportions of Patients with Neck Dissection

	No. of patients (n=9)	%
Selective Neck Dissection	2	22
Modified Radical Neck Dissection	0	0
None neck dissection	7	78

There were no operative and perioperative deaths that occurred within 30 days of surgery. There were also no reported cases of immediate postoperative complications. However, there was one case where the nasogastric tube was accidentally pulled out and the patient was subjected to parenteral nutrition for 2 weeks. All postoperative patients encountered some difficulties with breathing and swallowing because of edema of the arytenoids. However, they were managed successfully with steroids and decannulation was possible in all cases. The median time from the laryngectomy to decannulation was 20 days (range 10 to 30 days). **(Table 4)**

Table 4. Duration of Tube Removal

	Tracheostomy Time (Days)	Nasogastric Time (Days)
Tube Removal	10-30	10 -23

All patients eventually resumed adequate oral diet, although delayed swallowing and recurrent aspiration were initially common. The removal of nasogastric tube was successfully accomplished by the end of the first postoperative month. None of the patients underwent gastrostomy.

The mean length of hospitalization was 23 days (range 5- 44 days). Hospital days were prolonged in some patients due to either delayed swallowing or aspiration problems.

Although, there were no objective voice analyses used, voice quality of patients were harsh or breathy but were perceptually judged as satisfactory despite the absence of any speech therapy thereby allowing normal social interaction. Intensive postoperative speech therapy may play a major role in the successful functional outcome after SCPL-CHEP but unfortunately this was not a meaningful option for our patients because of non-compliance and poor follow up.

DISCUSSION

The standard treatment for patients with advanced laryngeal cancer is still total laryngectomy, especially in our institution where most of our cases seen at the outpatient department were already in their advanced stages. However, recently there has been an increased emphasis on the awareness of the quality of life assessment as an important outcome measure following radical surgery. Some patients are willing to sacrifice a portion of the probability of cure by choosing an alternative treatment that is more successful at preserving function. Thus, supracricoid laryngectomy with cricohyoidoepiglottopexy as a primary treatment modality presents a reasonable alternative. In some selected cases with laryngeal cancer, this procedure offers good prospect of cure without sacrificing the entire larynx.

In our institution, we began treating selected cases of laryngeal cancers mostly at stage 2 or stage 3 of the disease. Nine patients underwent supracricoid laryngectomy with cricohyoidoepiglottopexy. The use of this technique allows the patient to keep a normal airway and permits swallowing while maintaining a reasonable voice. Despite performing a less radical procedure, the 3-year survival rate is about 75 – 84.2% as reported by other authors (5). Local recurrences are about 7.1% as reported by Vincetiis et. al (6), local failure and neck failure rate was found to be 7% and distant failure rate was 4% in a study by Weinstein in 2001 (7).

Supraglottic lesions with neck node metastasis usually caries a poorer prognosis and indeed 2 of our patients with T2 lesions had local and nodal recurrences. As a preventive measure many authors advocate the use of bilateral selective neck node dissection (levels II, III, IV) for supraglottic lesions and unilateral neck dissection for glottic lesions for a N0 neck (7). For N+ disease, a more extensive neck dissection needs to be performed (usually an MRND or RND). In our study, only 2 patients with supraglottic lesion had a neck dissection, a T2 lesion with suspected paratracheal node intraoperatively and a T3 lesion underwent unilateral selective neck dissection. However, there was one study by

Vincentiis et. al stating that the presence of N2 disease in the neck is a contraindication of SCL-CHEP (8).

In this study, two patients had local and nodal recurrences respectively. One patient required completion laryngectomy as salvage procedure because of recurrence of the disease. The other patient who had a T2 lesion underwent SCL-CHEP without neck dissection and postoperative radiotherapy. The patient came back and had extensive neck node metastasis and was managed palliatively with radical neck dissection plus radiotherapy.

The most important major complication of SCL is intractable aspiration resulting in prolonged tracheostomy and a permanent gastric feeding tube secondary to swallowing impairment or a completion laryngectomy (9). Delayed decannulation may also result from edema or stenosis. Other complications include bleeding, infection, and fistula formation as well as laryngeal stenosis, hoarseness and inadequate voice. Fortunately, all of our patients had normal swallowing by the end of four to six weeks post-operatively and no permanent gastrostomy was performed. Furthermore, normal airway was achieved after successful decannulation and voice quality was subjectively perceived as adequate.

In a study by Laccourreye in 1990, the average time to decannulation was 7 to 10 days. The nasogastric tube was left in place on average for 15 days. Normal deglutition defined by no weight loss or aspiration pneumonia was attained by 75% of patients by the end of the first post-operative month. In our own series, the median time for decannulation and nasogastric tube removal was 20 days and 24 days respectively. This was longer than in other studies, which can be explained by the low performance status of our patients such as undernourishment and non-compliance to medications. Normal deglutition was also achieved by 75% of our patients within 1month postoperatively. These results are comparable to other studies (10).

CONCLUSION AND RECOMMENDATION

Our results with supracricoid partial laryngectomy with CHEP are very encouraging. The technique is a valuable alternative to radiotherapy for T2-T3 glottic or supraglottic squamous cell carcinomas and even for a more radical surgery such as the classic total laryngectomy because it allows for preservation of a good laryngeal function and local control of the disease. Although no statistically valid statement could be made about a very small group, further researches are necessary before definite conclusions can be made.

BIBLIOGRAPHY

1. Piquet JJ, Desau;ty A, Decroix G.. La Crico-hyoido-epiglotto-pexie. Technique operatoire et resultatsfonctionnels. Ann. Otolaryngol 1974; 91:681-6.
2. Laccourreye H, Laccourreye O, Weinstein G, et. al. Supracricoid laryngectomy with cricohyoidopexy: a partial laryngeal procedure for selected supraglottic and transglottic carcinomas. Laryngoscope 1990; 100:735-41.
3. Laccourreye H, Laccourreye O, Weinstein G, et. al. Supracricoid laryngectomy with cricohyoidopexy: a partial laryngeal procedure for glottic carcinomas. Ann Otol. Rhinol Laryngol, 1990;99: 421-26.
4. Brasnu D, Menard M, Fabre A, et al. Partial supracricoid laryngectomies: techniques, indications and results. J. Otolaryngol 1988; 17:173-78.
5. Laccourreye O, Weinstein G, Naudo P. Supracricoid laryngectomy after failed laryngeal radiation therapy. Laryngoscope 1996; 106:495-98.
6. Vincentiis, Marco, et.al., Supracricoid laryngectomy with cricohyoidopexy in the treatment of laryngeal cancer: a functional and oncological experience. Laryngoscope. 106: 1108-1114
7. Weinstein, Gregory, et.al., Laryngeal preservation with supracricoid partial laryngectomy results in improved quality of life when compared with total laryngectomy. Laryngoscope. 2001; 111: 191-199.
8. Adamopoulos G, Yiotakis J, Pelagia S, et. al. Modified supracricoid partial laryngectomy with cricohyoidopexy: Series report and analysis of results. Otolaryngology-Head And Neck Surgery. 123; no. 3: 288-93.
9. Naudo, Philippe, et.al., Complications and functional outcome after supracricoid partial laryngectomy with cricohyoidoepiglottopexy. Otolaryngology-Head and Neck Surgery. 118; no.1: 124-129.
10. Bron,Luc, et.al., Supracricoid partial laryngectomy with cricohyoido-epiglottopexy and cricohyoidopexy for glottic and supraglottic carcinomas. Laryngoscope. 111: 627-634.

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COMPUTED TOMOGRAPHIC ANALYSIS OF PARANASAL SINUS ANATOMIC VARIATIONS AMONG FILIPINOS*

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PETER SIMON JARIN, MD***

ABSTRACT

OBJECTIVE: To determine prevalence of the different bony anatomic variations and mucosal abnormalities among Filipino patients seen in a tertiary hospital.
STUDY DESIGN: Descriptive Study
SETTING: This study was conducted at the Radiology department of said hospitalwhere evaluation of high resolution PNS CT was performed by the investigators.
PATIENTS:

a. Inclusion criteria: 1.Patients were randomly selected from a pool of subjects who had a computed tomography scan of the paranasal sinuses (screening coronal) done within the last two years.
b. Exclusion criteria: 1. Patients of foreign nationality 2. Previous nasal surgery

RESULTS: A total of 51 plates were evaluated, this number was multiplied by 2 to represent both nasal cavities giving a total population of 102. This was however not done for the variants olfactory fossa type and septal deviation. Results showed the incidence of the following variants: Agger Nasi Cells=86%, Ethmoid Bulla=97%, Haller Cells=28%, most common Recessus Terminalis of the Uncinate Process=75%(Lamina Papyracea), most common Olfactory Fossa Type I=15.6%, Floating Ant Ethmoid Artery= 65.6%, Normal Middle Turbinate=73.5%, Type 1 Septal Deviation was more common=54.9%, Dehiscence of Lamina Papyracea=37%, Bulging Orbital Contents=22%, Pneumatized Crista Galli=98%, Hypoplasia of a paranasal sinus was a rare occurrence=2.9%(all involving the Frontal Sinus).
CONCLUSION: High resolution PNS screening coronal is an important tool in determining the different anatomic variants which will make for better pre-operative planning.

INTRODUCTION

A considerable number of literature has been published describing in detail the different anatomic variants and mucosal abnormalities in the nasal cavity, their prevalence and effect on nasal surgery. But to our misfortune, most of these studies were done on foreign subjects. However, in recent years a growing interest in the utilization of high resolution PNS CT scan as an indispensable diagnostic tool and adjunct to surgery has gained considerable ground in our country.

To date, only a handful of local studies have been done with regards to this topic and it is the intention of this paper to hopefully make a significant contribution to this growing pool of knowledge.

It is the belief of the authors that Asian, specifically Filipino nasal anatomy is unique and thus warrants special attention. Knowledge of the more common variants would be a great boon to the practice of Rhinology in our country, not only for the Otolaryngologist but more importantly for our patients in the local setting, as this would hopefully result in more efficient management with a decreased incidence of intra and post-operative complications. Herein lies the importance of this study.

GENERAL OBJECTIVE

To determine the prevalence of bony anatomic variations and mucosal abnormalities among Filipinos using high resolution computed tomographic scanning.

SPECIFIC OBJECTIVES

To determine the prevalence of the following:
1. Agger Nasi Cells
2. Enlarged Ethmoid Bulla

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3. Recessus terminalis of the uncinate process
   a. Lamina papyracea (LP)
   b. Skull base (SB)
   c. Middle turbinate (MT)
   d Combined (C)
4. Olfactory fossa (Ethmoid Roof) type (Keros)
   a. I-III
   b. Asymmetric
5. Floating Anterior Ethmoid Artery Canal
6. Middle turbinates
   a.Paradoxical Middle Turbinate (PMT)
   b.Concha Bullosa (unilateral vs. bilateral) (CB)
   c.Lamellar cell (LC)
   d.Laterally bent middle turbinate (LMT)
   e.Double attachment (DA)
7. Haller cells
8. Nasal septal deviation (Mladina)
   a. Type I-VII
9. Hypoplasia of:
   a. Maxillary sinus (MS)
   b. Frontal sinus (FS)
   c. Sphenoid sinus (SS)
10. Dehiscence of lamina papyracea
11. Bulging of orbital contents medially
12. Pneumatized crista galli

Significance:

1.) To provide awareness of the different anatomic variants and mucosal abnormalities among Filipinos which is crucial in pre-operative planning for any nasal surgery.

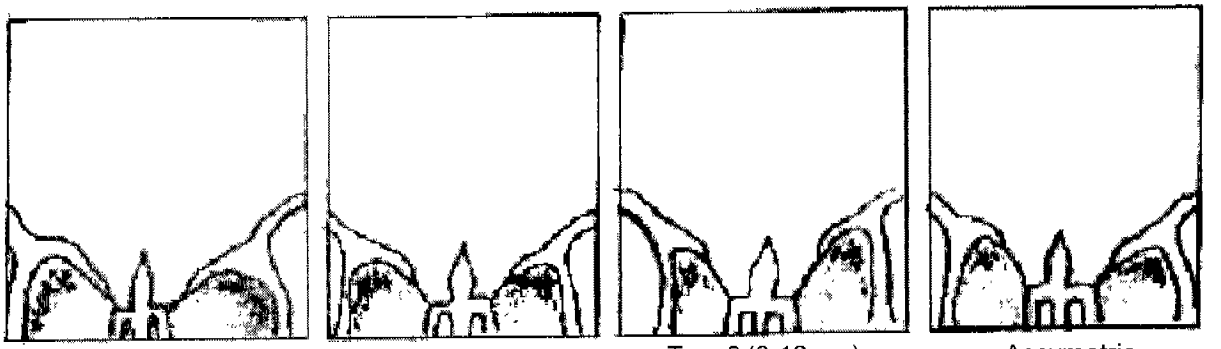
2.) To determine the type of instrumentation better suited for nasal surgery in Filipinos, which would result in faster and more efficient surgery eliminating any unwarranted manipulation.

MATERIALS & METHODS

This is a descriptive study wherein the authors randomly selected and studied pre-operative paranasal sinus tomography scans of Filipino patients done at a tertiary hospital's Radiology Department for the past two years.

Evaluation of the plates was done in the presence of the resource consultant. In cases where conflict or if any ambiguity arose during the evaluation of the plates, a Senior Radiology Consultant was asked to provide his interpretation to resolve the matter.

The presence or absence of bony and mucosal variants stated above was noted and tabulated, the frequency of each, represented as a percentage of the total number of cases seen.



Type 1 (1-3mm) Type 2 (4-7mm) Type 3 (8-16mm) Assymetric

A total of 51 patients were evaluated and for each criterion the total population was multiplied by 2 to represent the right and left sides of the nasal cavity, thus giving a total number of 102. This was however not the case for the variants of olfactory fossa and septal deviation where the original population of 51 patients were maintained.

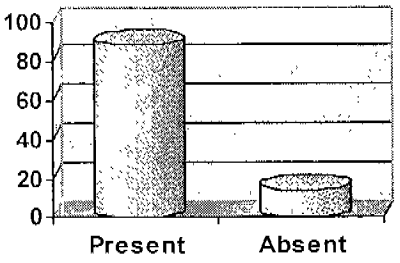
The height of the Ethmoid roof was determined by drawing two perpendicular horizontal lines at the level of the fovea ethmoidalis and the cribriform plate. The vertical distance between the two lines was then measured and classified according to the Types mentioned by Keros (above).

Nasal septal deviation was grouped into 7 types using the classification described by Mladina et al. wherein...

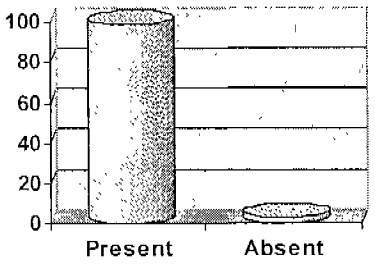
Type 1 = vertical septal deflection in the valve area does not interfere with normal valve function
Type 2 = Type 1 + interferes with normal valve function
Type 3 = Type 2 close to the head of the middle turbinate
Type 4 = Type 2 on one side + type 3 on the other
Type 5 = Unilateral septal basal crest
Type 6 = Unilateral, horizontal gutter in the anterior and basal septal parts
Type 7 = Variable, almost always bizarre

V. RESULTS:

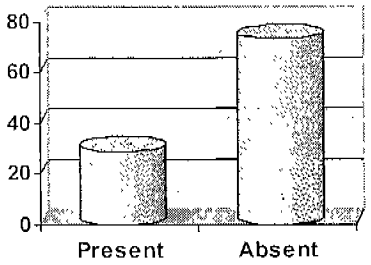
1) Agger Nasi Cells
   a. Present = 88(86%)
   b. Absent = 14(13.7%)



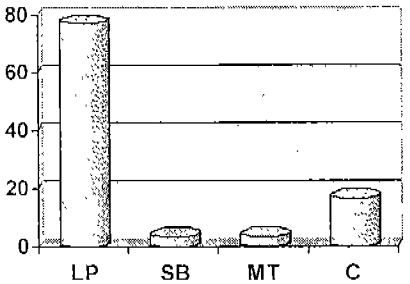
2) Ethmoid Bulla
   a. Present = 99(97%)
   b. Absent = 3(2.9%)



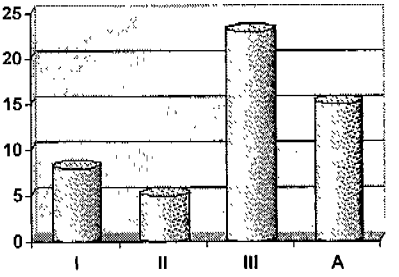
3) Haller Cells
   a. Present = 29(28%)
   b. Absent = 73(71.5%)



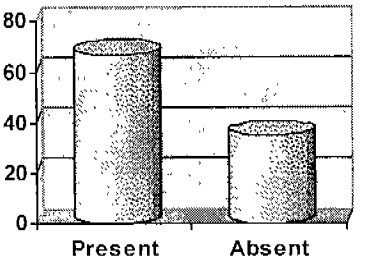
4) Recessus Terminalis of the Uncinate Process
   a. Lamina Papyracea (LP) = 77(75%)
   b. Skull Base (SB) = 4(3.9%)
   c. Middle Turbinate (MT) = 4(3.9%)
   d. Combined (C) = 17(16.6%)



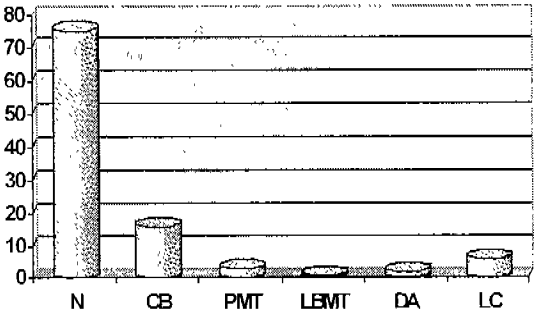
5) Olfactory Fossa
   a. Type I = 8(15.6%)
   b. Type II = 5(9.8%)
   c. Type III = 23(45%)
   d. Asymmetric = 15(29%)



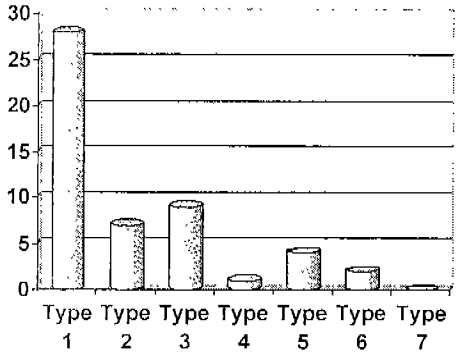
6) Floating Anterior Ethmoid Artery
   a. Present = 67(65.6%)
   b. Absent = 35(34%)



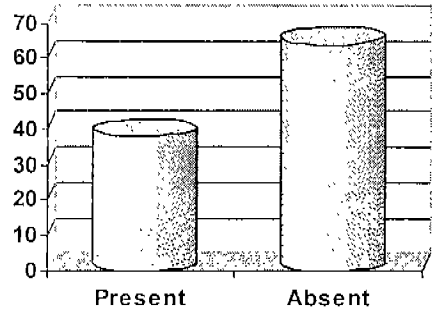
7) Middle Turbinate
   a. Normal (N) = 75(73.5%)
   b. Concha Bullosa (CB) = 16(15.6%)
   c. Paradoxical Middle Turbinate (PMT) = 3(2.9%)
   d. Laterally Bent Middle Turbinate (LBMT)= 1(0.9%)
   e. Double Attachment (DA) = 2(1.9%)
   f. Lamellar Cell (LC) = 6(5.8%)



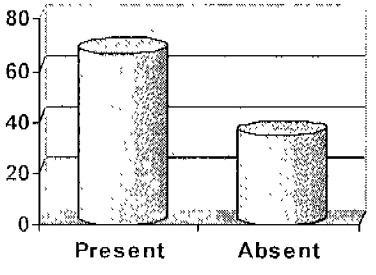
8) Septal Deviation
   a. Type 1 = 28(54.9%)
   b. Type 2 = 7(13.7%)
   c. Type 3 = 9(17.6%)
   d. Type 4 = 1(1.9%)
   e. Type 5 = 4(9.8%)
   f. Type 6 = 2(11.7%)
   g. Type 7 = 0



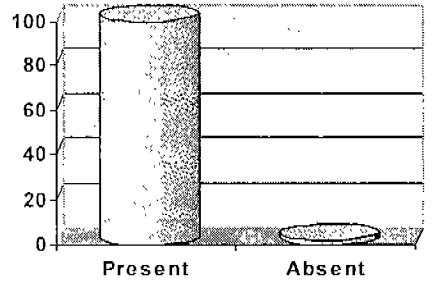
10) Bulging of Orbital Contents
   a. Present = 23(22%)
   b. Absent = 79(77%)



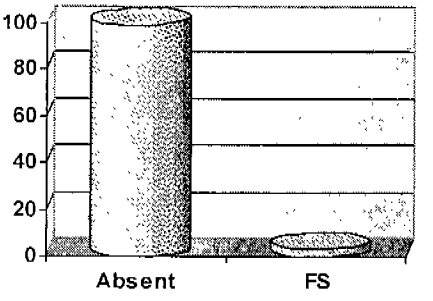
9) Dehiscence of Lamina Papyracea
   a. Present = 38(37%)
   b. Absent = 64(62.7%)



11) Pneumatized Crista Galli
   a. Present = 100(98%)
   b. Absent = 2(1.9%)



12) Hypoplasia
   a. Absent = 99(97%)
   b. Frontal Sinus (FS) = 3(2.9%)



DISCUSSION

Agger Nasi Cells

Agger Nasi is a Latin term which means *nasal mound* and refers to the most superior remnant of the first ethmoturbinal which results when the area immediately anterior and superior to the insertion of the middle turbinate becomes pneumatized. In our study 86% presented with Agger Nasi Cells. This is significant because depending on the degree of pneumatization, these cells may reach laterally to the lacrimal fossa and cause narrowing of the frontal recess which in turn, may contribute to the development of disease in the frontal sinus.

Ethmoid Bulla

In Latin, bulla means a hollow, thin walled, bony prominence and refers to the large and more constant air cell in the anterior ethmoid complex. It is formed by the pneumatization of the bulla lamella or second ethmoid basal lamella, and has been described as like a bleb on the lamina papyracea. In the absence of pneumatization, this variant is called torus ethmoidalis. As expected, our study showed a significant percent of the population presented with an Ethmoid bulla (99%). This is important for the surgeon because utmost care should be taken when working in the area of the bulla because of the possibility of injuring the orbit should the lamina papyracea be violated.

Haller Cells

Also known as the Infraorbital Ethmoid Cell, the pathophysiologic implication of these cells as described by Haller in 1765 is clear. These cells grow into the floor of the orbit which constitutes the roof of the maxillary sinus. It is separate from the Ethmoid bulla, and has the potential of narrowing the Ethmoid infundibulum or maxillary sinus ostium. In our study only 28% of the population presented with Haller Cells.

Recessus Terminalis of the Uncinate Process

The term uncinate process is derived from the Latin, processus uncinatus, which means hooked outgrowth, it is also a remnant of the descending portion of the first ethmoturbinal. In Endoscopic Sinus Surgery, this bone is frequently fractured in order to provide access to the maxillary ositum. Our results show that the most common superior attachment of the uncinate process is the lamina papyracea (75%), this should serve as a caution to surgeons when fracturing the uncinate to avoid going to high in order to preserve the integrity of the lamina papyracea.

Olfactory Fossa

Our data shows that the most common types of olfactory fossa are types III and Assymetric, (45% and 29% respectively). This is significant because the lateral lamella of the cribriform plate is the thinnest bone in the entire skull base. Therefore the potential for damage to the cribriform plate is highest with a type III configuration.

Floating Anterior Ethmoid Artery

During evaluation of the plates, the authors were thinking of a possible relationship between a type III olfactory fossa and the presence of a floating anterior ethmoid artery. Initially, it appeared that a negative correlation was emerging but as the number of cases increased, the presence of a positive relationship became the outcome (95%). The presence of this variant is important to determine preoperatively in order to avoid a possibly catastrophic sequelae when dissecting superiorly into the area of the olfactory fossa.

Middle Turbinate

Majority of patients evaluated presented with normal middle turbinates (73.5%). The most common variant noted was a concha bullosa (15.6%) Variations of middle turbinate anatomy are important to sinus pathology as most of them have the ability to cause obstruction to the ostiomeatal complex.

Septal Deviation

The most common type of deviation present in our study is type 1 (54.9%). This would imply that significant septal deviation that could cause sinus disease is not a common finding among the subjects.

Dehiscence of the Lamina Papyracea

Although only 37% of the population presented with this variation, the surgeon should nevertheless be aware of its presence preoperatively because of the risk of injuring the orbit.

Bulging Orbital Contents

It is interesting to note that of the population that presented with a dehiscence, 60.5% also presented with bulging of the orbital contents medially. Which gives more importance to determination of the said variants for obvious reasons.

Pneumatized Crista Galli

Presence of this variant is more of the rule rather than the exception as it is present in 98% of the population. Its value probably lies in the fact that it would provide more distance between the olfactory fossa and the base of the brain.

Hypoplasia

Hypoplasia of the sinuses was a rare occurrence in our study (2.9%), and only involved the frontal sinus and were all unilateral.

CONCLUSION

After careful evaluation of pre-operative paranasal sinus CT scans of 51 patients (screening coronal), the frequency of different anatomic variants, which may be of significance in the development of sinus disease and eventual decision to go into surgery, was determined. These variants are readily identified in high resolution PNS CT scans which makes a pre-operative scanning an indispensable tool in evaluating patients for surgery.

RECOMMENDATIONS

The authors recommend that more plates be studied to increase the validity of the study. Future investigators could also include axial cuts in their study in order to visualize other variants which cannot be seen in screening coronal cuts. More importantly, it is recommended that high resolution PNS CT be a pre-requisite whenever one is considering nasal surgery.

BIBLIOGRAPHY

1. Maniglia, AJ. Fatal and Major Complications of secondary nasal and sinus surgery. *Laryngoscope*,1989.99:276-281.
2. Acosta, Vicente. Risk Areas In Endoscopic Sinus Surgery: A Review Of 175 Computed Tomography Scans Of The Sinuses Among Patients With Nasal Polyposis. Philippine Journal of Otolaryngology-HNS.
3. Zinreich, SJ, D. Kennedy, A. Rosenbaum, B Gayler, A. Kumar, H. Stammberger. Paranasal Sinuses: CT Imaging Requirements for Endoscopic Surgery. *Radiology,* 1987; 163:769-775
4. Stammberger, H. Functional Endoscopic Sinus Surgery. 1991. Mosby-Year Book, nc, St. Louis, Missouri. 529pp
5. Teatini G, G Simonetti, U Salvolini, W. Masala, F Meloni, S Rovasio, GL Dedola. Computed Tomography of the Ethmoid Labyrinth and Adjacent Structures: Normal anatomy and most common variants. *Annals of Otology and Rhinology.* 1987. 96:239-243.
6. Lame, F, & W.R.K. Smoker. The Osteomeatal Unit and Endoscopic Surgery: Anatomy, Variations, and Imaging Findings in Inflammatory Diseases. *American Journal of Radiology.* October 1992. 159: 849-857.
7. Meyers, R.M., & G. Valvassori, Interpretation of Anatomic Variations of Computed Tomography Scans of the Sinuses: A Surgeon's Perspective. *Laryngoscope,* March 1998. 108:422-425.
8. Terrier, F., W. Weber, D. Ruefenacht, B. Porcellini. Anatomy of the ethmoid: CT, Endoscopic, and Macroscopic.American Journal of Roentgenology. March 1985.144: 493-500
9. Ohnishi, T, T. Tachibana, Y. Kaneko, S. Esaki. High-RiskAreas in Endoscopic Sinus Surgery and Prevention of Complications. *Laryngoscope.* October 1993.103: 1181-1185.
10. Bansberg, S., 5G. Harner, G. Forbes. Relationship of the Optic Nerve to the Paranasal Sinuses as Shown by Computed Tomography. *Otolaryngology-Head and Neck Surgery,* April 1987. 96 (4): 331-335.
11. Krmpotic-Nemanic, J., I. Vinter, J. Hat, D. Jalsovec. Variations of the Ethmoid Labyrinth and Sphenoid Sinus and CT Imaging. *European Archives of Otorhinolaiyngology,* 1993.250:209-212.
12. Elwany, S., I. Elsaeid, H. Thabet,. EndoscopicAnatomy of the Sphenoid Sinus. *The Journal of Laryngology and Otology.* February 1999. 113:122-126.
13. Stankiewicz, JA. Complications of Endoscopic Nasal Surgery: Occurrence and Treatment. *American Journal of Rhinology.* 1987. 1:45-49.
14. ChowJ, MF Mafee. RadiologicAssessment preoperative to endoscopic sinus surgery. *OCNA.* 1989.22(4): 691-701
15. Dessi, P., G. Moulin, J.M.Triglia, M. Zanaret, M.Cannoni. Difference in Height of the Right and Left Ethmoidal roofs : a Possible Risk Factor for Ethmoidal Surgery. Prospective Study of 150 CT scans. *The Journal of Laryngology and Otology.* March 1994, 168:261-262.
16. Mladina, Bastaic. What Do We Know about Septal Deformities?. Journal of Rhinology 4(2), 1997
17. Kayalioglu, Oyar, Govsa. Nasal cavity and paranasal sinus bony variations: a computed tomographic study. Rhinology, 38, 108-113, 2000.

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THE LOCATION OF THE VASCULAR PEDICLE OF THE EXTENDED LOWER TRAPEZIUS MYOCUTANEOUS AND RHOMBOTRAPEZIUS MYOCUTANEOUS FLAPS BASED ON FILIPINO CADAVER DISSECTION*

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ABSTRACT

GENERAL OBJECTIVE: To locate the dorsal scapular artery in Filipino cadavers using fixed, superficial, anatomic structures as landmarks
SPECIFIC OBJECTIVES:To identify landmarks that may be used as reference points to locate the dorsal scapular artery by observing consistently related structures. To determine the location of the dorsal scapular artery by using the identified landmarks
DESIGN: Descriptive study involving anatomical cadaver dissections
SETTING: Three anatomy laboratories of fully accredited colleges of medicine
PATIENTS/SUBJECTS: Thirty (30) adult cadavers with no gross musculoskeletal deformities, providing a total of 60 samples
RESULTS: The dorsal scapular artery can consistently be seen emerging between the rhomboid muscles at the level of the 4th thoracic vertebra, near the medial edge of the scapular spine. The 4th thoracic vertebra and the medial edge of the scapular spine were used as landmarks to determine the location of the dorsal scapular artery. The average location of the dorsal scapular artery is at the junction of the medial 4/5 and lateral 1/5 of a horizontal line drawn between the fourth thoracic vertebra and the medial edge of the scapular spine.
CONCLUSION: The spine of the 4th thoracic vertebra and the medial edge of the scapular spine can be used as reliable landmarks for the localization of the dorsal scapular artery. The dorsal scapular artery, which provides the dominant vascular supply to the pedicled lower extended trapezius island and rhombotrapezius flaps, can be located at the junction of the medial 4/5 and lateral 1/5 along the line drawn between the spine of the 4th thoracic vertebra and the medial spine of the scapula. This information can be utilized to facilitate flap harvesting and improve flap survival.

INTRODUCTION

The Evolution of Pedicled Flaps

The realm of head and neck cancer requires not only extirpation of the disease but also consideration of the reconstruction of the defects incurred. Thus an increased variety of flaps for reconstruction have been developed as time went by. Much progress has been achieved since it was first realized that extensive extirpations of soft tissues and/or bone in the head and neck must be followed by immediate repair. This reparative procedure is prompted by both cosmetic and functional objectives (Bertotti, 1980). With a thorough appreciation of the anatomy of flaps and their clinical application, a surgeon can be more aggressive in removing cancer and still give the patient an opportunity for successful rehabilitation by immediate reconstruction.

In 1842, Mutter first described the transfer of a cutaneous shoulder flap for reconstruction of the neck following a burn scar contracture, which was later modified by Zovickian. Reconstructive surgery was brought to new life in the 1970's with the advent of myocutaneous flaps. To increase the viability of the cutaneous flap and avoid the tedious measures to ensure flap survival, surgeons later elevated the skin with the underlying muscle

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(Netterville, Panje & Maves, 1987). The skin derives most of its blood supply from perforating muscle vasculature. The identification of subcutaneous muscle with a discrete independent arterial and venous pedicle allows transfer of the muscle with the overlying skin (Shapiro, 1981).

In 1977, McCraw *et al.* defined the current concepts during that time and applications of myocutaneous island flaps, based on anatomic and physiologic considerations. Four flaps suitable for head and neck reconstruction are based on latissimus dorsi, pectoralis major, sternomastoid, and trapezius, all of which have recognized vascular pedicles (Shapiro, 1981).

Although the pectoralis major myocutaneous flap subsequently has become the "workhorse" of myocutaneous flaps, other myocutaneous flaps, such as the three variations of the trapezius myocutaneous flap, may be better suited for certain dilemmas in head and neck reconstruction (Netterville, Panje & Maves, 1987).

Demergasso and Piazza described the trapezius myocutaneous flap as an original technique in reconstructive surgery for head and neck cancer in 1979. The superficial transverse cervical vessels usually provide the blood supply to this pedicled flap. If these vessels are absent, the posterior scapular or suprascapular vessels can be preserved. This flap has a rich blood supply and will survive even when transposed into a heavily irradiated area.

The use of this flap may enable the surgeon to reconstruct large surgical defects of the oral cavity, oropharynx, hypopharynx, and skin of the head and neck in a single operative procedure. The muscle is used to cover and protect the carotid arteries, to reinforce the internal suture lines, and to add bulk and contour to a dissected neck (Demergasso and Piazza, 1979).

There are circumstances wherein reconstruction would require a flap with bone. For example, when the body of the mandible, with its arch, needs to be resected, bone replacement is mandatory The flap should be reliable and tolerate the presence of heavily radiated tissue and contamination of oral bacteria. In the experience of Gregor *et al.* (1985), the pectoralis major myocutaneous flaps with rib have not been successful because of the late resorption of the rib bone. The free osteocutaneous groin flap has been used with success but the procedure is time consuming, requiring two surgical teams and microvascular expertise. The use of the sternocleidomastoid myocutaneous flap with the medial clavicle has been reported, but most of these cases have required bone segments of less than 5 cm in the lateral portion of the body of the mandible (Gregor *et al.*, 1985).

The trapezius osteomusculocutaneous island flap was first described by Panje and Cutting in 1980. It consisted of skin, trapezius muscle, and medial scapular spine based on the transverse cervical artery. Since then, this flap has been used mostly to reconstruct the mandible. In a study by Panje in 1985, this composite flap was used to reconstruct the lower jaw in 24 patients. About 85% of the cases were done for anterior arch defects and/or osteoradionecrosis. They had a success rate of 87% and concluded that this technique is a useful method for immediate reconstruction of the lower jaw.

In 1988, Krespi *et al.* commented that the lower trapezius flap is a relatively thin flap. He included the rhomboid muscles to augment facial defects. He added that it had a greater arc of rotation and this flap and may include the medial border of the scapula when bone is necessary. He believed that this flap has a significant advantage over previously described flaps in the treatment of defects that need greater bulk and length for adequate reconstruction. The addition of the rhomboid muscles incorporates the dorsal scapular artery to give an additional blood supply especially to the distal part of the flap. He recognized that the blood supply to this type of flap is primarily along the medial edge of the scapula, but no exact location was stated.

Tan in 1999 presented an innovation in reconstructive surgery. He introduced a trapezius flap based on the dorsal scapular artery and incorporates an extension of the flap that runs obliquely from the tip of the scapula to the midaxillary line. He claimed that his modification of the traditional vertical trapezius flap was reliable, reached most defects of the head and neck, capable of supporting viable skin paddles up to 23 cm in length.

Surgical Anatomy

The trapezius is a large, flat, triangularly shaped posterior cervical and upper thoracic muscle that takes part in shoulder movements. Its fibers originate in the midline from the occiput and the spinous processes of all the thoracic vertebrae, and inserts on the lateral third of the clavicle, the acromion, and the scapular spine (Figure 1). Nervous supply is provided by the spinal accessory nerve for motor function, and by the upper cervical nerves C_3 and C_4 for sensation. The blood supply is variable, but is primarily derived from the transverse cervical artery, with the dorsal scapular and posterior intercostal perforating arteries providing additional vascular supply (Figure 2). However, some studies on the trapezius myocutaneous flap describe a dual blood supply

to the lower half of the trapezius muscle provided by the dorsal scapular artery, situated lateral to the transverse cervical artery (Cummings *et al.*, 1989). It is of critical importance due to its more lateral origin and that it runs a course different and more complex from that of the transverse cervical artery. The venous drainage is usually composed of superficial veins in the subdermal plexus and deeper venae comitantes that accompany perforating arteries. These subsequently drain to the transverse cervical vein.

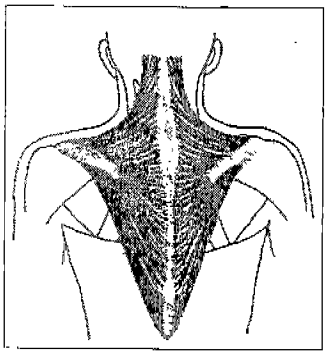


Figure 1. The Trapezius Muscle

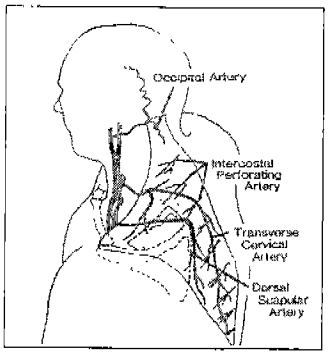


Figure 2. The Blood Supply of the Trapezius Muscle

Research Problem

Where is the specific location of the vascular pedicle of the extended lower trapezius island and rhombotrapezius myocutaneous flaps in relation to fixed, superficial structures of the back?

Significance of the Study

Identifying reliable landmarks to locate the dorsal scapular artery and using them to locate the vascular bundle of pedicled flaps, such as extended lower trapezius flaps and rhombotrapezius flaps, will facilitate the harvesting of the flap and reduce the potential damage that may be incurred on the vessel in the process of elevating the flap. The knowledge gained in this study may consequently be utilized to create a guideline in the preservation of this vascular bundle when the above-mentioned flaps are used in reconstructing various defects of the head and neck and successfully using these flaps would be a surgical innovation in our country.

OBJECTIVES

General Objective

To locate the dorsal scapular artery in Filipino cadavers using fixed, superficial, anatomic structures as landmarks

Specific Objectives

To identify landmarks that may be used as reference points to locate the dorsal scapular artery by observing consistently related structures To determine the location of the dorsal scapular artery by using the identified landmarks

MATERIALS AND METHODS

This research is a descriptive study involving anatomic dissections of 30 cadavers. The cadaver dissections were performed at Anatomy Department laboratories of three accredited medical schools.

Intervention first involved direct observation of consistently associated structures that may be used as reference points for describing the location of the dorsal scapular artery.

Elevation of the skin flaps was done. With the cadaver in the prone position, a vertical skin incision was made at the midline of the back, from the level of the 12th thoracic vertebra to the level of the clavicle. Then, a horizontal incision was made from the superior end of the vertical cut, to the left and right shoulders. Another horizontal incision was made from the inferior end of the vertical cut, to the left and right midaxillary line. The skin was retracted using large skin hooks and the skin flaps were developed using a surgical blade#20, exposing the trapezius, rhomboid major muscle, superior latissimus dorsi, and the scapula (Figure 3).

The trapezius muscle was elevated using blunt and sharp dissection from lateral and caudal, proceeding medial and cephalad (Figure 4), and it was freed from its vertebral attachments, the latissimus dorsi and levator scapulae (Figure 5).

Upon complete elevation of the middle and lower trapezius muscles and exposure of the surface of the rhomboid muscles, the dorsal scapular artery was identified (Figure 6) and structures that may be utilized as reference points were assessed.

After identifying the structures consistently related to the dorsal scapular artery, the following parameters were then used to describe the location of the dorsal scapular artery:

Vertebra-Scapula Width distance between the medial border of the scapula at the level of the medial edge of the spine of the scapula

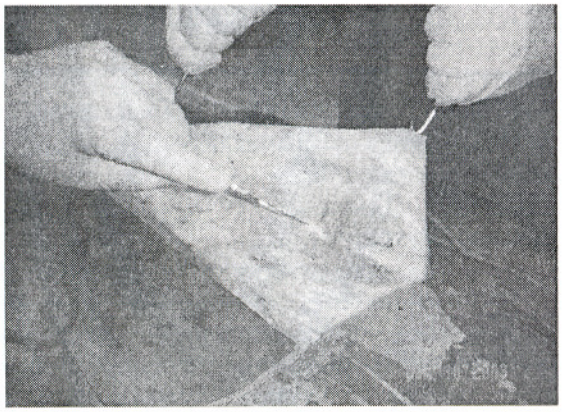


Figure 3. Elevation of skin flaps

Figure 4. Elevation of the trapezius muscle

Figure 5. Trapezius further separated from underlying structures

and the spine of the 4th thoracic vertebra

Vascular Bundle Point distance along the vertebra-scapula width from the spine of the 4th thoracic vertebra to the location of the dorsal scapular artery

The vertebra-scapula width was measured using a sliding caliper (Figure 7). At the level of the vertebra–scapula width, the distance of the dorsal scapular artery from the spine of the 4th thoracic vertebra was measured and was recorded as the vascular bundle point (Figure 8). The same procedure was done for all of the subjects.

The mean distance of the vascular bundle points was computed to determine the average distance of the dorsal scapular artery from the spine of the 4th thoracic vertebra.

RESULTS

A total of 30 cadavers were dissected (17 male; 13 female), providing 60 samples, taking into account the left and right sides.

The dorsal scapular artery was observed to emerge consistently at the level of the 4th thoracic vertebra, near the medial edge of the scapular spine, thus these structures were used as landmarks for determining the location the dorsal scapular artery.

The mean vertebra-scapula width for males was 5.2 cm, with a range of 3.8 to 6.7 cm. The mean vascular bundle point in males was 4.3 cm, with a range of 3.0 to 6.1 cm. The vascular bundle point was at 83% of the width, or at the junction of the medial 4/5 and lateral 1/5 of the vertebra-scapula width (Appendix Table 1). It is at this point that the dorsal scapular artery can most often be identified coursing perpendicular to the horizontal line drawn from the spine of the 4th thoracic vertebra to medial edge of the scapular spine as it emerges from between the major and minor rhomboid muscles.

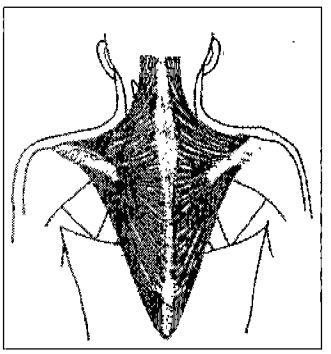
The mean vertebra-scapula width for females was 5.0 cm, with a range of 3.7 to 6.5 cm. The mean vascular bundle point in females was 4.1 cm, with a range of 2.9 to 5.4 cm. The vascular bundle was at 82% of the width, or at the junction of the medial 4/5 and lateral 1/5 of the vertebra-scapula width (Appendix Table 2).

The mean vertebra-scapula width for all samples was 5.12 cm, with a range of 3.7-6.7 cm. The vascular bundle point was located at a mean of 4.25 cm along the width of the vertebra-scapula width for all samples, with a range of 2.9-6.1 cm. The vascular bundle was at 83% of the width, or at the junction of the medial 4/5 and lateral 1/5 of the vertebra-scapula width (appendix table 3).

DISCUSSION

Based on available literature, a number of studies have been made to describe the anatomy of the trapezius muscle and its vasculature. According to Yang *et al.* (1998), for the past two decades, the vascular anatomy of the trapezius muscle has been the subject of several anatomic studies. Moreover, the anatomy of the trapezius is variable and confusing, and it is this anatomic variability that seems to be the basis for unpredictable clinical results of the

to the lower half of the trapezius muscle provided by the dorsal scapular artery, situated lateral to the transverse cervical artery (Cummings *et al.*, 1989). It is of critical importance due to its more lateral origin and that it runs a course different and more complex from that of the transverse cervical artery. The venous drainage is usually composed of superficial veins in the subdermal plexus and deeper venae comitantes that accompany perforating arteries. These subsequently drain to the transverse cervical vein.



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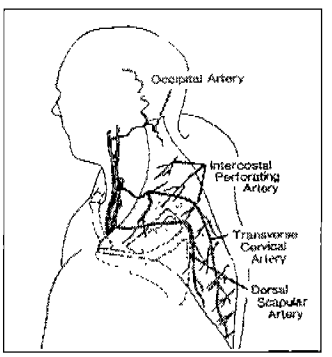

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trapezius muscle flap. Urken reported in 1991 that partial flap loss in the past ranged from 6% to 27% despite an apparently thorough understanding of the anatomy.

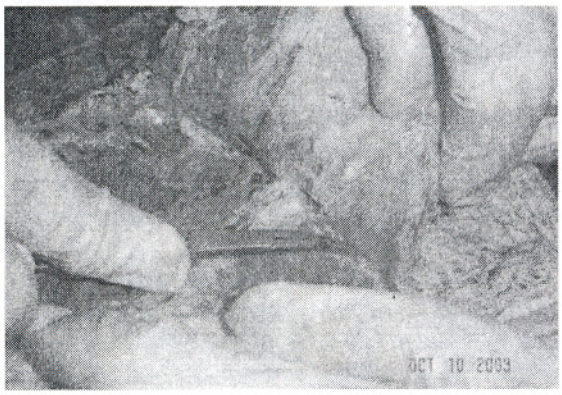


Figure 6. Isolation of the dorsal scapular artery

In Yang's study (1998), it was concluded that there are two main patterns of vascular supply to the trapezius, and that the muscle is principally supplied by three vascular sources: the transverse cervical artery, the dorsal scapular artery, and the posterior intercostal arterial branches. Netterville and Wood (1991) studied the relative importance of the descending branch of the transverse cervical artery and the dorsal scapular artery, and found that the dorsal scapular artery was the dominant feeding vessel in 15 of 30 dissections and the transverse cervical artery in 9 of 30 dissections.

The course of the dorsal scapular artery has also been described before. The dorsal scapular artery arises from the second or third part of the subclavian artery or the transverse cervical artery, each seen in approximately 33% of the subjects based on 89 cadaver dissections by Huelke (1958). The course of the dorsal scapular artery is then variable. When it arises from the subclavian artery, it passes through the brachial plexus, but it may pass over or under the plexus as well. It then passes over the upper margin of the serratus anterior muscle and descends on the medial border of the scapula near the base of the scapular spine. When the dorsal scapular artery arises from the transverse cervical artery, it descends directly along the medial border of the scapula. In this location, it runs deep to the rhomboid minor muscle at a point approximately 14 cm distal to the upper margin of the trapezius. The dorsal scapular artery gives

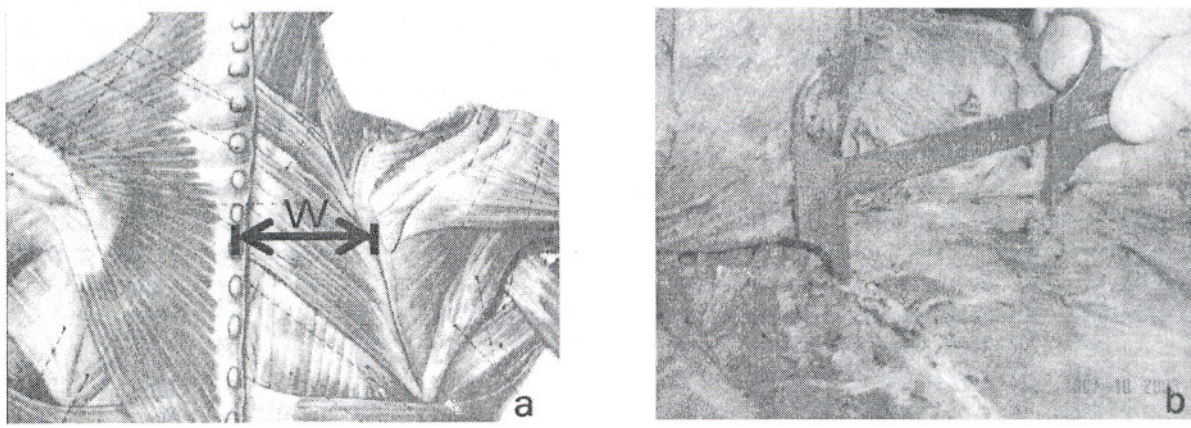


Figure 7. a & b measurement of the vertebra-scapula width (W)

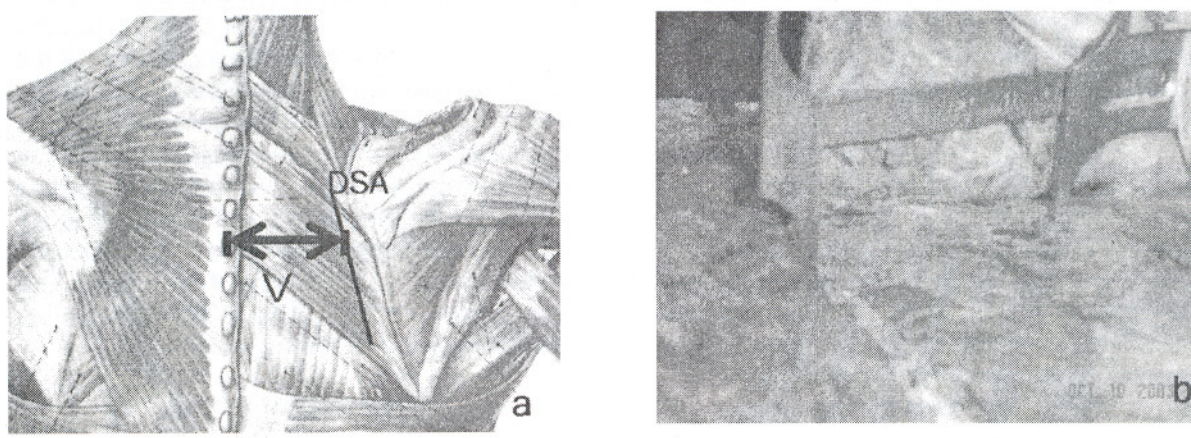


Figure 8. a & b measurement of the vascular bundle distance (V)

off a large branch that perforates the rhomboid to enter the deep surface of the trapezius. The point of emergence between the rhomboid muscles has been stated in many literatures, however no studies have been done to locate exactly this point of emergence, except for that it is very near the medial border of the scapula.

Gallardo *et al.*, in 1999, described in a local study, the location of the vascular pedicle of the extended island trapezius flap by using fixed, superficial landmarks. He used the width of the 7th cervical vertebral spine and the acromioclavicular joint as a reference. The distance of the transverse cervical artery from the 7th cervical vertebral spine along the width was measured and recorded as the vascular bundle point. The mean distance of the vascular bundle point from the 7th cervical vertebral spine was correlated to the width of the 7th cervical vertebral spine to the acromioclavicular joint. It is by this similar technique the utilizable landmarks were identified and used to describe the vascular bundle point of the dorsal scapular artery in this study. The artery emerged from between the rhomboid muscles at the level of the 4th thoracic vertebra, thus, the spine of this bone was considered as one landmark. The medial scapular edge was noted to be in close proximity to the point of emergence of the dorsal scapular artery, thus this structure was considered another landmark. The vascular bundle point was observed to fall along the horizontal line connecting the above landmarks. The distance of the 4th thoracic vertebra and the medial scapular edge was used as the comparator width, and was designated as the vertebra-scapula width.

In this study, it was noted that the dorsal scapular artery emerged from underneath the rhomboid minor at the level of the fourth thoracic vertebra at a mean of 4.25 cm lateral to the spine of the 4th thoracic vertebra of all subjects. The mean vertebra-scapula width of all subjects was 5.12 cm. Therefore, the vascular bundle point was located at the 83% the distance of the vertebra-scapula width. This location could also be interpreted as the junction of the medial 4/5 and lateral 1/5 of the vertebra-scapula width.

Due to the availability of cadavers for dissection, there was an unequal number of male subjects and female subjects. Therefore comparison of male and female subjects was not made an objective in this study. However, the relative distances of the vascular bundle in male subjects and female subjects were found to be the same. The mean vertebra-scapula width in males was 5.2 cm and the vascular bundle point was at 4.3 cm, or 83% of the width. This distance could be interpreted as 4/5 of the vertebra-scapula width. In females, the mean vertebra-scapula width was 5.0 cm and the mean vascular bundle point was 4.1 cm. The relative distance of the vascular bundle point was 82% or 4/5 of the vertebra-scapula width. It was therefore observed that there was no difference in the relative distance of the vascular bundle point between male and female cadavers.

Identification of the vascular supply to the lower and the extended lower trapezius flap is tantamount to flap survival. In a local study made by Gallardo in 1999, the vascular pedicle of the transverse cervical artery was localized based on cadaver dissection. He emphasized the preservation of the transverse cervical artery and the dorsal scapular artery in the trimming of the pedicle, by recommending an 8 cm width of pedicle immediate to the paddle. He added that only when the dominant vessel is properly identified could we taper the width of the pedicle. Therefore, knowing the location of the dorsal scapular artery and the transverse cervical artery will improve preservation of the vascular supply and thus increase the usefulness of the extended lower trapezius flap and the rhombotrapezius myocutaneous flap.

CONCLUSION

The spine of the 4th thoracic vertebra and the medial edge of the scapular spine can be used as reliable landmarks for the localization of the dorsal scapular artery. The dorsal scapular artery, which provides the dominant vascular supply to the pedicled lower extended trapezius island and rhombotrapezius flaps, can be located at the junction of the medial 4/5 and lateral 1/5 along the line drawn between the spine of the 4th thoracic vertebra and the medial spine of the scapula. This information can be utilized to facilitate flap harvesting and improve flap survival.

RECOMMENDATIONS

It is recommended that a larger sample size be utilized so as to come up with a more representative value for the population. Further correlation may be done to age and sex. The information that was gained from this study may be used as a basis for a surgical innovation in our country, such as using a rhombotrapezius myo-osseous or an extended lower trapezius island flap for head and neck reconstruction.

curved piece of cancellous bone. (Figure 2) It has a natural contour that has been utilized for the oromandibular reconstruction purposes. In 1991, Urken et al reported the use of the iliac crest along with the attached internal oblique muscle as a composite free flap in 10 cases of oromandibular reconstruction. (6)

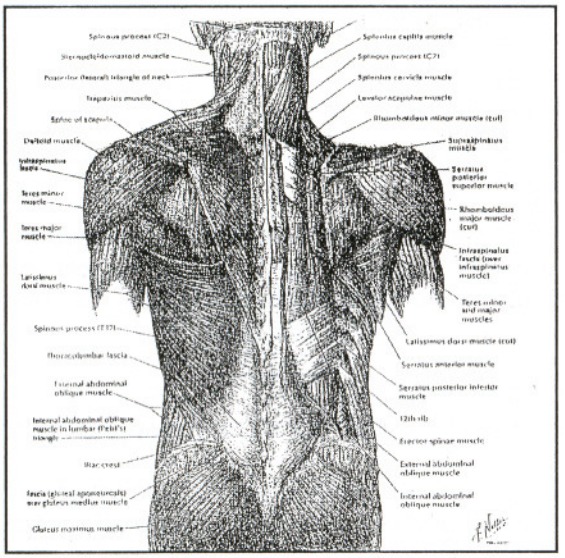


FIGURE 1. Latissimus Dorsi Anatomy

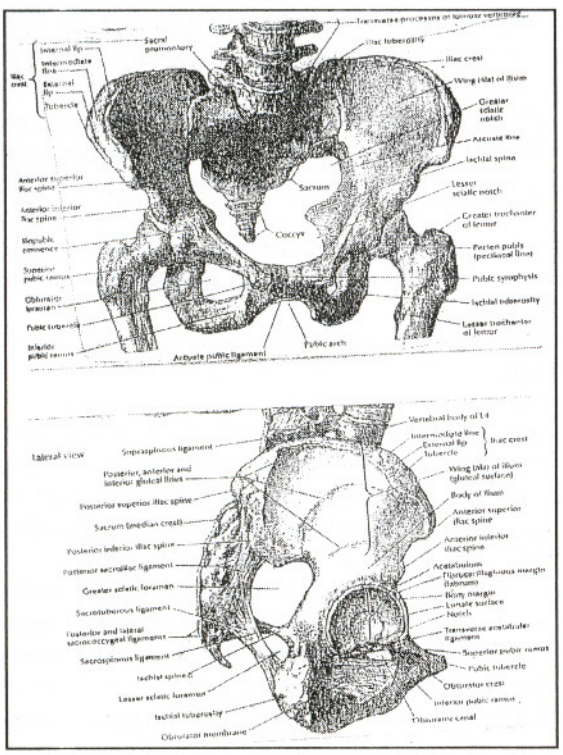


FIGURE 2. Iliac Bone *(from Netter's Atlas of Human Anatomy)*

The latissimus dorsi's conspicuous attachment to the iliac crest incited the researchers to investigate the feasibility of employing the pedicled latissimus dorsi myocutaneous flap and its iliac crest attachment for the reconstruction of oromandibular defects.

The latissimus dorsi muscle is supplied by the thoracodorsal and segmental perforating branches of the intercostals and lumbar arteries. (7,8) On the other hand, the ilum, is supplied circumflex iliac and gluteal arteries. (9,10)

The disparate blood supplies of the latissimus dorsi and the iliac bone designates the prospective utilization of the iliac crest (by virtue of its attachment to the latissimus dorsi) for oromandibular reconstruction as a non-vascularized free bone graft. However, Hoffman et al reported wide distribution of musculocutaneous perforators over the latissimus dorsi muscle surface that provides blood from skin down to the iliac crest.(8) Preservation of the musculocutaneous perforators on harvesting of the flap (along with the thoracolumbar fascia) will impart the characteristics of a pedicled osteomyocutaneous flap to the proposed latissimus dorsi and iliac crest attachment flap. Employment of such a vascularized bone flap has been proven to be more reliable than a free bone graft.(11)

On the basis of above premise and cognizant of the risks and limitations of the proposed innovation, the study ultimately aims to explore the possibility of employing the iliac crest attachment of the pedicled latissimus dorsi myocutaneous flap as an option for the reconstruction of oromandibular defects. The investigation must commence with a descriptive study of anatomic measurements pertinent to the latissimus dorsi and its attachment to the crest of the iliac bone.

The objectives of the study are:

1. To describe important anatomic characteristics and measurements related to the latissimus dorsi and its attachment to the iliac crest among adult Filipino cadavers.
2. To record the following anatomic variables in the cadaver subjects: sex and height, latissimus dorsi muscle length, iliac crest bone length attached to the latissimus dorsi muscle, and width of the iliac crest bone.

SUBJECTS AND METHODS

Nineteen adult Filipino cadavers (13 males, 6 females) without gross thoracolumbar deformities served as the subjects of this descriptive study.

Each cadaver was placed in the prone position. The latissimus dorsi muscle and the iliac crest were exposed on both sides for each cadaver. (Figure 3)

The following anatomic characteristics/ measurements were recorded:

FIGURE 3. Cadaver Dissection

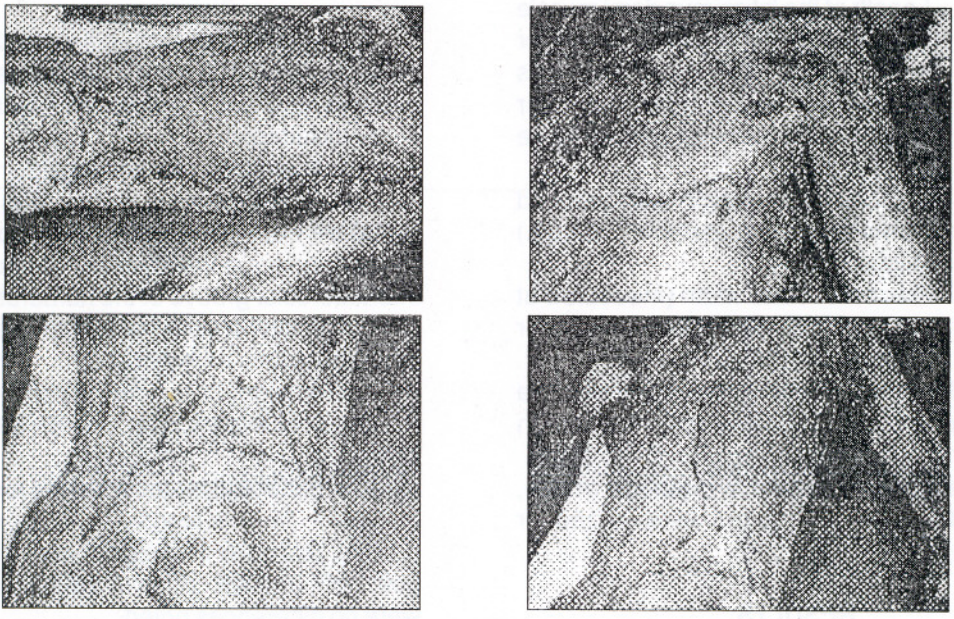


FIGURE 4. Determination of muscle length and Iliac crest Length with muscle attachment

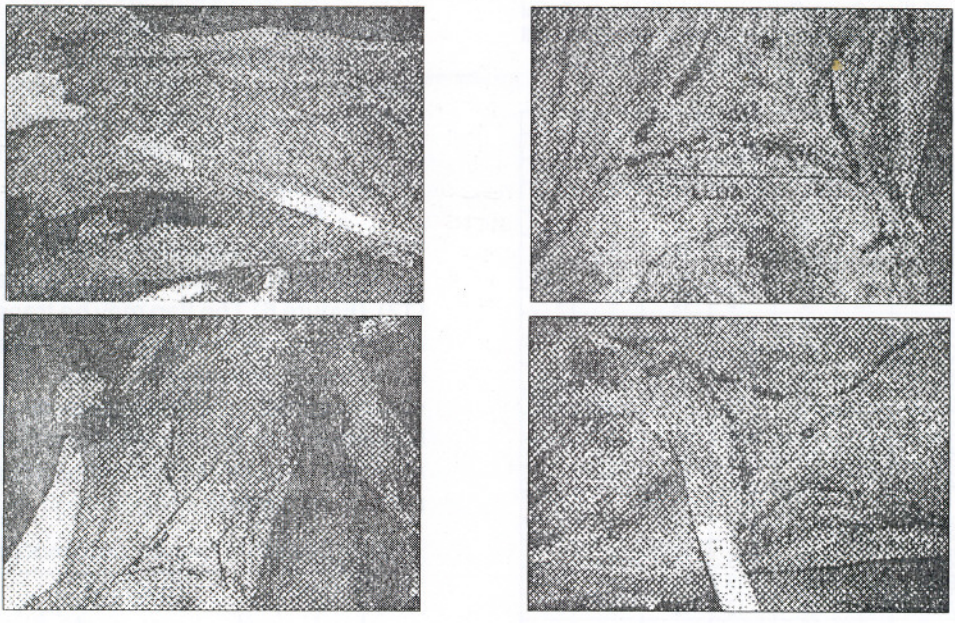
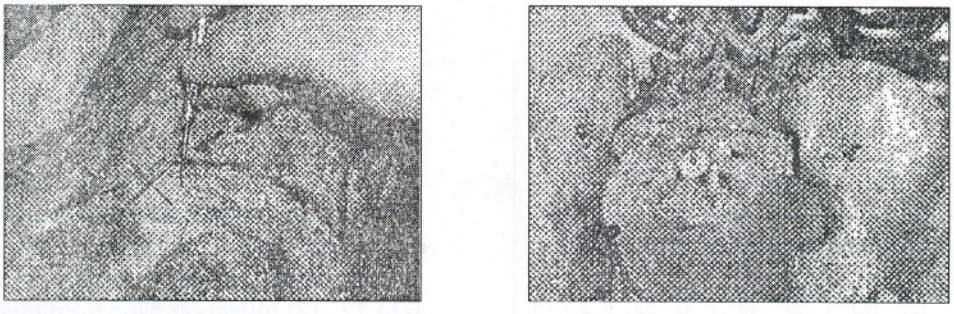


FIGURE 5. Determination of Iliac bone width (BW) (measured at the posterior superior iliac spine)



trapezius muscle flap. Urken reported in 1991 that partial flap loss in the past ranged from 6% to

Figure 6. Isolation of the dorsal scapular artery

cervical artery and the dorsal scapular artery, and found that the dorsal scapular artery was the dominant feeding vessel in 15 of 30 dissections and the transverse cervical artery in 9 of 30 dissections.

The course of the dorsal scapular artery has also been described before. The dorsal scapular artery arises from the second or third part of the subclavian artery or the transverse cervical artery, each seen in approximately 33% of the subjects based on 89 cadaver dissections by Huelke (1958). The course of the dorsal scapular artery is then variable. When it arises from the subclavian artery, it passes through the brachial plexus, but it may pass over or under

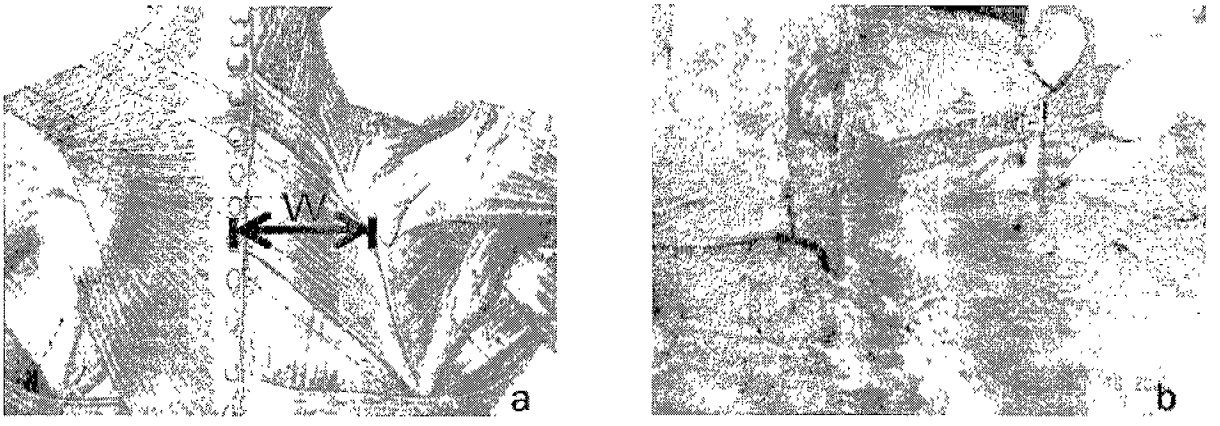


Figure 7. a & b measurement of the vertebra-scapula width (W)

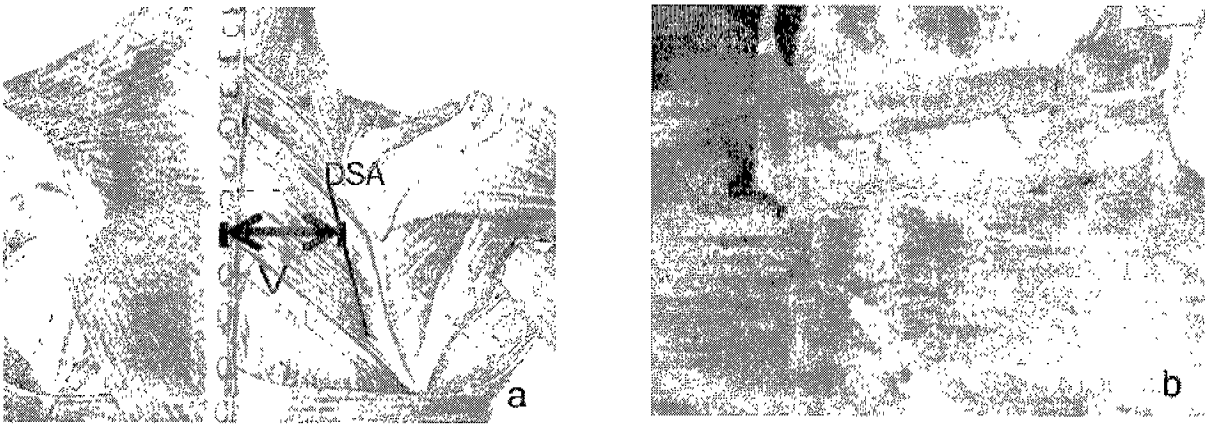


Figure 8. a & b measurement of the vascular bundle distance (V)

27% despite an apparently thorough understanding of the anatomy.

In Yang's study (1998), it was concluded that there are two main patterns of vascular supply to the trapezius, and that the muscle is principally supplied by three vascular sources: the transverse cervical artery, the dorsal scapular artery, and the posterior intercostal arterial branches. Netterville and Wood (1991) studied the relative importance of the descending branch of the transverse

the plexus as well. It then passes over the upper margin of the serratus anterior muscle and descends on the medial border of the scapula near the base of the scapular spine. When the dorsal scapular artery arises from the transverse cervical artery, it descends directly along the medial border of the scapula. In this location, it runs deep to the rhomboid minor muscle at a point approximately 14 cm distal to the upper margin of the trapezius. The dorsal scapular artery gives

off a large branch that perforates the rhomboid to enter the deep surface of the trapezius. The point of emergence between the rhomboid muscles has been stated in many literatures, however no studies have been done to locate exactly this point of emergence, except for that it is very near the medial border of the scapula.

Gallardo *et al.*, in 1999, described in a local study, the location of the vascular pedicle of the extended island trapezius flap by using fixed, superficial landmarks. He used the width of the 7th cervical vertebral spine and the acromioclavicular joint as a reference. The distance of the transverse cervical artery from the 7th cervical vertebral spine along the width was measured and recorded as the vascular bundle point. The mean distance of the vascular bundle point from the 7th cervical vertebral spine was correlated to the width of the 7th cervical vertebral spine to the acromioclavicular joint. It is by this similar technique the utilizable landmarks were identified and used to describe the vascular bundle point of the dorsal scapular artery in this study. The artery emerged from between the rhomboid muscles at the level of the 4th thoracic vertebra, thus, the spine of this bone was considered as one landmark. The medial scapular edge was noted to be in close proximity to the point of emergence of the dorsal scapular artery, thus this structure was considered another landmark. The vascular bundle point was observed to fall along the horizontal line connecting the above landmarks. The distance of the 4th thoracic vertebra and the medial scapular edge was used as the comparator width, and was designated as the vertebra-scapula width.

In this study, it was noted that the dorsal scapular artery emerged from underneath the rhomboid minor at the level of the fourth thoracic vertebra at a mean of 4.25 cm lateral to the spine of the 4th thoracic vertebra of all subjects. The mean vertebra-scapula width of all subjects was 5.12 cm. Therefore, the vascular bundle point was located at the 83% the distance of the vertebra-scapula width. This location could also be interpreted as the junction of the medial 4/5 and lateral 1/5 of the vertebra-scapula width.

Due to the availability of cadavers for dissection, there was an unequal number of male subjects and female subjects. Therefore comparison of male and female subjects was not made an objective in this study. However, the relative distances of the vascular bundle in male subjects and female subjects were found to be the same. The mean vertebra-scapula width in males was 5.2 cm and the vascular bundle point was at 4.3 cm, or 83% of the width. This distance could be interpreted as 4/5 of the vertebra-scapula width. In females, the mean vertebra-scapula width was 5.0 cm and the mean vascular bundle point was 4.1 cm. The relative distance of the vascular bundle point was 82% or 4/5 of the vertebra-scapula width. It was therefore observed that there was no difference in the relative distance of the vascular bundle point between male and female cadavers.

Identification of the vascular supply to the lower and the extended lower trapezius flap is tantamount to flap survival. In a local study made by Gallardo in 1999, the vascular pedicle of the transverse cervical artery was localized based on cadaver dissection. He emphasized the preservation of the transverse cervical artery and the dorsal scapular artery in the trimming of the pedicle, by recommending an 8 cm width of pedicle immediate to the paddle. He added that only when the dominant vessel is properly identified could we taper the width of the pedicle. Therefore, knowing the location of the dorsal scapular artery and the transverse cervical artery will improve preservation of the vascular supply and thus increase the usefulness of the extended lower trapezius flap and the rhombotrapezius myocutaneous flap.

CONCLUSION

The spine of the 4th thoracic vertebra and the medial edge of the scapular spine can be used as reliable landmarks for the localization of the dorsal scapular artery. The dorsal scapular artery, which provides the dominant vascular supply to the pedicled lower extended trapezius island and rhombotrapezius flaps, can be located at the junction of the medial 4/5 and lateral 1/5 along the line drawn between the spine of the 4th thoracic vertebra and the medial spine of the scapula. This information can be utilized to facilitate flap harvesting and improve flap survival.

RECOMMENDATIONS

It is recommended that a larger sample size be utilized so as to come up with a more representative value for the population. Further correlation may be done to age and sex. The information that was gained from this study may be used as a basis for a surgical innovation in our country, such as using a rhombotrapezius myo-osseous or an extended lower trapezius island flap for head and neck reconstruction.

APPENDIX

Table 1. The Measurements of the Vertebra-Scapula Width and the Vascular Bundle of Male Subjects

Subject No.	Sex	Vertebra-Scapula Width (cm)		Vascular Bundle Point (cm)	
		Right	Left	Right	Left
2	M	4.4	4.4	3.4	3.4
3	M	4 7	4.7	3.5	3.5
4	M	5.2	5.2	3.4	3.4
5	M	6.5	6.5	4.6	4.6
6	M	6.4	6.4	5.9	5.9
7	M	5.4	5.2	5.7	5.7
9	M	5.0	5.0	4.5	4.5
10	M	6.0	6.0	4.5	4.5
16	M	5.2	5.2	4.4	4.3
17	M	4.8	4.8	3.6	3.5
18	M	3.8	3.9	3.0	3.1
19	M	6.2	6.2	5.7	5.7
20	M	6.7	6.6	6.1	6.1
22	M	5.0	5.0	4.3	4.3
25	M	3.8	3.8	3.0	3.0
29	M	4.8	4.8	3.6	3.6
30	M	5.4	5.3	4.5	4.5
TOTAL		**89.3**	**89.0**	**73.7**	**73.6**

Computed Mean Values for Males

Vertebra – scapula width = (89 3+89 0)/ 34 = 5 2 cm

Vascular Bundle Point = (73 7+73 6)/34 = **4.3 cm**

Computed Average Distance of Vascular Bundle Point from Spine of T_4 in Males

Vascular Bundle point/ vertebra-scapula width

= 4.3/5.2

= 0 83 or 83%

Interpretation: *The average distance of the vascular bundle of the dorsal scapular artery from the spine in males is at a point 83% or 4/5 of the distance representing the vertebra-scapula width*

Table 2. The Measurements of the Vertebra-Scapula Width and the Vascular Bundle of Female Subjects

Subject No.	Sex	Vertebra-Scapula Width (cm)		Vascular Bundle Point (cm)	
		Right	Left	Right	Left
1	F	5.8	5.8	4.0	4.0
8	F	6.3	6.3	5.2	5.2
11	F	6.5	6.5	5.4	5.4
12	F	4.2	4.2	3.6	3.6
13	F	3.9	3.9	3.3	3.3
14	F	4.0	4.0	3.4	3.4
15	F	4.4	4.3	3.5	3.5
21	F	3.7	3.7	2.9	3.0
23	F	5.4	5.4	4.9	4.8
24	F	5 6	5.4	4.6	4.6
26	F	4.6	4.7	4.0	4.1
27	F	4.9	4.9	4.3	4.3
28	F	5.2	5.2	4.6	4.6
TOTAL		**64.5**	**64.3**	**53.7**	**53.9**

Computed Mean Values for Females

Vertebra – scapula width

= (64 5+64 3)/26 = 5 0 cm

Vascular Bundle Point

= (53 7+53 9)/26 = 4 1 cm

Computed Average Distance of Vascular Bundle Point from Spine of T_4 in Females

Vascular Bundle point/ vertebra-scapula width = 4.1/5 0

= 0.82 or 82%

n: *The average distance of the vascular bundle of the dorsal scapular artery from the spine in females is at a point 82% or 4/5 of the distance representing the vertebra-scapula width*

Table 3. The Measurements of the Vertebra-Scapula Width and the Vascular Bundle of All Subjects

Subject No.	Sex	Vertebra-Scapula Width (cm)		Vascular Bundle Point (cm)	
		Right	Left	Right	Left
1	F	5.8	5.8	4.0	4.0
2	M	4.4	4.4	3.4	3.4
3	M	4.7	4.7	3.5	3.5
4	M	5.2	5.2	3.4	3.4
5	M	6.5	6.5	4.6	4.6
6	M	6.4	6.4	5.9	5.9
7	M	5.4	5.2	5.7	5.7
8	F	6.3	6.3	5.2	5.2
9	M	5.0	5.0	4.5	4.5
10	M	6.0	6.0	4.5	4.5
11	F	6.5	6.5	5.4	5.4
12	F	4.2	4.2	3.6	3.6
13	F	3.9	3.9	3.3	3.3
14	F	4.0	4.0	3.4	3.4
15	F	4.4	4.3	3.5	3.5
16	M	5.2	5.2	4.4	4.3
17	M	4.8	4.8	3.6	3.5
18	M	3.8	3.9	3.0	3.1
19	M	6.2	6.2	5.7	5.7
20	M	6.7	6.6	6.1	6.1
21	F	3.7	3.7	2.9	3.0
22	M	5.0	5.0	4.3	4.3
23	F	5.4	5.4	4.9	4.8
24	F	5.6	5.4	4.6	4.6
25	M	3.8	3.8	3.0	3.0
26	F	4.6	4.7	4.0	4.1
27	F	4.9	4.9	4.3	4.3
28	F	5.2	5.2	4.6	4.6
29	M	4.8	4.8	3.6	3.6
30	M	5.4	5.3	4.5	4.5
TOTAL		153.8	153.3	127.4	127.5

Computed Mean.

Vertebra - scapula width
= (153.8 + 153.3)/60 = 5.12 cm
Vascular Bundle Point (127.4+127.5)/60 = 4.25 cm

Computed Average Distance of Vascular Bundle From Spine of T_4:

Vascular bundle point mean/ vertebra-scapula width mean
= 4.25/ 5.12
= 0.83 or 83%

Interpretation: The average distance of the vascular bundle of the dorsal scapular artery from the spine is at a point 83% or 4/5 of the line representing the vertebra-scapula width

BIBLIOGRAPHY

1 Bertotti, JA. 1980. Trapezius-Musculocutaneous Island Flap in the Repair of Major Head and Neck Cancer. Plastic and Reconstructive Surgery. 65(1). 16-21

2 Demergasso, F, and MV Piazza. 1979. Trapezius Myocutaneous Flap in Reconstructive Surgery for Head and Neck Cancer: An Original Technique. The American Journal of Surgery. 138: 533-536.

3. Cummings, CW, DW Eisle, and MD Coltrera. 1989. Lower Trapezius Myocutaneous Island Flap. Arch Otolaryngol Head Neck Surg. 115:1181-1185.

4. Gallardo, JM, AM Chiong, Jr. and V Alarva. 1999. The Extended Island Trapezius Myocutaneous Flap: Localization of the Vascular Pedicle Based on Filipino Cadaver Dissection Phil J Otolaryngol Head Neck Surg. 14(1):8-14

5 Gregor, RT and KJ Davidge-Pitts. 1985. Trapezius Osteomyocutaneous Flap for Mandibular Reconstruction. Arch Otolaryngol. 111: 198-203.

6 Huelke, D. 1958 A Study of the Transverse Cervical and Dorsal Scapular Arteries. Anat . 132:233-245.

7. Krespi, YP, RW Oppenheimer and JM Flanzer. 1988. The Rhombotrapezius Myocutaneous and Osteomyocutaneous Flaps. Arch Otolaryngol Head Neck Surg. 114: 734-738.

8. Netterville, JL and DE Wood. 1991. The Lower Trapezius Flap: Vascular Anatomy and Surgical Technique. Arch Otolaryngol Head Neck Surg. 117(1) 73-6.

9. Netterville, JL, W Panje and MD Maves. 1987. The Trapezius Myocutaneous Flap: Dependability and Limitations. Arch Otolaryngol Head Neck Surg 113:271-281.

10. Panje, W 1985. Mandible Reconstruction with the Trapezius Osteomusculocutaneous Flap. Arch Otolaryngol. 111: 223-229.

11. Shapiro, MJ. 1981. Use of Trapezius Myocutaneous Flaps in the Reconstruction of Head and Neck Defects. Arch Otolaryngol. 107: 333-336.

12. Urken, ML, RK Naidu, W Lawson et al. 1991. The Lower Trapezius Island Musculocutaneous Flap Revisited. Arch Otolaryngl Head Neck Surg. 117:502-514.

13 Yang, D, and S. Morris. 1998. Trapezius Muscle: Anatomic Basis for Flap Design. Ann Plast Surg. 41:52-57.

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ANATOMIC MEASUREMENTS RELATED TO THE LATISSIMUS DORSI MUSCLE AND ITS ILIAC CREST ATTACHMENT: A STUDY BASED ON FILIPINO CADAVER DISSECTIONS*

JOSEPH NOEL N. OCONER, MD**
KENNETH O. BARITUA, MD**
JAY REMY GONZALEZ, MD**
ARMANDO M. CHIONG JR., MD, FPSO-HNS***

ABSTRACT

OBJECTIVES: 1. To describe and record important anatomic measurements related to the latissimus dorsi and its attachment to the iliac crest among adult Filipino cadavers. 2. To record the following anatomic variables in the cadaver subjects: sex and height, latissimus dorsi muscle length, iliac crest bone length attached to the latissimus dorsi muscle, and width of the iliac crest bone.
DESIGN: Cross-Sectional Study
SETTING: Anatomy laboratories of 3 medical schools in Metro Manila
SUBJECTS: 19 cadaver subjects (13 male, 6 female) yielding a total of 38 latissimus dorsi muscles and iliac crests.
RESULTS : For the MALE cadaver subjects, cadaver heights yielded mean, a standard deviation, and range values of 148.9 cms. , 10 cms., and 138 to 168 cms. respectively. Muscle length yielded mean, standard deviation, and range values of 34.69 cms., 6.17 cms., and 22 to 24 cms. respectively. Length of iliac crest bone and attached latissimus dorsi yielded mean, standard deviation, and range values of 13.69 cms., 1.32 cm., and 12 to 16 cms respectively. Iliac crest bone widths yielded mean, a standard deviation, and range values of 3.68 cms., 0.24 cm., and 3.2 to 4 cms. respectively. For the FEMALE cadaver subjects, cadaver heights yielded mean, a standard deviation, and range values of 140 cms. , 9.58 cms., and 131 to 159 cms. respectively. Muscle length yielded mean, standard deviation, and range values of 32.67 cms., 4.72 cms., and 27 to 40 cms. respectively. Length of iliac crest bone and attached latissimus dorsi yielded mean, standard deviation, and range values of 13.50 cms., 1.049 cm., and 12 to 15 cms respectively. Iliac crest bone widths yielded mean, a standard deviation, and range values of 3.83 cms., 0.186 cm., and 3.6 to 4 cms. respectively.
CONCLUSION: The anatomic characteristics and measurements described in this study may prove useful in the prospective employment of the latissimus dorsi muscle and its iliac crest attachment for the reconstruction of oromandibular defects.

INTRODUCTION

Oromandibular reconstruction is a formidable and challenging area of expertise in the specialty of head and neck surgery. Options for restoring mandibular continuity include the use of alloplastic materials, free bone graft, and vascular bone flaps (may be pedicled and free). (1)

The latissimus dorsi myocutaneous flap is a reliable and versatile pedicled flap The muscle flap has figured in head and neck, breast/chest and abdominal wall reconstruction works; arm/ shoulder coverage, functional muscle and free flap transfers. (2). The flap has been successfully utilized for oromandibular reconstruction along with its scapular and rib attachments. (3,4)

The latissimus dorsi muscle prominently originates from the crest of the iliac bone. (Figure 1) The iliac bone is an irregular bone which forms the hip or coxal bone along with the ischium and pubis.(5) The crest of the iliac bone is a large

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curved piece of cancellous bone. (Figure 2) It has a natural contour that has been utilized for the oromandibular reconstruction purposes. In 1991, Urken et al reported the use of the iliac crest along with the attached internal oblique muscle as a composite free flap in 10 cases of oromandibular reconstruction. (6)

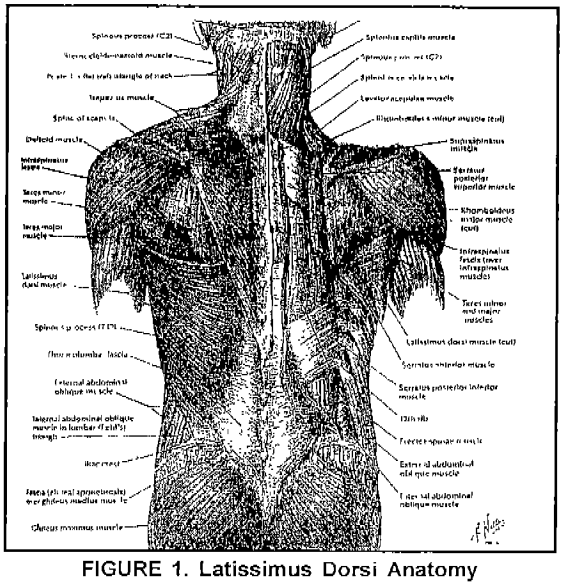


FIGURE 1. Latissimus Dorsi Anatomy

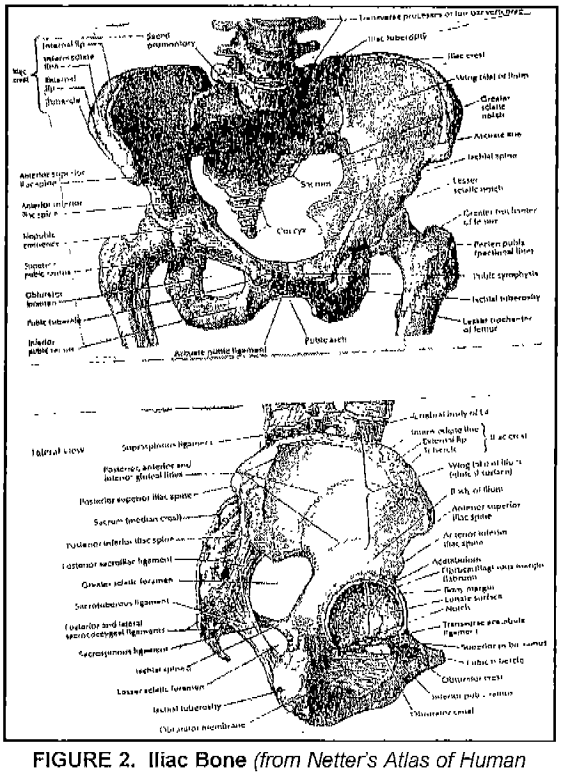


FIGURE 2. Iliac Bone *(from Netter's Atlas of Human Anatomy)*

The latissimus dorsi's conspicuous attachment to the iliac crest incited the researchers to investigate the feasibility of employing the pedicled latissimus dorsi myocutaneous flap and its iliac crest attachment for the reconstruction of oromandibular defects.

The latissimus dorsi muscle is supplied by the thoracodorsal and segmental perforating branches of the intercostals and lumbar arteries. (7,8) On the other hand, the ilum, is supplied circumflex iliac and gluteal arteries. (9,10)

The disparate blood supplies of the latissimus dorsi and the iliac bone designates the prospective utilization of the iliac crest (by virtue of its attachment to the latissimus dorsi) for oromandibular reconstruction as a non-vascularized free bone graft. However, Hoffman et al reported wide distribution of musculocutaneous perforators over the latissimus dorsi muscle surface that provides blood from skin down to the iliac crest.(8) Preservation of the musculocutaneous perforators on harvesting of the flap (along with the thoracolumbar fascia) will impart the characteristics of a pedicled osteomyocutaneous flap to the proposed latissimus dorsi and iliac crest attachment flap. Employment of such a vascularized bone flap has been proven to be more reliable than a free bone graft.(11)

On the basis of above premise and cognizant of the risks and limitations of the proposed innovation, the study ultimately aims to explore the possibility of employing the iliac crest attachment of the pedicled latissimus dorsi myocutaneous flap as an option for the reconstruction of oromandibular defects. The investigation must commence with a descriptive study of anatomic measurements pertinent to the latissimus dorsi and its attachment to the crest of the iliac bone.

The objectives of the study are:

1. To describe important anatomic characteristics and measurements related to the latissimus dorsi and its attachment to the iliac crest among adult Filipino cadavers.
2. To record the following anatomic variables in the cadaver subjects: sex and height, latissimus dorsi muscle length, iliac crest bone length attached to the latissimus dorsi muscle, and width of the iliac crest bone.

SUBJECTS AND METHODS

Nineteen adult Filipino cadavers (13 males, 6 females) without gross thoracolumbar deformities served as the subjects of this descriptive study.

Each cadaver was placed in the prone position. The latissimus dorsi muscle and the iliac crest were exposed on both sides for each cadaver. (Figure 3)

The following anatomic characteristics/ measurements were recorded:

FIGURE 3. Cadaver Dissection

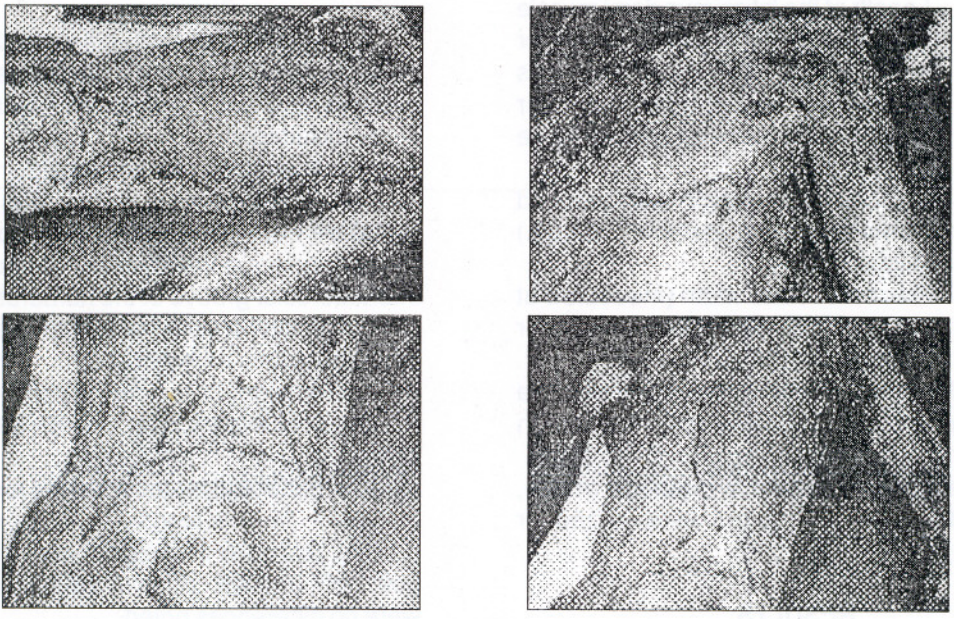


FIGURE 4. Determination of muscle length and Iliac crest Length with muscle attachment

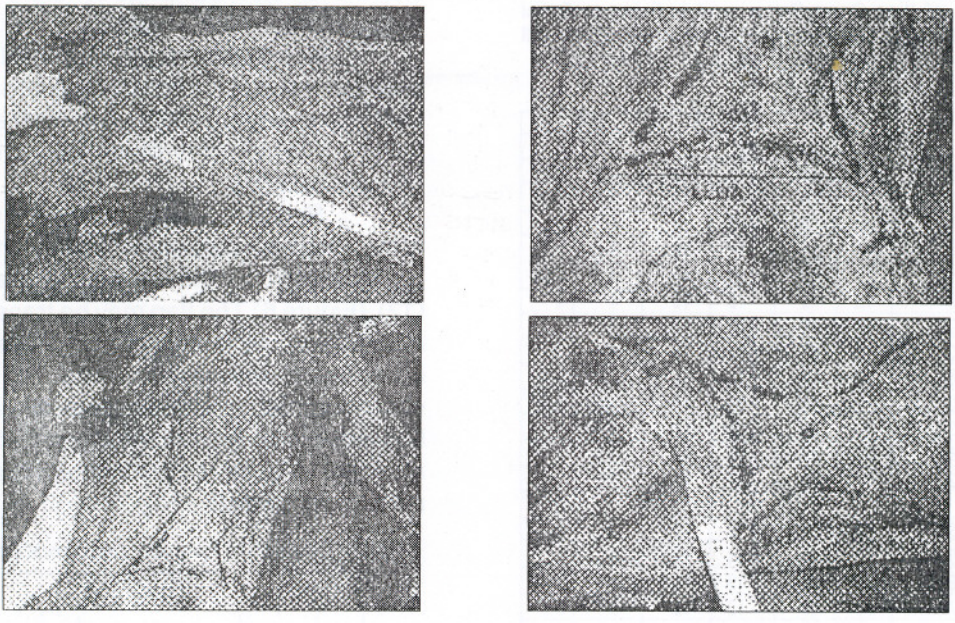
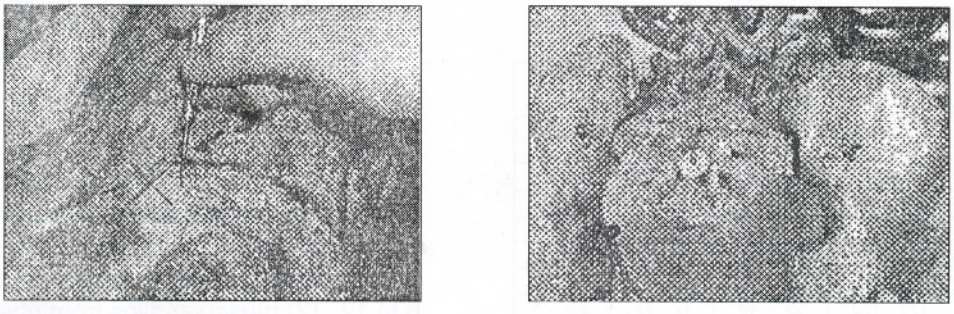


FIGURE 5. Determination of Iliac bone width (BW) (measured at the posterior superior iliac spine)



1. Cadaver height and sex
2. Length of the latissimus dorsi muscle (measured from the posterior superior iliac spine to the muscle's attachment to the intertubercular groove of the humerus) (ML) (Figure 4)
3. Iliac crest bone length with attached latissimus dorsi muscle (LLDA) (Figure 4)
4. Iliac crest bone width (measured at the point of the posterior superior iliac spine) (BW) (Figure 5)

All measurements were done using a measuring tape and a caliper and recorded in centimeters.

Descriptive statistical methods (mean, standard deviation, and range) were utilized for the study.

RESULTS

Table 1. Height, Length of the Latissimus Dorsi Muscle (ML), Length of Iliac Crest Bone and Latissimus Dorsi Attachment (LLDA), and Iliac Crest Bone Width (BW). (all measurements in centimeters; R- right side, L-left side)

	Height	ML		LLDA		BW	
Male		R	L	R	L	R	L
1	145	33	33	13	13	3.7	3.7
2	138	30	30	14	14	3.4	3.4
3	143	30	30	12	12	4	4
4	140	28	28	12	12	3.7	3.7
5	144	29	29	14	14	3.2	3.2
6	168	42	42	16	16	4	4
7	170	44	44	12	12	3.7	3.7
8	150	38	38	15	15	4	4
9	148	39	39	15	15	3.8	3.8
10	150	40	40	15	15	3.5	3.5
11	150	39	39	13	13	3.8	3.8
12	138	32	32	14	14	3.5	3.5
13	152	38	38	13	13	3.6	3.6
Female							
1	138	27	27	15	15	3.7	3.7
2	159	40	40	14	14	4	4
3	139	30	30	13	13	3.6	3.6
4	137	36	36	12	12	3.7	3.7
5	138	33	33	13	13	4	4
6	131	30	30	14	14	4	4

Table 2. Means, Standard Deviations, and Ranges

	Height	ML (R&L)	LLDA (R & L	BW (R & L)
Male				
Mean	148.923	34.692	13.692	3.685
SD	10.062	6.1696	1.315	0.244
Range	138 - 168	22 – 44	12 - 16	3.2 – 4
Female				
Mean	140.333	32.667	13.500	3.833
SD	9.584	4.718	1.049	0.186
Range	131 - 159	27 – 40	12 - 15	3.6 – 4

DISCUSSION

A total of 19 cadavers were dissected (13 male, 6 female) yielding 38 latissimus dorsi muscles and iliac crest bones. Variables in the study included:

1. cadaver sex and height
2. latissimus dorsi muscle length (obtained from the posterior superior iliac spine to the tendinous insertion of the muscle at the intertubercular groove of the humerus (ML)
3. iliac crest bone length attached to the latissimus dorsi muscle (LLDA)
4. width of the iliac crest (measured at the posterior superior iliac spine) (BW)

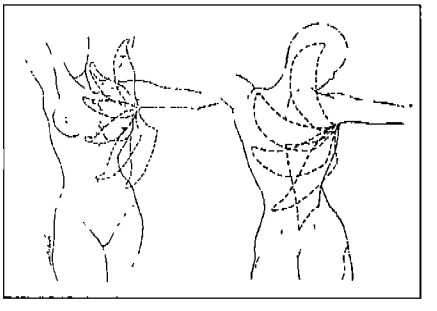
Individual measurements are presented in Table 1. Muscle length (ML), iliac crest length (LLDA), and bone width (BW) were measured on both right and left sides of the cadavers. There were no differences noted.

The male subjects were noted to be taller than the females, but range of height was slightly wider among males. (Table 2)

Muscle length (ML) denotes the possible extent of reach of the prospective latissimus dorsi myocutaneous flap and its iliac crest attachment. Table 2 shows higher mean values in the male cadaver subjects.

Barton et al established the reliable use of the latissimus dorsi muscle flap in the coverage of any defect from the thorax to the nasopharynx. (12) (Figure 6) The flap may be transferred as a muscle flap, as a myocutaneous flap , or as a composite osteomyocutaneous flap. As a composite flap, the latissimus dorsi has been harvested with the underlying serratus anterior muscle and rib for reconstruction of maxillary and mandibular defects. (14)

FIGURE 6. Arcs of Rotation, Latissimus Dorsi Muscle



The latissimus dorsi muscle (measuring 20x40 cm) has six points of *origin*: (1) spines and supraspinous ligaments of thoracic vertebrae 6 to 12, (2) muscular slips from ribs 9 to 12, (3) muscular slips from the scapula, (4) muscular slips intedigitating with the external oblique muscle, (5) the iliac crest , and (6) the

thoracolumbar fascia. (Figure 1) The 10 cm tendinous *insertion* of the muscle attaches to the intertubercular groove of the humerus. The muscle *functions* to (1) adduct and medially rotate the arm, and (2) assist posteroinferior shoulder motion. (2) (13)

The *dominant blood supply* of the muscle is the thoracodorsal artery, a terminal branch of the subscapular artery (from the axillary artery). Measuring about 2-4 mm in diameter, the thoracodorsal artery courses along the posterior portion of the axilla for about 8-14 cms before entering the latissimus dorsi muscle. Accompanying the thoracodorsal artery are 2 thoracodorsal veins (may be single in some individuals) and a thoracodorsal nerve. The neurovascular supply of the latissimus dorsi muscle can be identified at the midpoint between the scapula and the abducted humerus – about 1.25 cm from the muscle's free border. (7)

A *secondary blood supply* for the latissimus dorsi muscle comes from the segmental perforating branches of the intercostals and lumbar arteries. These vessels enter the muscle' s deep surface at the posterior midline. (8)

The latissimus dorsi muscle prominently originates from the crest of the iliac bone. Length of the iliac crest bone attached to the latissimus dorsi muscle (LLDA) denotes the length of bone that can be harvested with accompanying muscle bulk. A higher mean value was obtained from the male cadaver subjects (13.69 cm) versus. The female cadaver subjects (13.50 cms) . (Table 2)

Urken et al reported that up to 14 cms. of iliac bone can be harvested to bridge a corresponding mandibular defect in an internal oblique-iliac crest osteomyocutaneous free flap. (8)

Bone width (BW) means for the cadaver subjects are presented in Table 2. Means were higher in the female cadaver subjects.

Greater variability was noted in the values for iliac crest length (LLDA) and bone width (BW) in the male cadaver subjects.

Four vascular pedicles supply the ilium: (1) the superficial circumflex iliac artery (SCIA), (2) the deep circumflex iliac artery (DCIA), (3) the superior deep branch of the gluteal artery and (4) the ascending branch of the lateral circumflex artery. While the DCIA is the most reliable of the 4, the latter two vascular pedicles have proven inadequate for free flap transfer. (9,10)

The existence of musculocutaneous perforators over the latissimus dorsi muscle surface that provides blood from skin down to the iliac crest bone has been reported. This supply however is not completely reliable and some authors recommend flap delay measures. (5) These perforators are advantageous insofar as the prospective surgical innovation will have the boon attributes of an osteomyocutaneous flap. An osteomyocutaneous flap will have a higher chance for survival over a free bone graft.

Autogenous, non-vascularized, osteoperiosteal rib, clavicle, and iliac bone have been used in mandibular reconstruction since the early 1900's. (14) Results with free bone grafting technique generally has been poor with high donor site morbidity, bone resorption, and unpredictable results. (15,16) Foster et al in 1999, evaluated 75 consecutive cases of oromandibular reconstruction [26 cases of non-vascularized bone grafts (NVBGs), 49 cases of vascularized bone flaps (VBFs)]. Successful bony union occurred in 69% of NVBGs and 96% of VBFs. NVBGs required 2.3 operations as compared to 1.1 operations for VBFs . Overall implant success occurred in 82% of NVBGs and 99% Of VBFs. (17)

In 1986, Mogi et al described the use of a latissimus dorsi-iliac bone flap for oromandibular reconstruction. In their study, a segment of the iliac crest was harvested 2 weeks before tumor extirpation. The bone was transplanted beneath the latissimus dorsi muscle and later transferred as a composite flap. The flap was used in 2 patients with disappointing results. Bony union was not achieved in both patients. (18)

The use of the latissimus dorsi muscle and its iliac crest attachment for the reconstruction of an oromandibular defect is an attractive and logical option to the researchers. This descriptive study detailing anatomic measurements and characteristics related to the latissimus dorsi and iliac crest attachment is a prelude to the application of the proposed surgical innovation on a patient/s requiring oromandibular reconstruction. The investigators intend to preserve the iliac crest attachment and the musculocutaneous perforators of the latissimus dorsi muscle in addition to utilizing flap delay measures to increase the viability of the flap in prospective patients.

CONCLUSION

Anatomic landmarks and measurements related to the latissimus dorsi muscle and the muscle's conspicuous attachment to the iliac crest were described and measured. Cadaver sex and height, latissimus dorsi muscle length (ML), iliac crest bone length attached to the latissimus dorsi muscle (LLDA), and width of the iliac crest (BW).

Mean values for ML and LLDA were

higher in males than in the female cadaver subjects. The mean value for BW in the female cadavers was higher compared to males.

The reported occurrence of musculocutaneous perforators over the latissimus dorsi muscle surface (that provide blood from skin down to the iliac crest bone) pose the best chances for a viable pedicled latissimus dorsi-iliac crest bone flap for oromandibular reconstruction applications.

The anatomic measurements and characteristics described in this study may prove useful in the prospective employment of the latissimus dorsi muscle and its iliac crest attachment for the reconstruction of oromandibular defects.

RECOMMENDATIONS

The investigators would like to make the two recommendations:

1. The proposed latissimus dorsi-iliac crest bone flap be used to reconstruct simulated oromandibular defects in cadavers.
2. Correlation and regression analyses be performed on the variables utilized in the study. Correlation analysis (e.g. Pearson's correlation coefficient) measures the strength and direction of the relationship between two or more variables. (e.g. increasing muscle length may be related to increasing cadaver height). Regression analysis will aid in the identification/estimation of a particular variable on the basis of a prediction equation (e.g. muscle length may be computed/ estimated from a given cadaver height).

BIBLIOGRAPHY

1. Bailey, BJ et al. Head and Neck Surgery-Otolaryngology. 3rd ed. USA: Lippincott Williams Wilkins, 2001.
2. Bostwick, J et al. Sixty latissimus dorsi flaps. Plastic and Reconstructive 63(1):31-41, 1979.
3. Allen et al. The latissimus dorsi-scapular bone flap. Plastic and Reconstructive Surgery. 94, 1994.
4. Yamamoto, Y et al. An anatomic study of the latissimus dorsi-rib flap: an extension of the subscapular combined approach. Plastic and Reconstructive Surgery. 18(5):811-816, 1996.
5. Chung, KW. Gross Anatomy.3rd ed. USA:Williams and Wilkins, 1995.
6 Urken, ML et al. The internal oblique-iliac crest free flap in composite defects of the oral cavity involving the bone, skin, and mucosa. Laryngoscope. 101:257-270, 1991.
7. Bartlett, J, JW May, and MY Yaremchuk. The latissimus dorsi muscle: A fresh cadaver study of the primary neurovascular pedicle. Plastic and Reconstructive Surgery. 67(5):61-36, 1986.
8. Strauch, B ed. Grabb's Encyclopedia of Flaps. 2nd ed. PA:Lippincott-Raven Publishers, 1998.
9. Moscoso J and ML Urken. The iliac crest composite flap for oromandibular reconstruction. Otolaryngologic Clinics of North America. 27(6):1097-1117, December, 1994
10. Smith J. Mandibular Reconstruction. EMedicine, 2003.
11. Gregor RT et al. Trapezius Oteomyocutaneous Flap. Archives of Otorhinolaryngology 111: 198-203
12. Barton, FE, TE Spicer, and HS Byrd. Head and neck reconstruction with latissimus dorsi myocutaneous flap : anatomic observations and report of 60 cases. Plastic and Reconstructive Surgery. 71(2):199-204, 1983.
13. Polynice, A et al. Latissimus Myocutaneous Flap. EMedicine. March, 2003.
14. Blocker, TG and RA Stat. Mandibular reconstruction in World War II. Plastic and Reconstructive Surgery 4:153-156.
15. Kuriloff D and MJ Sullivan. Mandibular reconstruction using vascularized bone graft. Otolaryngologic Clinics of North America.. 24(6):1391-1418, December, 1991.
16. Conley J. A technique of immediate bone grafting in the treatment of benign and malignant tumors of the mandible – a review of 17 cases. Cancer. 6:568-577, 1953.
17. Foster, RD et al. Vascularized bone flap versus non-vascularized bone graft for mandibular reconstruction : an outcome analysis of primary union and endosseous implant success. Head Neck. 21(1):66-71, January, 1999.
18. Mogi, G et al. Latissimus dorsi myocutaneous-iliac bone flap for reconstruction of defects of the mandible and oral basis. Laryngoscope. 96:171-177, 1986.

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SINGLE STAGE MANDIBULAR RECONSTRUCTION USING CLAVICLE WITH SCM PEDICLE FLAP: CASE SERIES*

HOMER M. MATIAS, MD**

ABSTRACT

OBJECTIVES: To describe the operative technique in the reconstruction of the mandible using the clavicle with sternocleidomastoid (SCM) pedicle flap in a single stage procedure. It shall also report the outcome of the single stage mandibular defect reconstruction using the clavicle with SCM pedicle flap based on (1) number of post-op hospital days, (2) complications of recipient and donor sites, and (3) return to function of the newly reconstructed mandible.
STUDY DESIGN: Case Series.
SETTING: Tertiary care hospital.
PATIENTS: Six cases of mandibular defects after resection of benign tumors (5 Ameloblastoma, 1 Fibromyxoma). There were three patients with hemimandibular defects, two with segmental defects and one with extended hemimandibular defect.
RESULTS: Post-op hospital days ranged from six to twentythree (6-23) days (average of 13 days). Five patients had good recipient site healing; one patient had wound dehiscence on floor of mouth, which was tertiary closed using a tongue flap. Speech was intelligible in all patients. All patients had good swallowing and occlusion, as well as cosmetically acceptable mandibular contour and symmetry. No donor site post operative complications were noted. Shoulders were posteriorly displaced but there was no limitation of range of motion. Return to oral feeding was achieved after removal of NGT at four weeks post-op in five patients, and six weeks after in one patient with complication (as noted above).
CONCLUSION/RECOMMENDATION: Single stage mandibular reconstruction of the mandible using the clavicle with sternocleidomastoid (SCM) pedicle flap is a useful surgical option with good cosmetic and functional outcome.

INTRODUCTION

The mandible is an important structure of the head and neck. It provides protection to the upper airway and supports the tongue, the lower dentition, and the muscles of the floor of the mouth. These functions of the mandible permit mastication, articulation, deglutition, and respiration. Aesthetic deformities and functional deficits will occur if scarring, fibrosis, and contractures develop especially if the resected ends of the mandible are allowed to float free after reconstruction (Kanter, 1997). In addition, scarring and fibrosis may cause problems of drift to the remaining segment of the mandible by which reconstructing the mandibular defect primarily is beneficial.

Mandibular reconstruction after trauma or tumor resection offers difficulties to many head and neck surgeons. However, advances in bone science, grafting technique and reconstruction plates have increased surgical options for mandibular reconstruction.

Review of medical records from our institution from 1991 up to present revealed that there were 31 patients who have undergone mandibular resection due to tumors (27 benign; 3 carcinoma). One had mandibular defect secondary to gun shot wound. Fourteen of these patients underwent mandibular reconstruction using reconstruction plates and pins; eight (57%) with complication of plate extrusion. Three were reconstructed using pedicle flap (2 pectoralis major with rib and 1 clavicle with SCM). Another patient underwent reconstruction of the mandible with free bone graft (iliac bone) and plates. This particular patient had prolonged confinement and recuperation at home due to poor wound healing.

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The rest of the patients (41%) did not undergo reconstruction after tumor resection of the mandible. For the majority of these patients, the major problem was asymmetry and drift of the mandible to the unresected site (with associated poor dental rehabilitation and occlusion).

The review of the 31 patients above reflects the observation of certain studies: 1) the high extrusion rate of plates and 2) a better outcome of the use of pedicle flaps (Zenn 1997). Free vascularized tissue transfer for mandibular reconstruction has been widely acceptable and proven to be a good surgical option. Our institution is still at its initial steps towards this advancement. However, cost-effectiveness, surgical skills and availability of reconstruction plates are the primary factors to consider in mandibular reconstruction. To address these health issues, it is a must to any head and neck surgeon to have other surgical options with this kind of problem.

This study shall describe the operative technique in reconstruction of mandibular defect using the clavicle with SCM pedicle flap in single stage procedure. It will describe the outcome of single stage mandibular reconstruction using the clavicle with SCM pedicle flap based on (1) number of post-op hospital days, (2) complications of recipient site and donor site, and (3) return to functions of the newly reconstructed mandible.

METHODOLOGY

Six patients were included in this study (February 2001 to July 2003). Patient age ranged from 19 and 54 years (mean 33 years). They have all benign tumors with five (5) Ameloblastoma and one (1) Fibromyxoma. Table 1 summarizes the subject profile, type of tumor and extent of defects.

TABLE 1

Patient	Age/Sex	Type of tumor	Defects
I.T.	30/F	Ameloblastoma	Extended hemimandibular defect
S.M.	20/F	Ameloblastoma	Segmental defect
A.A	27/F	Ameloblastoma	Hemimandibular defect including condyle
E.S.	54/F	Fibromyxoma	Segmental defect
J.E.	19/M	Ameloblastoma	Hemimandibular defect including condyle
R.D.	43/M	Ameloblastoma	Hemimandibular defect including condyle

All patients underwent single stage mandibular reconstruction using the clavicle with SCM pedicle flap. Pre-operative biopsy was done and panoramic view of the mandible was requested for evaluation of the extent of the tumor. A curvilinear incision was made from the mastoid area to the mentum (with the option of midline lip splitting for proper exposure of the mass). Uninvolved tissues were spared. The tumor was excised with 1 to 1.5 cm margin using the Gigli saw. Condylar disarticulation was done in all hemimandular defects. The incision along the clavicle is made up to periosteum with preservation of the insertion of the SCM. The attached pectoralis major muscle was separated and cut. The clavicle was harvested with the clavicular head of the SCM. Subplatysmal tunneling was made between the incision on the clavicle and on the previous incision. The SCM was freed carefully from its fascia. The length of the clavicle to be harvested was determined by the length of the defect. [There is an average of 16 centimeters of bone that is available for harvest (Seikaly, 1996).] The clavicle with SCM was passed through the subplatysmal tunnel. The SCM was freed and rotated at the level of the hyoid bone or higher so as not to compromise its blood supply. Each end of the clavicle was attached to each remaining segments of the resected mandible with the use of K-wire in cases of segmental mandibular defect. For hemimandibular defect, the clavicle was attached to remaining segment and was used as cantilever and attachment of soft tissues. Positioning of the clavicle was considered before wiring so that the contour of the clavicle will simulate the contour of the lost bone part. The defect in the oral cavity was closed tightly to prevent leakage of saliva. A nasogastric tube was inserted. Interdental wiring and mandibulomaxillary fixation is done. Drain was placed and incisions are closed. Figures 1-6 show photos of the procedures.

RESULTS

Mandibular continuity was obtained in two cases of segmental defects. Problems of drift of the remaining mandibular segment and contracture of the surrounding tissues were avoided among those who have hemimandibular defects. No failure of the pedicle flaps and bone resorption were noted. Uncomplicated primary wound closure was obtained in five (5) cases. Dehiscence developed in the floor of the mouth in one patient with an extended hemimandibular defect. Tension on closure due to less mucosa led to dehiscence and violation of watertight seal on the lingual side of the defect. However, this was addressed by tertiary closure using a tongue flap. This complication did not lead to failure of the clavicle with SCM flap in this patient. Delay in incision site healing was noted on 2 patient probably related to poor nutritional status as patient were on NGT feeding. Speech was

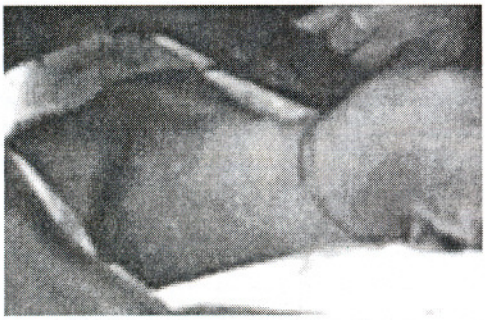

FIGURE 1. Lines of incision drawn.

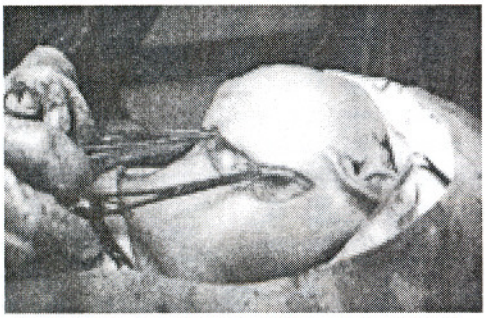

FIGURE 2. Subplatysmal flap undermined.

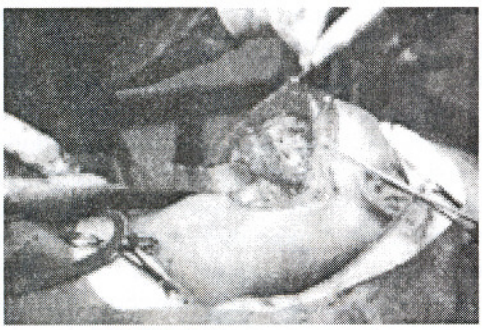

FIGURE 3. Tumor exposed.

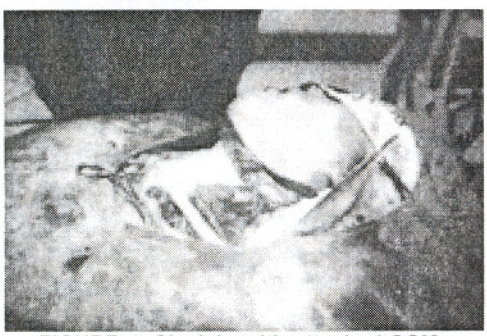

FIGURE 4. Clavicle with attached SCM

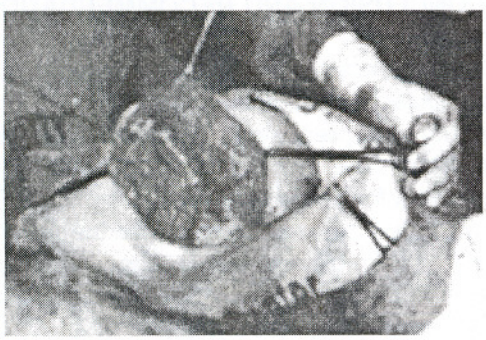

Figure 5. Clavicle now attached to mandibular defect.

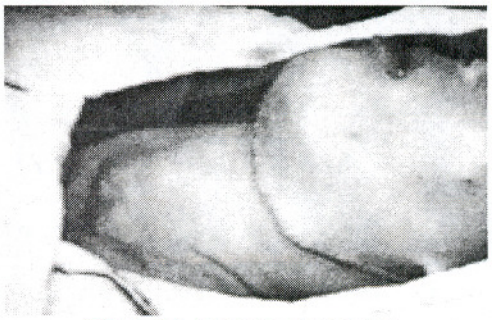

FIGURE 6. Closure of incision.

intelligibly understandable to all patients, with good swallowing and occlusion, and cosmetically acceptable mandibular contour and symmetry.

TABLE 2

Patient	# post-op hospital days	# of days NGT in place	Complications
I.T.	23	8 weeks	dehiscence on FOM
S.M.	6	4 weeks	None
A.A	14	4 weeks	delayed healing of incision site
E.S.	7	4 weeks	None
J.E.	14	4 weeks	delayed healing of incision site
R.D.	16	4 weeks	None

No donor site post-operative complications were noted. The shoulders of all patients were noted posteriorly displaced but there were no limitations of range of motion. Post-op hospital days ranged from six to twenty three (6-23) days. Return to oral feeding was achieved after removal of NGT at four (4) weeks in five (5) patients, and eight (8) weeks after in one patient complicated with dehiscence.

Table 2 summarizes the complications, number of post-op days and number of days NGT was removed post-operatively. Figures 7-11 show post-op photos of patient J.E.

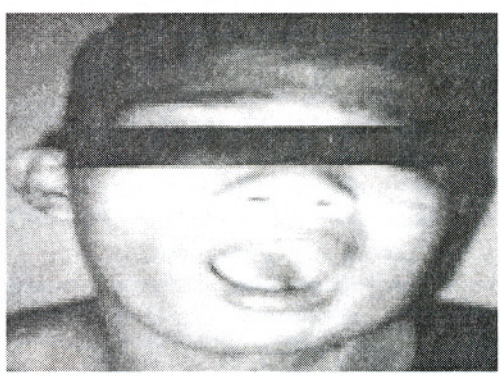

FIGURE 4. Good oral cavity mocusa closure.

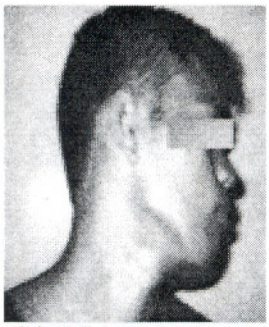
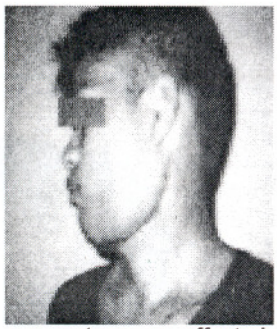

FIGURE 8 and 9. Note the symmetry on unaffected side versus the reconstructed side.

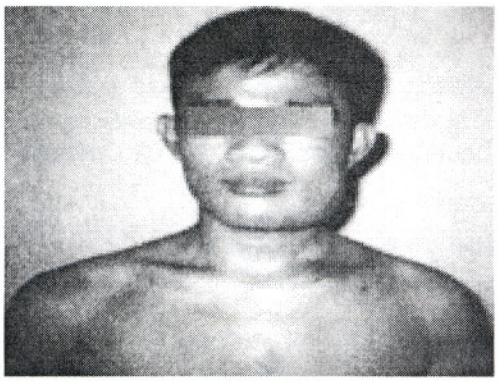

FIGURE 10. Note the prevention of drift towards reconstructed defect. The bulge on the affected side represent the SCM that was rotated with the clavicle. The SCM will eventually atrophy.

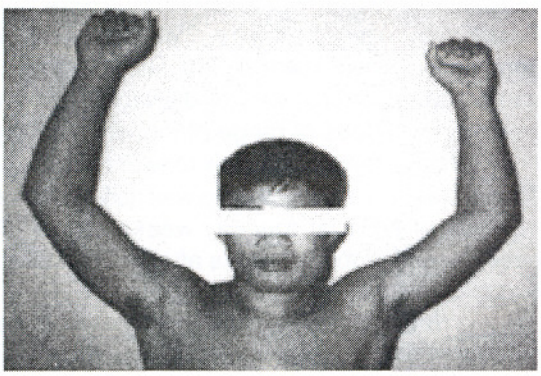

FIGURE 11. Patient with no difficulty in raising his arms. Note that the left arm is posteriorly displaced.

DISCUSSION

A series of six (6) cases with mandibular defects after tumor resection has been presented. All patients underwent single stage mandibular reconstruction using clavicle with SCM pedicle flap. Lawson et al, in 1982, reported a success rate of 90% for delayed reconstruction versus 46% for primary reconstruction. However, due to improvement in treatment modalities primary reconstruction is now frequently applied. Our series showed 100% success rate in primary mandibular reconstruction without a second operation due to flap failure. There was no patient with mandibular malignancy during the period this study was made. Theoretically, malignant tumors may compromise this kind of procedure especially in those tumors requiring neck dissection which may compromise the blood supply of the SCM (or the SCM may not have been spared in the neck dissection).

Post-operative oral rehabilitation is comparable to other studies. The abilities to manipulate food bolus, to swallow, and to articulate speech are preserved. These functions are difficult to perform in the unreconstructed mandible since there is deviation to the resected side due to unopposed pull of remaining muscles of mastication, soft tissue contraction and scar formation. Dental rehabilitation was limited to false dentures in our series. Likewise, facial symmetry is acceptable compared to the unreconstructed mandible.

Many investigators infrequently used pedicle bone transfer due to technical problems. These include limited arc of rotation and difficulty in harvest. Bone thickness availability also limits dental rehabilitation. Ariyan and Cuono (1980), reported the use of pectoralis major pedicled flap transfer with underlying fifth rib. Panje (1980) also introduced the trapezius osteomyocutaneous flap with 87% success rate. All these procedure are difficult, complex and require more surgical skills and training. Likewise, sacrificing trapezius function is rarely indicated. However, they have their own indications for mandibular reconstruction. In our series we chose the clavicle since it is strategically near the defect to be reconstructed with blood supply from perforators coming from the SCM. This procedure is simpler than those described by Ariyan and Panje. However, function of the clavicle is sacrificed. This is limited to decreased lifting capacity and posterior displacement of the shoulder.

This procedure is cost-effective. It offsets the unavailability and high cost of reconstruction plates. It is also a simple procedure with less surgical technicalities.

CONCLUSION AND RECOMMENDATION

Operative technique of single stage mandibular reconstruction using SCM pedicle flap has just been presented. This procedure has an important role in mandibular reconstruction particularly for benign tumors of the mandible. This procedure is cost effective and simple. It can be used as a surgical option for reconstruction of the mandible, resulting to a functioning and aesthetically acceptable jaw.

BIBLIOGRAPHY

1. Zenn MR, Hidalgo DA. Current Role of the Radial Forearm Free Flap in Mandibular Reconstruction, Plastic and Reconstructive Surgery, 99:1012-1017, 1997.
2. Ariyan S, Cuono CB. Myocutaneous Flaps for Head and Neck Reconstruction. Head and Neck Reconstruction Surgery 2 (4):321-345, 1980.
3. Lawson W, Black SM, Loscalso LV, Biller HF, Krespi YP. Experience with Immediate and Delayed Mandibular Reconstruction. Laryngoscope 92:5-10, 1992.
4. Seikaly H, Calhoun K, Rassekh C, Slaughter D. The Clavicopectoral Osteomyocutaneous Free Flap. Otolaryngology Head and Neck Surgery 1996.
5. Talesnik A, Markowits B, Calcaterra T, Ahn C, Shaw W. Cost and Outcome of Osteocutaneous Free Tissue Transfer versus Pedicled Soft-Tissue Reconstruction for Composite Mandibular Defects. Plastic Reconstruction Surgery 97 (6):1167-1177, 1996.
6. Urken ML, Buchbinder D, Weinberg H, et al. Functional Evaluation Following Microvascular Oromandibular Reconstruction of Oral Cancer Patient: A Comparative Study of Reconstructed and Non-Reconstructed Patient. Laryngoscope 101:935-950, 1991.
7. Kanter A, Bleiller R, Fielding A. Use of Polymethylmethacrylate as a Space Maintainer for Delayed Reconstruction of Mandibular Defects. Temple University Health Science Center, Philidelphia Pennsylvania, Sept, 1997.
8. Urken ML, Composite Free Flaps in Oromandibular Reconstruction. A Review of Literature. Arch. Otolaryngology Head and Neck Surgery, 117:724, 1991.
9. Chen YT, Chen H, Hahn L. Major Mandibular Reconstruction with Vascularized Bone Graft: Indicators and Selection of Donor Tissue. Microsurgery 15:227, 1991.

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COMPOSITE STERNOCLEIDOMASTOID MUSCULO-CLAVICULAR GRAFT FOR IMMEDIATE RECONSTRUCTION OF MANDIBULAR DEFECTS REVISITED*

VINCENT MARK L. JARDIN, MD**
MARIANO B. CAPARAS, MD, FPSO-HNS***

ABSTRACT

Immediate reconstruction for mandible defects secondary to excision of tumor has been dealt with in various ways. With the advent of newer technology and micro-vascular surgery, some methods that are reliable in past, have now become passé. This paper demonstrates three cases where we used a myo-osseo-cutaneous composite flap, the sternocleidomastoid-clavicular graft to reconstruct the mandible for our ameloblastoma patients. This paper will illustrate the reliability of the graft, flexibility of its use, and gross viability after a few months post-operatively. In the three cases, no complications were noted, however long term follow-up still has to be made to assess its use and compare it with those done in other centers. The technique is simple and can be done by an otolaryngologist alone, as well as feasible in the absence of microvascular expertise and resources such as plating system, etc.. This is written as a pioneering report to revisit known surgical techniques in the past that may still have a role in dealing with mandible defect reconstruction in our present situation.
KEYWORDS: clavicular graft, ameloblastoma, segmental mandibulectomy, myoosseocutaneous pedicled flap

INTRODUCTION

Major surgical resection of intra-oral lesions like ameloblastoma causes loss of both lining and skeleton support. The lack of skeletal reconstruction even in the presence of adequate replacement of lining continues to create significant functional problems for the patient postoperatively. These include deviation of the remaining mandibular segment, a poorly supported lower lip, and a lining that responds to gravity and therefore drags downward, creating a well and taking the tongue with it. Optimal function given the degree and extent of resection is not possible in terms of mastication, deglutition, and speech. Appearance may also be unacceptable, together with occasional drooling (1).

Many vascularized bone grafts have been devised in attempts to restore skeletal continuity in this group of patients. These have fallen into two categories. The first is in the field of microvascular free transfer that has included the dorsalis pedis flap with a second ray, iliac bone carried on the deep circumflex iliac vessels and fibular free graft with the peroneal artery. The second group comprises bone carried on a regional muscle such as sternocleidomastoid and clavicle, trapezius and spine of scapula, and pectoralis major and rib combinations (1).

Various techniques have been employed in the reconstruction of defects of the mandible created by extirpative surgery for malignant and benign lesions like ameloblastoma. One technique involves reconstruction of the mandibular arch using composite graft pedicled on the sternocleidomastoid muscle. The advantages of this graft for immediate reconstruction of mandibular defects are several. First, post-operative radiation therapy can be administered four to six weeks after surgery without any resultant bone loss for malignant cases. Second, mandibular deviation and temporal mandibular joint ankylosis are prevented. Third, dental prosthetic reconstruction can be performed postoperatively to facilitate mastication, speech, and the overall rehabilitation of these patients. Fourth, the cosmetically disfiguring "Andy Gump" deformity can be avoided when resections involve the region of the symphysis (2,3).

Mandibular reconstruction in the practice of head and neck oncology is a problem for which there are many acceptable solutions. The diversity of accepted techniques for dealing with the mandibular defect indicates that there is no uniform opinion regarding a superior or preferred way of handling this problem. It is not the purpose of this article to present another "superior" method of reconstruction, but rather to present a

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technique that has been recently re-introduced, has proved reliable, and offers some distinct advantages (2).

Compound osseocutaneous flaps, using clavicle and overlying skin, have been described since the early 1900s. The article of Conley, first presented in 1971 (published in 1972) was the first to mention the use of compound myosseous flaps in head and neck reconstruction (2).

The method of reconstruction studied in this article was described by Siemssen, et al.(4). They reported the reconstruction of mandibular defects in a single stage operation using sternocleidomastoid clavicular myosseous flap. Siemssen et al used the procedure in the treatment of gunshot wounds to the mandible, fractures of atrophic mandibles, congenital malformations, reconstruction of previous resections, osteoradionecrosis, and tumor invasion and destruction (2).

TECHNIQUE

The technique employed was similar to that described by Siemssen et al (4) and Barnes et al (2). However, in all our cases, there were no external fixation done unlike those done by Barnes, et al. Like Siemssen, et al, the grafts were fixed using interosseous wiring and interdental wiring and fixation. Another difference would be the extent of surgery, all our cases were benign lesions of the mandible, ameloblastoma. Our cases were less extirpative compared to both studies which involved mandibular resection for neoplasms. In a way, we did not have the problem of soft tissue coverage.

The constancy of the vascular supply of the sternocleidomastoid muscle provides the basis for an apparently viable myosseous flap. The inferior third of the muscle is supplied by branches of the thyrocervical trunk, the middle third by branches of the superior thyroid artery, and the superior third by branches from the posterior auricular artery. The muscle is capable of surviving with any one of the three vessels intact.

The procedure was initiated with a naso-tracheal intubation or via trachoetomy and putting the patient under general anesthesia. The margins for the resection of the primary tumor in the mandible and the extra-osseous extent were marked. The skin flaps were developed. The mandible was exposed and was prepared for resection by elevating a skin flap laterally and forming tunnels for passage of a gigli wire. Prior to resection of the mandible, arch bars were placed and occlusion was estimated. The primary tumor, mandible and soft tissue involved were resected en bloc.

Attention was then turned into the ipsilateral sternocleidomastoid muscle and clavicle. The clavicle was measured to fit precisely the defect created in the mandible. The measured clavicle graft included the medial head of the clavicle and a portion or all of the medial two thirds of the clavicular body. The sternocleidomastoid muscle was then dissected from the point of the clavicular attachment superiorly. The blood supply from the thyrocervical trunk was identified and transected. Dissection was further carried up the muscle. The branches from the superior thyroid trunk were demonstrated and preserved. The spinal accessory was identified and preserved. The clavicle was then freed from all attachments except the sternocleidomastoid muscle and transected at the previously marked points. The clavicle rotated easily into the defect. Contouring was done so as to facilitate smooth apposition with the remnant mandible. Once positioned into the defect, the clavicle was fixed with intra-osseous wires. The intra-oral defect was closed primarily in two layers where possible. The external skin flap was repositioned over the grafted clavicle. Suction drains were placed, and the neck was closed in the standard two-layer fashion. Interdental wiring was done after the closest approximate of occlusion was achieved. Intermaxillary-mandibular fixation (IMMF) was done to one patient, interdental wiring was not feasible due to absence of mandible from one side of the angle to the other. Please refer to Appendix A: Summary of the Procedure.

CASES

Case One

B.F. is a 34/M with a left mandibular mass gradually enlarging for a year before consult to our institution. Panoramic x-ray showed a multicystic and locular lesion in the mandible involving the posterior aspect of the body up to the condyle. Biopsy revealed ameloblastoma. Excision of the tumor was done in the same incision as above removing the mandible from the parasymphysis up to the condyle. The defect was around 14 cms. An ipsilateral sternocleidomastoid-clavicular graft was harvested from the sternum up to 2/3 of the clavicular body measuring around 13 cms. The sternal portion of the clavicle graft was connected mesially using stainless wires and was loosely attached to the zygoma which was partially fractured and rotated inferiorly with periosteum left intact using wires as well. Closure was done in layers and course in the wards was uneventful. Patient was discharged after five days when the JP drains were removed.

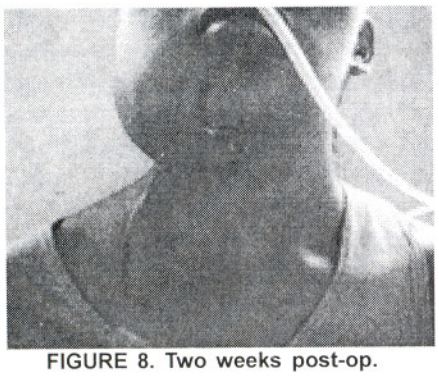

FIGURE 8. Two weeks post-op.

Case Three

E. A. is a 35/F with a 5-year history of gradually enlarging mass in the central gingival area that was initially excised in a local hospital. Biopsy showed ameloblastoma. The mass recurred within a year and the patient was lost to follow up till it involved the entire anterior mandible and gingival area. She was seen at our clinic with a panorex that showed a multicystic mass involving the entire anterior portion of the mandible extending from the left ramus to the right. She underwent wide excision under GA via tracheostomy using an apron incision with bilateral backward extensions up to the clavicle on each side. The mandibular mass was excised from just above the angle on each side, around 1 cm margin grossly from the mass edge and leaving the both condyles intact. The defect was around 14 cms. The right clavicle was harvested first with its sternal head and body measuring around 7 cms. The left side was likewise harvested and measured around 6 cms.. The sternal heads were wired using stainless wires in a figure of eight configuration to the remaining condyles and the clavicular body portions of the graft were wired together mesially as mentum. Intermaxillo-mandibular fixation (IMMF) was done. Closure was done in layers. Course in the wards was uneventful. Patient was discharged after a week after being successfully decannulated.

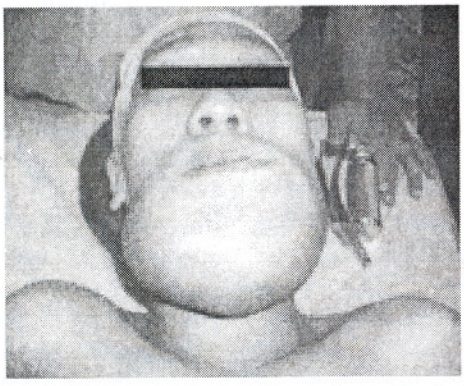

FIGURE 9. Mandibular mass from above the body on both sides, pre-op.

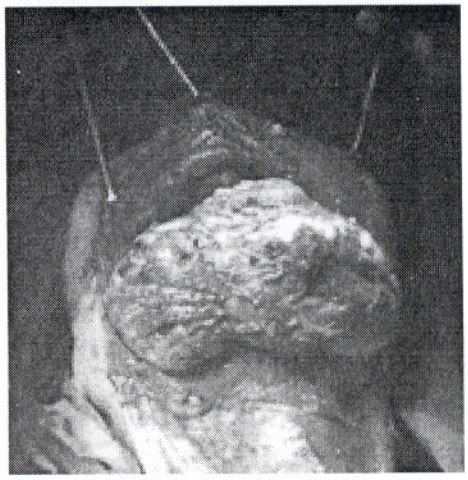

FIGURE 10. The mass exposed intra-op

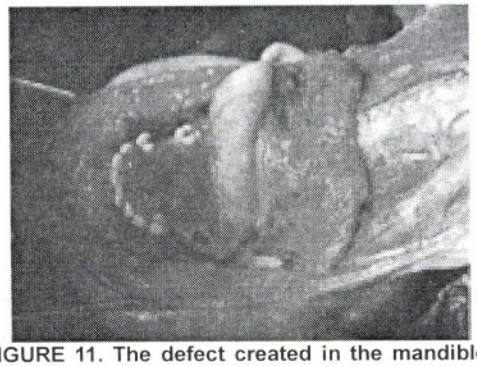

FIGURE 11. The defect created in the mandible post-op.

FIGURE 12. Sterno-clavicular graft harvested on one side.

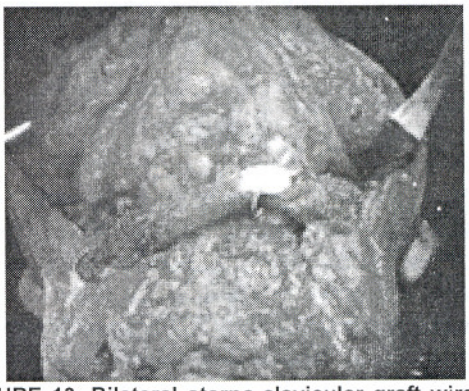

FIGURE 13. Bilateral sterno-clavicular graft wired.

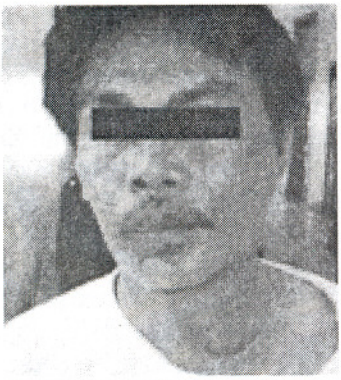

FIGURE 1. Eight weeks post-op

FIGURE 2. Clavicular graft wired to the defect

Case Two

R.A. is a case of a 17/M who had a 6-month history of enlarging mandibular mass on the left side around 8x12 cms. Panorex was done showing an extensive multiloculated mass in the left mandible from the first pre-molar up to the condyle. An incision biopsy was done and revealed ameloblastoma. Patient underwent wide excision of the tumor using a lip-split, half-visor with modified Schoebinger incision. The resected mandible included the canine area up to the condyle and coronoid process which was around 13 cms in length . The clavicular graft harvested included the sternal attachment up to more than two thirds of the clavicular body and measured 12 cms. The sternal end of the clavicle was attached mesially to the parasymphysis of the remaining mandible and the other end was loosely connected to posterior portion of the zygoma. Interdental wiring was done to ensure fixation and occlusion. Patient was discharged well after five days when the JP output was taken out.

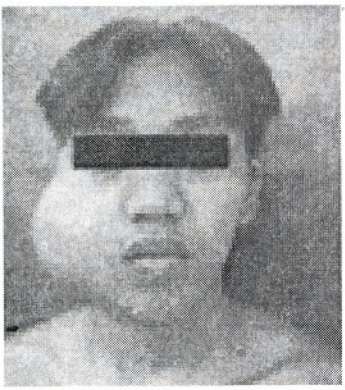

FIGURE 3. Pre-op picture, right Mandibular mass

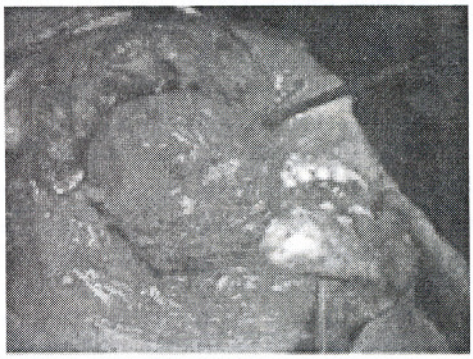

FIGURE 4. Mandibular mass exposed and medial margin prepared for osteotomy.

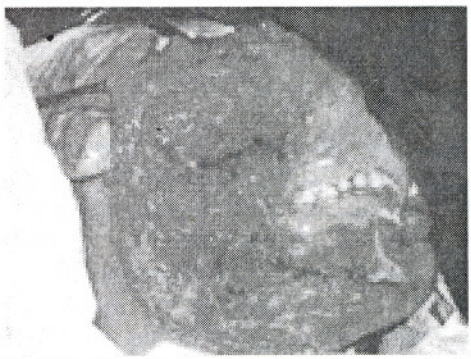

FIGURE 5. Mandibular defect after mass excised.

FIGURE 6. Sterno-clavicular graft harvested

FIGURE 7. Sterno-clavicular graft wired to the zygoma and mandible.

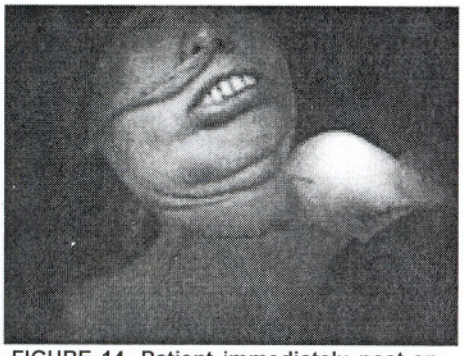

FIGURE 14. Patient immediately post-op.

RESULTS

All three patients done had follow ups from just one month post-op to six months. The first patient has an acceptable cosmetic result with occlusion partially established after six months. He is due for fitting of dentures. No note of dehiscence nor extrusion or infection of wires seen. The graft is grossly viable at six months. We plan to do technetium scan (4) to document viability on the third post-operative month, but was not done due to financial constraints.

The second patient is six weeks post-op and with good cosmetic results. Occlusion cannot be assessed yet as there is still interdental wiring in place that will be removed on the eighth week. Although there is a noticeable of clavicular asymmetry, he can still function fully his right arm. He also has some torticollis on the ipsilateral side. No infection was noted nor dehiscences or rejection at this time, but some granulation tissue were seen intra-orally at the posterior suture lines. Graft is also grossly viable. He is due for technetium scan on the third month and dental appliance planning once the inter-dental wires are removed.

The third patient is a month post-op with the best cosmetic result. She has the best symmetry of the three. Occlusion cannot be established, and no interdental fixation was done as it is not feasible in her case so an IMMF was used instead. IMMF is due for removal after six weeks. She is due for dental appliance placement. No note of infection, dehiscence, or rejection noted. A technetium scan will be done after three months.

COMMENT

All three cases were done for a benign disease, ameloblastoma. This make the procedure more viable and a good option for reconstruction of mandibular defects. Viable in a way that sterno-clavicular graft is a pedicled graft with a reliable blood supply and at the same time, no post radiation is done for these patients. There was also no problem with regard to soft tissue coverage as the lesion is benign. The graft is accessible and close in proximity to the mandible without so much morbidity in harvesting and transposition of graft. As noted in all three cases, the defects were large from 13 to 14 cms. Despite these large defects, there was enough clavicular bone length and soft tissue to cover for the defect. All cases were grossly viable post-operatively, however these need to be documented via technetium scan. And lastly, the need to establish occlusion should be emphasized. Dental appliances should be placed to facilitate feeding function of the oral cavity.

The follow-up for these patients is still guarded. Although there has been success in the past with regard to the use of the graft for mandible defect reconstruction, it still needs to prove its reliability and viability in the long run.

DISCUSSION

There had been a lot of advances in the field of reconstruction for mandibular defects secondary to extirpative surgery for both benign and malignant tumors of the oral cavity. The advent of microvascular surgery, fibular vascular free graft in the reconstruction of mandible defects has made some reliable options like sterno-clavicular graft less appealing. The versatility and equitable success of microvascular surgery compared to these regional flaps with note of minimal morbidity in experienced hands and precision technology, has started surgeons to abandon these old techniques.

The cases presented in this paper exemplify one option of mandibular reconstruction that has been proven to be reliable and within an otolaryngologist's field of expertise. The procedure is cosmetically acceptable and facilitates oral cavity function (eg. mastication, speech, and deglutition) that may not be possible if mandible reconstruction is not done (Andy Gump deformity). Aside from these advantages, what makes the procedure appealing is that in cases where an ideal team approach is not feasible, mandibular reconstruction can be done by an otolaryngologist in a single stage operation without the necessity for microvascular training. The flap is reliable and noted to be viable without the eccentricities of special surgical techniques and can withstand post-operative radiation even if the need arises for malignant tumors.

The graft being technically simple and reliable, it is a good option that should be considered if there is scarcity of resources like plates, time of surgery and sometimes cost.

Some aspects that may not be applicable or within reach by our charity patients.

Emphasis should be reiterated on the shorter follow-ups of the patients, the success seen should be guarded as we cannot generate yet the long-term effects of the said graft.

SUMMARY/CONCLUSION

This paper demonstrates three cases were a myo-osseocutaneous flap like sterno-clavicular graft is made an alternative for mandible defect reconstruction for a benign lesion such as ameloblastoma. The procedure has not been popular lately with the advent of microvascular surgery, which has an advantage of better cosmetic result, function, and survival of graft. However, when situations arise where such procedures are not feasible employing a team approach (a trained microvascular surgeon or availability of resources), a sternoclavicular graft is an otolaryngologist's option that will likely give good cosmetic as well as functional results. Again, only time will tell as to the effectivity of the graft in our patients since these surgeries were just done recently. Long term follow-up and ancillary procedures like technetium scanning if feasible is still advised. Quality of life studies should also be undertaken in these patients to assess their well being before and after surgery.

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CHRISTINE JOY S. ARQUIZA, MD
JASON R. GUEVARA, MD

APPENDIX A

SUMMARY OF THE PROCEDURE:

1. Patient is in placed under general anesthesia via naso-trache tube or via tracheostomy
2. Skin incisions were designed both for tumor resection and sterno-clavicular graft harvest.
3. Flaps were developed, the mandible was exposed, and margins for resection were marked.
4. Arch bars placed and occlusion estimated.
5. Tumor resection of the mandible was done using gigli wire and defect was measured.
6. Harvesting of the sterno-clavicular graft proceeded, the clavicle was measured to fit precisely the created defect and marked.
7. SCM separated from its attachment inferiorly from the clavicle and dissected superiorly preserving the superior thyroid trunk and spinal accessory nerve.
8. The clavicle was freed of its marked points and rotated to fill the mandibular defect.
9. Contouring of the clavicle done and was fixed to the mandible or zygoma using intra-osseous wires.
10. Hemostasis secured. NGT inserted as necessary.
11. Intra-oral defect was closed primarily, drains were placed and layered external closure was done.
12. Inter-dental wiring was done to ensure fixation and close estimation of occlusion.

BIBLIOGRAPHY

1. Robertson GA. *The Role of Sternum in Osteo-myocutaneous Reconstruction of Major Mandibular Defects.* The American Journal of Surgery 1986; 152:367-370.
2. Barnes DR, Ossoff RH, Pecaro B, Sisson GA. *Immediate Reconstruction of Mandibular Defects with a Composite Sternocleidomastoid Musculoclavicular Graft.* Archives of Otorhinolaryngology 1981; 107: 711-14.
3. Behringer WH, Schweiger JW. *Mandibular Replacement After Resection for Tumor.* The Laryngoscope 1977; 87: 1922-1931.
4. Siemssen SO, Kirkby B, O'Connor TPF. *Immediate Reconstruction of A Resected Segment of the Lower Jaw, Using a Compound Flap of Clavicle and Sternomastoid Muscle.* Plastic and Reconstructive Surgery 1978; 61 (5): 725-735.
5. Couno CB, Ariyan S. *Immediate Reconstruction of a Composite Mandibular Defect with A Regional Osteomusculocutaneous Flap.* Plastic and Reconstructive Surgery, 1980; 65(4): 478-483.
6. Conley, J. *Use of Composite Flaps Containing Bone for Major Repairs in the Head and Neck.* Plastic and Reconstructive Surgery, 1972; 49 (5): 522-526.
7. Kowalik, S.. *Reconstruction of Mandible with Pedicle Bone Grafts.* International Journal of Oral Surgery, 1980; 9: 45-48.

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STRAIGHT LINE MUSCLE REPAIR AND TRIANGULAR SKIN FLAP TECHNIQUE FOR UNILATERAL CLEFT LIP SURGERY*

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ABSTRACT

Muscle preservation technique was employed in repair of Unilateral Cleft lip. The procedure uses the Triangular skin flap technique but employing a different procedure in the repair of the Orbicularis Oris muscle. Instead of cutting the muscle in conformity with the triangular flap and discarding portions of it together with the skin, the muscle was actually separated from the skin and subcutaneous tissue, spared and closed in a straight line fashion, approximation of the skin follows the triangular flap technique. Evaluation of the results were done one month after the procedure with reference to the criteria proposed by Steffensen, W. H. as follows: 1. Accurate skin, muscle and mucus membrane union; 2. Symmetrical nostril floors; 3. Symmetrical vermillion border; 4. Slight eversion of the lip; 5. A minimal scar which by its contraction will not interfere with the accomplishment of the other stated requirements. . There were 8 patients who were included in this study; 2 complete cleft lip with complete cleft of primary & secondary palate, 2 complete cleft lip with incomplete cleft of the primary palate , and 4 with incomplete cleft lip without cleft palate. The youngest subject is 6 months old and the oldest is 8 years old. All procedures were done under general anesthesia.

INTRODUCTION

The incidence of cleft lip with or without cleft palate ranges from 0.8 - 1.6 per 1000 livebirths. Isolated cleft lip accounts for 20% - 30% of the total, cleft lip and palate accounts for 35% - 55% and isolated cleft palate at 30% - 45%. Despite these figures it is stated that the true incidence of cleft lip with or without cleft palate is still underreported due to omission or failure to recognize the condition co existing with other abnormalities.

Children born with a cleft lip or a cleft lip and palate experience several conditions that may affect or impair their intellectual, social or personality development. The most important of these conditions are special problems of care and feeding during infancy, the burden of surgery early in life and the reactions of parents, family members and other people to them as handicapped individuals. They may as well have the handicap of facial disfigurement, hearing loss and defective speech. It is for these reasons that the need for a good technique of repair should be instituted at the most earliest time. It is likewise important to bear in mind that any technique should be done to achieve a satisfactory functional and cosmetic result.

Since early 1825, Lexer von Graefe had already started the modifications of previous techniques which were the usual straight line closure of the lip defect. He advocated curving the incisions to avoid notching of the cleft edges and from that time on the development of rotation advancement flap was born.

"It is advisable that any operation on the cleft lip be made simple, uncomplicated, conserve a maximum amount of available tissue, be based on definite landmarks be adaptable not only to a variety of clefts but to revision at a later date if there be any need. It is also helpful if the technique is easily taught to residents and is reliable for the surgeon who does not do many cleft lip repair so that a large measure of surgical experience with

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clefts is not necessary for a successful surgery. These were the words mentioned by Randall in describing his technique. The Triangular flap selection is made because it is simple and easily learned with its precise measurements and definite landmarks. There is but a simple modification that was done on the Triangular flap technique in this paper and that was conservation of the orbicularis oris muscle with repair in a straight line fashion. The modification is uncomplicated and is easily incorporated to the original technique. This study then has the aim to describe the result of the technique with reference to the criteria for a satisfactory cleft lip repair as proposed by steffensen, W. H.

OBJECTIVES

1.To describe the result of straight line orbicularis oris muscle approximation in combination with the Triangular skin flap technique of unilateral cleft lip repair.

2.To describe results with reference to the criteria for satisfactory cleft lip repair proposed by Steffensen as follows:

1.) Accurate skin,muscle and mu cus membrane union
2.) Symmetrical nostril floor
3.) Symmetrical vermillion borders
4.) Slight eversion of the lip
5.) Minimal scar which by its con traction will not interfere with the accomplishment of other stated requirements.

3.To identify the problems attributed to the technique.

METHODOLOGY

There were 8 patients included in this study , 2 unilateral complete cleft lip with incomplete cleft of the primary palate, 2 unilateral complete cleft lip with complete cleft of the primary and secondary palate and 4 incomplete cleft lip without cleft palate. The subjects were selected as they come and the only criteria for inclusion is the presence of a unilateral cleft lip. All procedures were done under general anesthesia after securing pediatric clearances and informed consent of the modified technique. Patient follow up was done weekly after discharge.Evaluation of the results with reference to the criteria for a satistfactory cleft lip repair proposed by Steffensen W. H. was done one month post-operatively together with final photo documentation.

SURGICAL TECHNIQUE:

1. The patient is put in general anesthesia with endotracheal intubation.
2. skin antiseptic prep of surgical field is done
3. Drapings
4. Landmarks are identified with sterile pen marker following the usual triangular flap pattern
5. The following points are marked on the medial lip element Point 1 is the midpoint of cupid's bow on the vermillion border. Point 2 is the apex of the cupid's bow on the non-cleft side. Point 3 is the apex of the cupid's bow on the cleft side such that lengths 1-2 equals length 1-3(point 3 corresponds to point 13).
6. The medial lip element is pushed toward the cleft, straightening the columella in the midline. Point 5 is on the vermillion border of the medial element at the base of the columella. Point 4 is the corresponding point at the base of the columella on the opposite nostril sill. Point 6 is a point in the nostril floor of the lateral element with the same relationship to the cleft side alar base as point 4 has to the non-cleft side alar base.
7. Line 5-3 is drawn
8. Point 7 is generally on the philtral midline such that angle 5-3-7 is a right angle.
9. Line 3-7 is drawn
10. Point 8 is located on the vermillion border of the lateral element at the point the mucocutaneous ridge becomes attenuated. The distance from point 8 to the ipsilateral oral commissure equals the distance from point 2 to the non-cleft side oral commissure.
11. Point 10 is approximately the midpoint of 7-13, and point 11 is approximately the midpoint of 9-12.
12. The locations of points 9 & 12 vary according to the size of the cleft and the amount of tissue available. Point 9 is chosen first on a trial basis and adjusted so that the following relationships are true:
    a. Length 6-9 is made equal to length 5-13
    b. Length 4-2 minus length 5-10 equals length 8-11the distance across the base of the flap or the amount required to drop cupid's bow into normal position
    c. Lengths 8-12 equals lengths 9-12
13. A Line from point 3 to point 2 is drawn and is labeled line
14. Full thickness incisions are made on the medial side of the cleft extending from point 5 to point 13 and to point 2. Excess lip is not initially trimmed. The incision 7-13 is

made just skin and subcutaneous tissue thick. Skin and subcutaneous tissue is undermined from the base of the columella extending to the lateral philtral line separating it from the orbicularis muscle. The cupid's bow is rotated down to its normal position.

15. Markings are rechecked before the construction of the lateral triangular flap: lengths 4-2 equals the projected length 5-10-3 equals the projected length 6-11-8. Full thickness incisions are then made along the muco-cutaneous border of the lip to point 8. Incision is then made skin and subcutaneous tissue thickness from point 6 to point 9-12-8. The muscle is then carefully dissected from skin and subcutaneous tissue. Excess skin is excised and discarded. Mobilization of the alar base and cheek is performed sufficiently to realign the naris on the cleft side to match as closely as possible the normal naris. Further undermining of skin is done about 1 cm from the borders of the triangular flap. After isolation of the muscle, it is dissected from its attachment to the base of the columella and the base of the ala on the cleft side. Muscle is then approximated with its counterpart in a straight line fashion using chromic 4-0. Skin is approximated using nylon 5-0 with points 6 to 5, 9 to 13, 12 to 7 and 8 to 3. The medial vermillion is trimmed at point 3. The lateral vermillion is trimmed leaving about 3-4 mm of excess length from its point of attachment to the medial component. The excess length of vermillion is de-epithelialized and is made to fill up the notching brought about by the straight line muscle closure. Approximation of the vermillion is now done using chromic 4-0. By this time completion of mucosal closure is done.

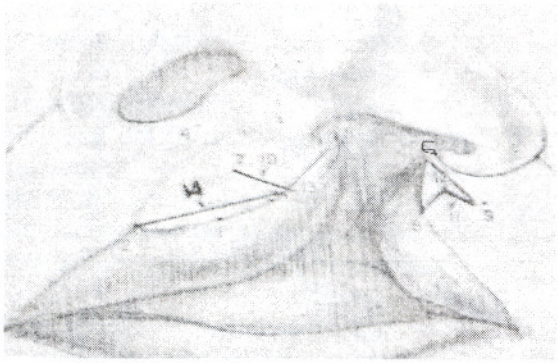


FIGURE 1. Out line of the triangular skin flap which represents actual skin incision lines.

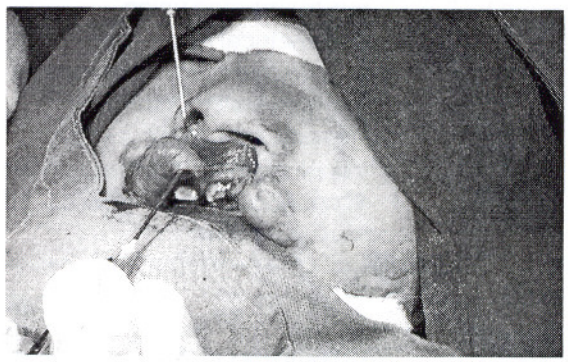
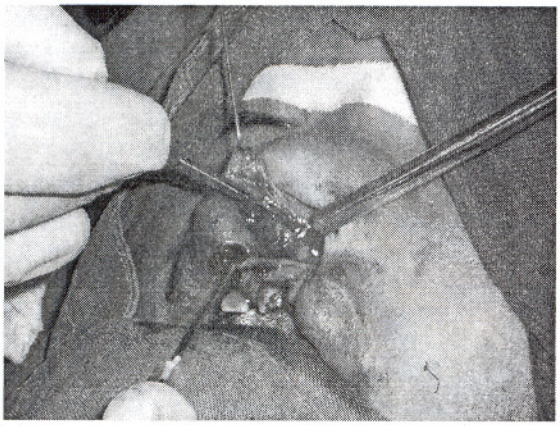


FIGURE 2. Full thickness incision along the edges of the cleft mucocutaneous junction



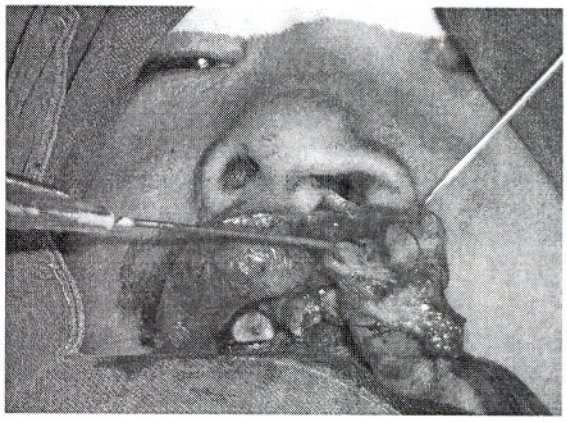
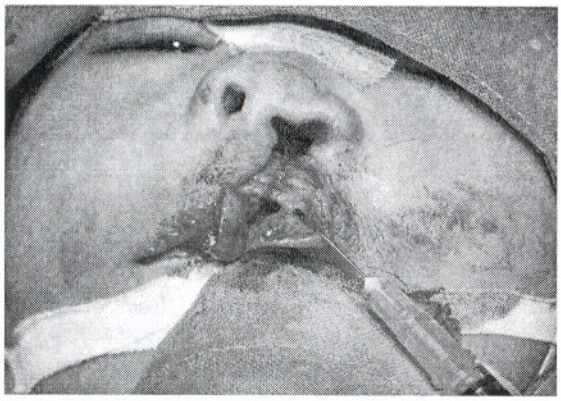


FIGURE 3. Skin undermining and separation of muscle



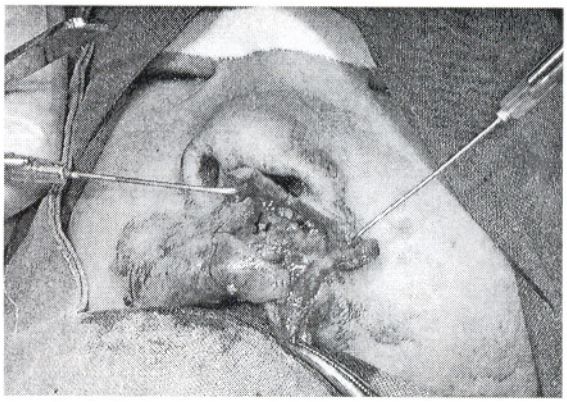


FIGURE 4. Straight line muscle repair

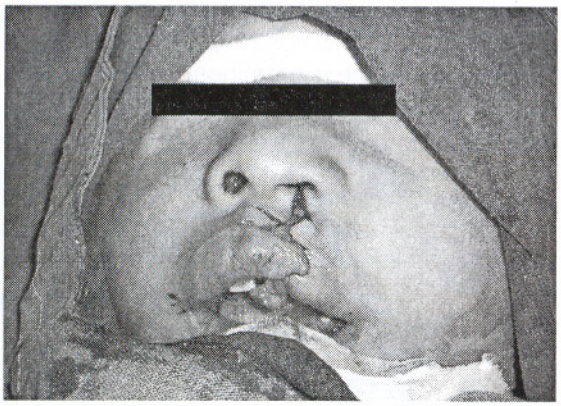


FIGURE 5. Completed muscle repair and skin flaps mobilization

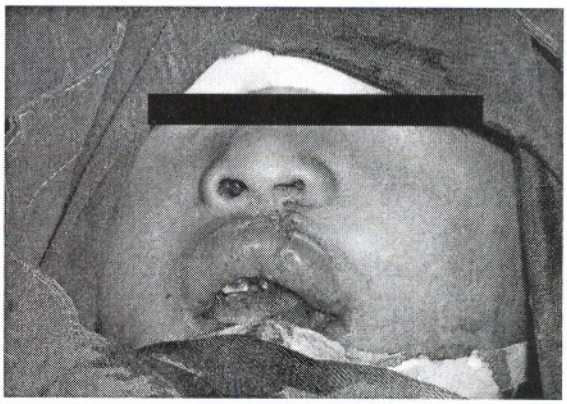
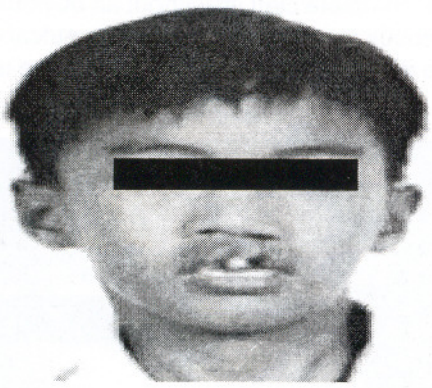
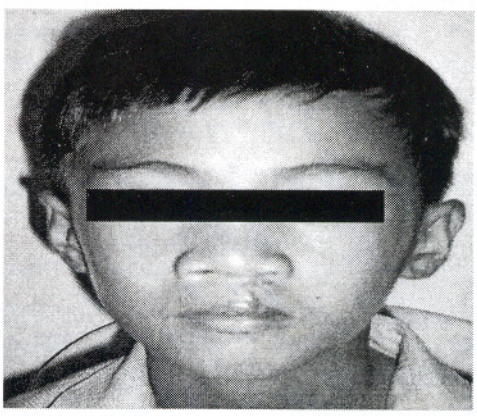


FIGURE 6. Completed repair

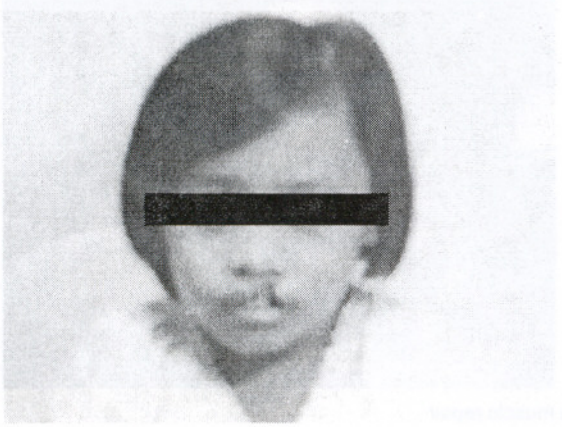
RESULTS

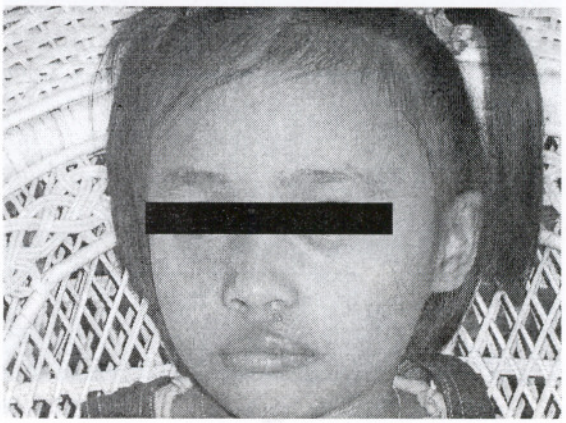




PATIENT # 1:

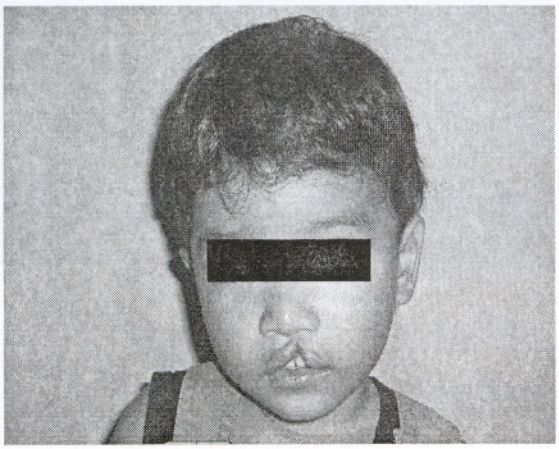
An 8 year old, male child with a complete cleft lip, widened assymetrical nasal floor on the cleft side. One month post op picture shows an almost symmetrical nasal floor and vermillion borders. Skin repair lines are distorted by the presence of an obvious hypertrophic scar. There is flattening of the cupids bow and the tubercle is replaced by a hypertrophic scar which likewise produced notching on the previously non-cleft side.

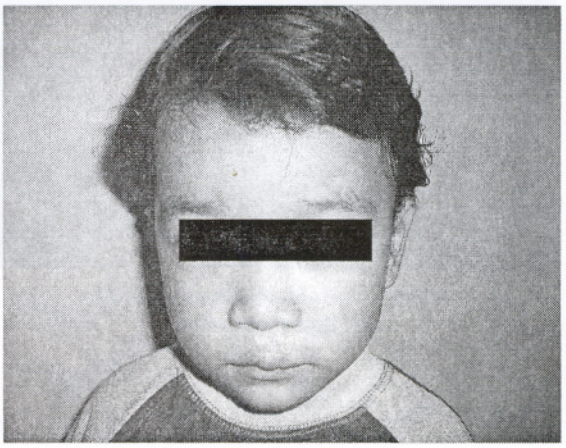




PATIENT # 2:

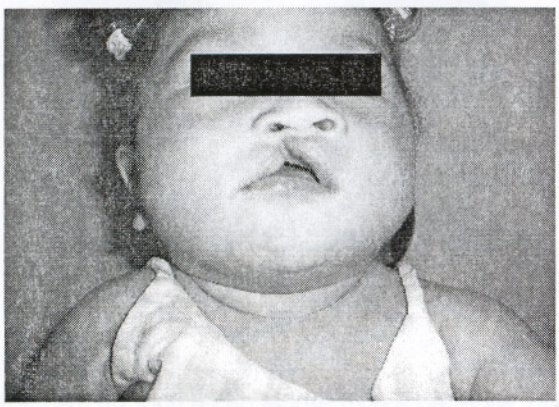
An 8 year old, female child with unilateral, isolated, incomplete cleft lip and slight asymmetry of the nasal floor. One month post op picture shows accurate skin and mucus membrane closure, vermillion borders are symmetrical, nasal floors are symmetrical. The cupids bow was straightend, the cupid's tubercle has deviated off midline to the previously cleft side and scar tissue is prominent on skin incision lines.

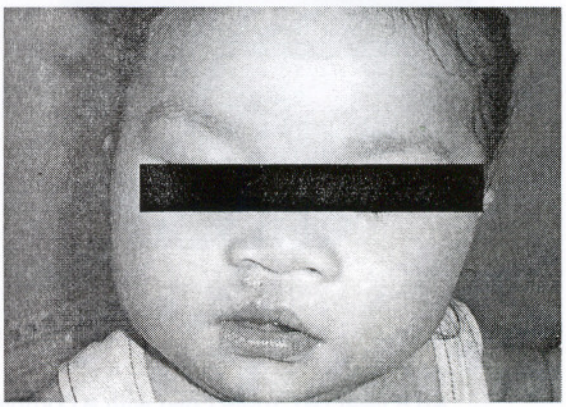




PATIENT # 3

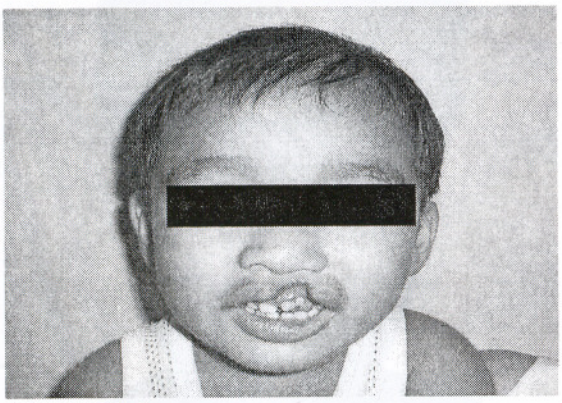
A 3 year old, male child with an isolated unilateral, incomplete cleft lip without an obvious nasal deformity. One month post op picture shows accurate skin, mucus membrane union, symmetrical vermillion borders, cupid's bow at the midline. The cupid's tubercle is likewise in the midline and there is slight eversion of the lip symmetrically.

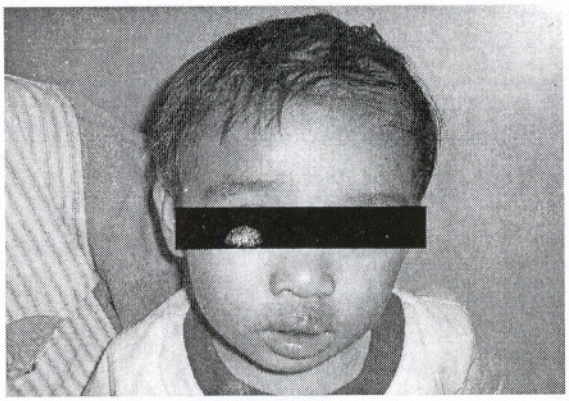




PATIENT # 4

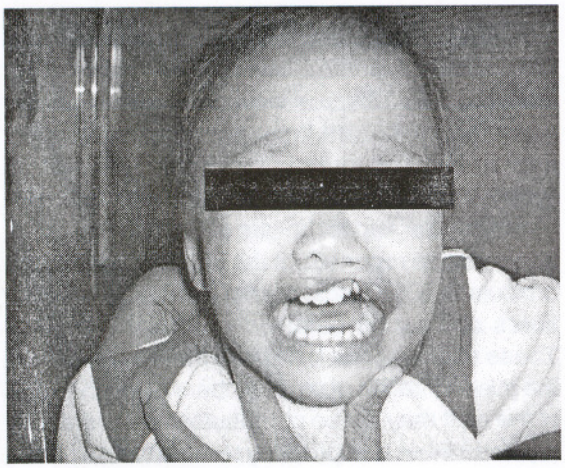
A 6 month old, female infant with unilateral incomplete cleft lip with complete cleft of the primary and secondary palate and a slight nasal deformity on the cleft side. One month post-op picture shows an accurate mucus membrane union, symmetrical nasal floors, slight eversion of the lip symmetrically and symmetrical vermillion borders. The Cupid's bow is at the midline as well as the Cupid's tubercle. There is an obvious scar along the skin incision lines.

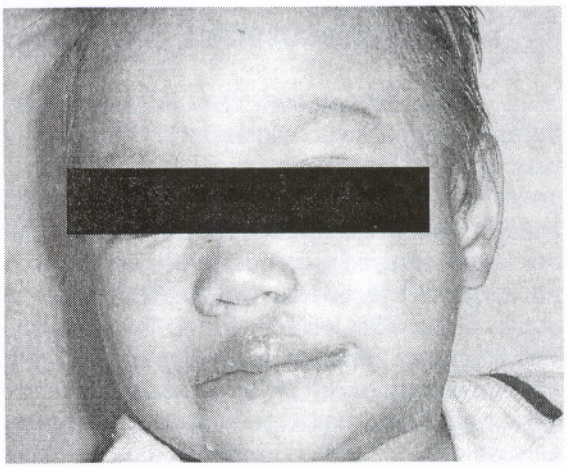




PATIENT # 5

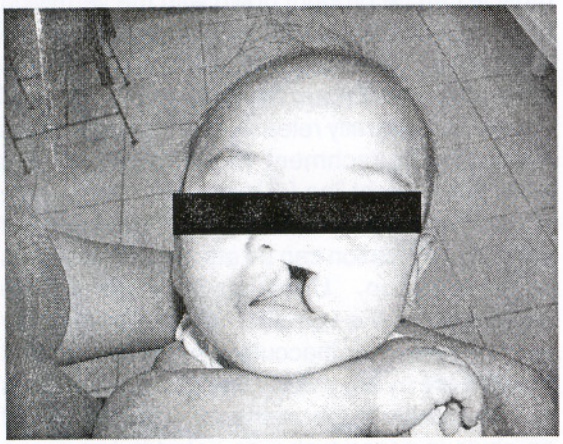
A 3 year old, male child with unilateral, incomplete cleft lip and incomplete cleft of the primary palate and a slight nasal deformity. One month post op picture shows an almost symmetrical nasal floor, symmetrical vermillion borders and slight eversion of the lip symmetrically. The cupid's bow is in the midline as well as the cupid's tubercle. There is notching of the red lip along the side of union

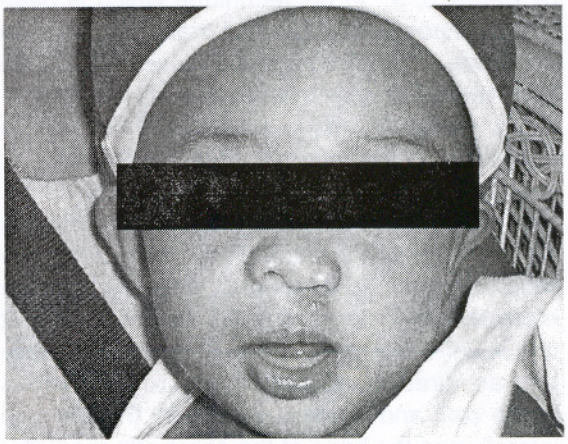




PATIENT # 6

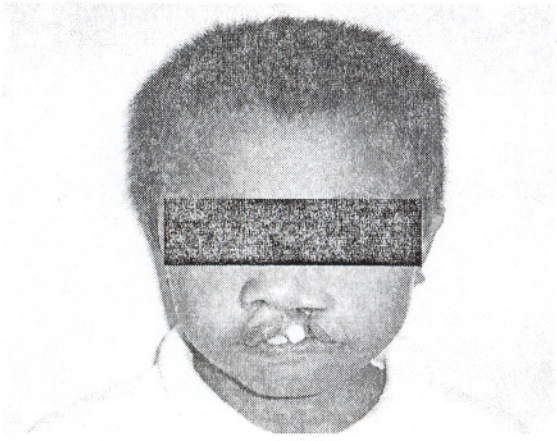
A 2 year old male, child with incomplete cleft lip and incomplete cleft of the primary palate and a mild nasal deformity. One month post op picture shows a symmetrical nasal floor, accurate skin union and slight eversion of the lip. There is an inaccurate union of the mucus membrane of the lip. There is a slight over rotation of the cupid's bow from the horizontal and the vermillion border on the cleft side is slightly asymmetric.

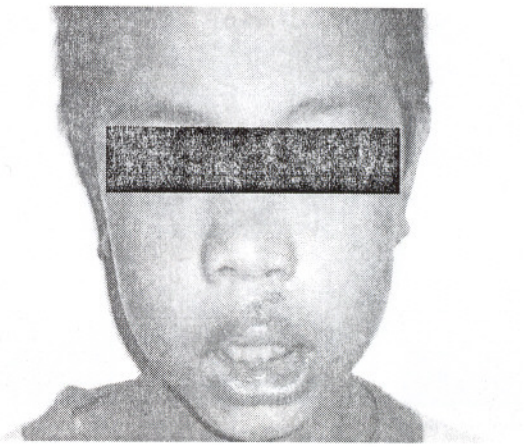




PATIENT # 7

A 6 month old, male infant with a complete, unilateral cleft lip and complete cleft of the primary and secondary palate. One month post op picture shows that skin union is accurate, vermillion borders are symmetrical. There is an inaccurate union of the mucus membrane, lip eversion is asymmetric as well as the nasal floors.





PATIENT # 8

A 9 year old, male child with a complete cleft lip, incomplete cleft of the primary palate and the associated nasal deformity. One month post op picture showed an accurate skin and mucus membrane union, symmetrical vermillion borders, symmetrical nasal floors and symmetrical lip eversion.

DISCUSSION

The straight line cleft lip closure was done as the early techniques of lip closure but was not very satisfactory and because of this newer techniques were introduced, most of which are rotation advancement flaps. The Triangular flap had been used in combination with a rotation advancement technique (Millard technique) in some applications as mentioned in textbooks. The triangular flap was used as a skin flap and rotation advancement for the muscle flap or the other way. This entailed soft tissue undermining and isolation of the orbicularis oris muscle to design the desired flap type and repair. Thorough search for a direct muscle approximation without doing a triangular or a rotation advancement flap on the muscle, yielded no similar study.

The technique of soft tissue undermining and isolation of the orbicularis muscle was done by Bardach, J. in his technique which is basically composed of two small triangular flaps on each side of the cleft segments which would look like a modification of the Tennison-Randall technique. In his technique, he isolated the muscle from the skin and mucosa. The upper portion of the misdirected muscle fibers is transected from the base of the columella medially and the ala nasi laterally. This created two flaps of muscle which was rotated downward to reconstruct the orbicularis muscle. The basis for this is the fact that in unilateral complete cleft lip the muscle fibers are directed upward, parallel to the margins of the cleft and terminate beneath the ala nasi laterally and the base of the columella medially.

In doing the straight line muscle repair we have to answer the question why do straight line repair when the accepted technique is doing the flap? It is our curiosity that made us scrutinize the role of reconstructing the proper orientation of the orbicularis oris muscle and its effect on the cosmetic appearance of the repair. We have noted that even the Millard technique which is popular and noted for success did not attempt to reconstruct the muscle in its proper orientation. The triangular flap technique of Randall may have attempted to reconstruct the inferior fibers of the orbicularis oris muscle but not most of its superior fibers and yet he obtained satisfactory results. These observations lead us to think that perhaps the misorientation of muscle fibers along the edge of the cleft may not be contributory to satisfactory repair whether one properly reconstructs it or not. This observation though has no factual basis for the moment.

In the modification that this study employed a full thickness incision was made along the mucocutaneous junction of the cleft edges and in so doing,some fibers of the misdirected muscle can be brought down with the vermillion to be approximated with its counterpart on the other side. The release of the muscle from its columellar attachment medially and the base of the ala nasi laterally releases the muscle from its misdirected attachment to approximate each other in a straight line fashion. The results were not uniform and is needing a lot of improvement which in our opinion can be attributed to the skills of the surgeon. Unsatisfactory results like asymmetry of the vermillion border, asymmetry of the nasal floor, inaccurate union of skin and mucosa are by any means due to miscalculations and inaccurate measurements. The problem of an obvious scar which was noted in two cases might as well be due to patient factor. These scars must be the subject of further observation since its outcome may not be definitely known until after a year or two.

SUMMARY

In summary, we observed that a satisfactory result can be obtained from this technique with carefull attention to accurate measurements and these favorable results are evident in incomplete clefts without complete cleft of the primary palate. A less satisfactory result was noted in one patient with complete cleft lip and complete cleft of the primary and secondary palate. Scar formation is noted in two cases but may need long term follow up to determine its outcome. Finally, as HG Thomson would say, " There is probably no best single method of cleft lip repair, but rather several best methods and that precision and artistry in execution maybe more important than the design in many instances".

RECOMMENDATIONS

It is being recommended that more cases should be done using this technique and a possible experimental study should be in the way to compare it with other standard techniques. A long term follow up should be done to determine the late results and long term effects in relation to other adjacent facial structures.

BIBLIOGRAPHY

1. BARDACH, J.,KELLY, KM., SALYER KE: The effects of lip repair with and without soft tissue undermining and delayed palate repair on maxillary growth. Plast. Reconstr. Surg. 94:343, 1994
2. MUSGRAVE RH: General Aspects of Unilateral Cleft Lip repair: Textbook Cleft Lip & Palate, 11: 175-191 1st ed, 1971
3. SEIBERT RW, WIET GJ, BUMSTED RM:Triangular flaps in unilateral cleft lip repair, Textbook pediatric otolaryngology 3rd ed.,10:148-150, 1998
4. THOMSON HG: Quadrilateral flap in the repair of cleft lip & Palate, Textbook cleft lip & palate 14:225 1st ed, 1971
5. STEFFENSEN WH: Further experience with the rectangular flap operation for cleft lip repair, Plast. Reconstr. Surg. 11:49, 1953

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PINOY VOICE AMPLIFIER SYSTEM (PiVAS)*

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CELSO V. URETA, MD, FPSO-HNS***
GERARDO E. CRUZ, MD, FPSO-HNS***

ABSTRACT

OBJECTIVES: The objective of this paper is to introduce the Pinoy Voice Amplifier System (PiVAS) for the laryngectomee and discuss its potential role as a communication aid for laryngectomees.
DESIGN: Descriptive prospective study .
SETTING: Tertiary government Hospital from March to May, 2003.
PATIENTS: Male and female patients who underwent Total Laryngectomy but capable of speaking either thru the esophageal speech method, tracheo-esophageal fistula method or thru the use of the electro larynx.
RESULTS: A locally made voice amplifier was given to 10 laryngectomees They were asked to use the PiVAS for one week and asked to answer a questionnaire to evaluate the device. All patients found the device very convenient and very helpful in their communication with other individuals.
CONCLUSION: The Pinoy Voice Amplifier System is an effective and affordable aid for communication among laryngectomee's.

INTRODUCTION

Laryngeal carcinoma accounts for 1.2% of all new cancer diagnoses and 1/5 of all head and neck cancers. It usually affects males with a 5:1 preponderance compared to women with peak incidence occurring between the 5th and 7th decade of life and a 5 year survival rate of 67% with adequate treatment (Go,1998). However surgical treatment of the pathology is debilitating because it leaves the patient the stigma of being unable to speak. Loss of voice is one of the dreaded sequela of the operation and is usually the cause of post operative psychosis among laryngectomees.

Communication is very vital for the survival of every individual. As a social being, we need to express our thoughts and feelings to others.

Through the years, several techniques have already been developed for the laryngectomee to acquire speech. Methods like esophageal speech, tracheo-esophageal fistula technique and the use of electronic devices have been developed to help the patient speak again. However, to speak is not enough. Sometimes they need to raise their voice to stress a point or sometimes shout to be understood. Thus voice amplifiers have been utilized to aid them in communicating. However, there are no locally available voice amplifiers in our country and the ones that are commercially available are expensive.

OBJECTIVE

The objective of this paper is to introduce the Pinoy Voice Amplifier System (PiVAS) for the laryngectomee and discuss its role as a communication aid for laryngectomees.

*Presented, PSO-HNS Poster Session on Surgical Instrumentation Contest, December 2, 2003, 47th Annual Convention, Westin Phil. Plaza Hotel, Manila
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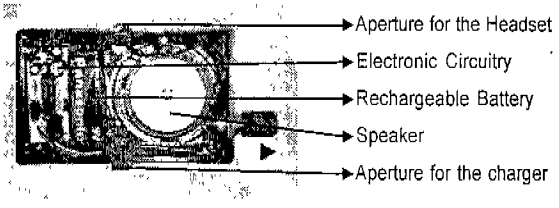
MATERIALS AND METHODS

The PiVAS is a locally manufactured equipment. Below are the materials used and their cost.

Items	Cost
Electronic circuitry	P550.00
Casing	50.00
Headset	250.00
Rechargeable battery	400.00
Battery Charger	150.00
Labor	300.00
Total	**P1,700.00**



The study was done from March up to May, 2003. Ten laryngectomees were asked to use the device for one week, after which they were asked to answer a simple yes or no questionnaire related to the use of the device as to convenience and clarity. Only one device was used for the duration of the study. Convenience was defined as ease of handling of the device and its portability. Clarity was defined as understandability of their amplified speech when conversing.

RESULTS AND DISCUSSION

Patients stricken with laryngeal Cancer who underwent total laryngectomy will have speech handicap. But it is very reassuring to know that in our institution we have different methods to help them speak even if the larynx has been removed.

A tracheo-esophageal fistula technique for voice rehabilitation can be done, either in the primary operation or as a second stage procedure. In this technique, the patient has to occlude the tracheostoma to force the air from the lungs to pass thru the fistula to create sound. Another voice rehabilitation technique is thru esophageal speech training, whereby the patient swallows air and forces it out in bursts to produce sound. Finally, electronic devices like the electrolarynx is available. The vibration is produced by the gadget and modified by the soft tissues of the floor of the mouth to produce understandable sound.

However, one problem often encountered is that most patients, although they are able to speak, usually have a weak voice and they have difficulty increasing the volume of their voice. Thus, the use of a voice amplifier would be very helpful.

John Pierce, the Bell Labs engineer who pioneered communications satellites wrote that in the case of amplification, the transistor is used to amplify a signal. One example of such a signal is a sound. The sound entering a microphone is converted to an electrical signal that is amplified in the transistor. This amplified sound signal then travels through the circuit until it reaches the loudspeaker. This speaker converts the electrical sound signal back into a sound. The sound leaving the speaker is the same as the sound that entered the microphone, only much louder. This is called amplification – the sound is being amplified, as shown in the figure below:

Sound▶ Microphone▶ Transistor▶ Speak▶ SOUND

Fig. 1. Pathway of sound thru the voice amplifier.

There are many advantages of using a voice amplifier. It rests the throat to allow healing or to avoid damage. It minimizes overall strain and fatigue when physical condition makes talking a tiring effort. It allows less need for repetition and eventually fewer misunderstandings. Furthermore, it allows longer phrasing for esophageal speakers, and helps develop poise and self-confidence for laryngectomees in public conversation.

Today, various portable amplifiers are available commercially, some of them are shown below:

Spokeman ($180.00)	ChatterVox ($184.95)
EchoVoice ($349.00)	Voicette ($253.50)

Fig. 2. Commercially available Voice Amplifiers.

At today's peso-dollar exchange rate, the cheapest will approximately amount to P10,000.00. The relatively high cost of acquiring a commercial voice amplifier certainly makes it difficult for most of our patients to acquire one.

It is for this reason that the Pinoy Voice Amplification System (PiVAS) was developed. The PiVAS's total cost only amounted to P1,700.00, which is only about 17% of the cost of the cheapest voice amplifier featured above. All materials used are locally available. The device measures 6cm

(H) x 10cm (L) x 3cm (T) and weighs approximately 200 grams. It is designed with a belt clip for easy handling, and a volume control. It runs on a 9V rechargeable battery and is equipped with a head set with microphone which can be modified to suit the user's desire. The unit can be used around 3-5 days before recharging. The unit also comes with a charger, which directly plugs into the unit for ease

Data collected from the questionnaire to evaluate the PiVAS are as follows:

Variable	YES	NO
Convenience	10	0
Clarity	10	0

Table 2. Data summary of Evaluation Questionnaire

Table 2 shows clearly that the laryngectomees who used the device found it very helpful. All ten of them found the device very convenient as it clips to the belt easily to leave your hands free. The patients encountered only slight problems like the occurrence of feedbacks easily addressed by lowering the volume. All the patients had no problem with clarity as they are better understood now by other people. They won't have to put too much effort to make their voices louder when conversing. The device is also easily maintained because the materials are locally available, the circuitry is relatively simple and you will only have to replace the rechargeable battery.

CONCLUSION

The paper has presented the Pinoy Voice Amplifier System (PiVAS) which is a locally manufactured equipment to help our Laryngectomee's improve their communication skills. Advantages of the equipment include, its affordability, its convenience, it is easily maintained and it is locally available.

RECOMMENDATIONS

The author recommend that further test and examination regarding PiVAS be done. The author also recommend that studies on the equipment be done if it can utilized by other patients other than a laryngectomee like those with a weak voice or a throat problem such as: vocal nodules, Parkinson's, ALS, MS, Guillan Barre, impairment of throat or chest muscles, damaged or partially paralyzed vocal cords and diminished lung capacity.

BIBLIOGRAPHY

1. Cummings, C.W., M.D. et. al. *Otolaryngology, Head and Neck Surgery*, 3rd edition, Mosby-USA, 1998
2. Brinkman, B., Lang, D., *Physics and the Communication Industry*, Reviews of Modern Physics, 1999.
3. Go, C. E., M.D. , *Primary Voice Reconstruction in Total Laryngectomy using the Funnel Technique.* The Phil. Scientific Journal. 1998.
4. De Guzman, E.G., et.al. *Pectoralis Myocutaneous "fly-over" flap for reconstruction after Extended Laryngectomy.* Phil Journal of Otolaryngology, Head and Neck Surgery. *1996.*
5. *Lore, J.M. An* Atlas of Head and Neck Surgery (3rd ed.) Philadelphia, W.B. Saunders and Co., 1988.

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PNEUMOSINUS DILATANS OF THE FRONTAL SINUS: AN UNUSUAL CAUSE OF FRONTAL BOSSING IN A HEALTHY ADULT MALE*

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GIL M. VICENTE, MD, FPSO-HNS, MD***
ANTONIO H. CHUA, FPSO-HNS, MD***

ABSTRACT

GENERAL OBJECTIVE: To present an unusual case of frontal bossing in a healthy adult male.
SPECIFIC OBJECTIVES:
(1) To discuss the differential diagnoses of frontal bossing
(2) To discuss the possible etiologies and theories of this case
(3) To describe surgical management of this case
DESIGN: Case Report
SETTING: Tertiary Government Hospital
PATIENT: A healthy, 22 year old adult male had been complaining of gradual enlargement of the lower forehead for 9 years. He also had been experiencing diplopia and headache. Aside from the frontal bossing, other pertinent physical findings were unremarkable. Systemic causes of frontal bossing have been ruled out because they were not compatible with the clinical presentation. Plain films and CT scan of the frontal sinus demonstrated an expanded, hyperaerated frontal sinus. This corresponded to the frontal bossing in our patient. With the exclusion of other causes and radiographic findings, he was diagnosed as having pneumosinus dilatans of the frontal sinus, a rare and unusual cause of frontal bossing.
CONCLUSION: A patient with an unusual cause of frontal bossing was presented in this case report. An abnormally hyperaerated frontal sinus was the cause of frontal bossing in our patient. He was diagnosed as having pneumosinus dilatans of the frontal sinus. Increased intrasinus pressure, ball valve defect, increased growth hormone production and congenital malformations are some of the proposed mechanism by which this pathology happens. None of them has been proven and etiology of this condition remains unclear. In our literature search, cosmetic deformity was the primary indication for surgery in patients with pneumosinus dilatans of the frontal sinus. Correction of the frontal bossing with creation of an osteoplastic flap with recession of the anterior table into the sinus and fat obliteration was standard treatment of choice in most patients.

INTRODUCTION

Frontal bossing has always been associated with systemic diseases such as acromegaly wherein growth hormone excess leads to a chronic debilitating disease associated with bony and soft tissue overgrowth[1]. *There are limited available data on other disease conditions that cause frontal bossing- probably due to misdiagnosis or underdiagnosis of these disorders.* One such condition will be presented in this case report.

For over a century now, an unusual cause of frontal bossing had been described called pneumosinus dilatans. Pneumosinus Dilatans is an extremely rare condition in which facial deformity is caused by gross enlargement of apparently normal paranasal sinus[2]. Reports had been sporadic although 51 cases were reported in one case series[3]. To our knowledge, this will be the first time that this condition will be reported locally.

Despite the existence of this pathology for a long time, very little is known of this condition. It is not even mentioned in our standard textbooks. As an otolaryngologist or as a general medical practitioner, it is very important that we become aware of its existence.

This paper aims to present an unusual cause of frontal bossing in an apparently healthy

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individual. Differential diagnoses, etiologies as well as management of this case will also be discussed.

CASE

A healthy 22 year old adult male had been complaining of frontal bossing of 9-year duration. The cosmetic deformity started as a gradual but progressive enlargement of the bilateral supraorbital ridges and lower forehead. He also experienced intermittent frontal headache and suffered from occasional pain on that area in spite of remedies and drugs prescribed by several medical practitioners. He did not complain of blurring of vision, however, he had occasional diplopia. The patient had no signs of increased growth hormone production, history of radiation or history of other systemic diseases. Three years prior to consultation, with the progressive enlargement of the forehead, he consulted our rhinology specialty clinic. Examination showed a marked, bony, non- tender prominence of the lower forehead (see Figures A and B). On nasal endoscopy, the patient had normal looking turbinates and lateral nasal wall, nasal septum was midline and there was absence of purulent discharge. The adenoids, however were hypertrophic. Other pertinent physical and neurologic findings were essentially normal.

Plain radiograph (Waters, Caldwell and Skull True Lateral View) of the paranasal sinuses revealed a well-aerated and dilated frontal sinus (See Figures C and D). CT scan of the paranasal sinus showed a markedly dilated frontal sinus, frontal bossing with superior extension to the frontal bone. No bony erosions were noted in either sinus (See Figures E and F). Diagnosis was not clear from the history however he was suspected to have a frontal sinus mucocele.

The case was presented in our weekly grandrounds. Review of clinical history, plain films and CT scan pointed to a normal individual with

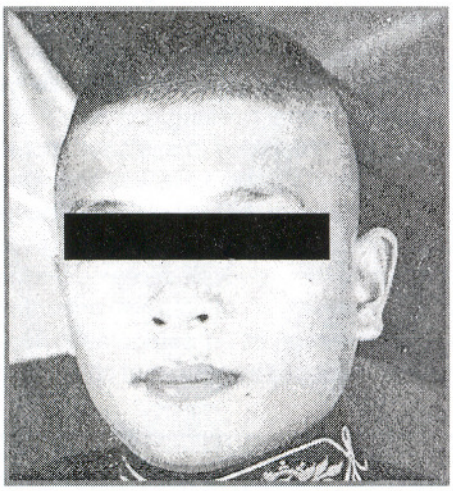


Fig. A Patient at 19 years old showing enlarged, bony swelling

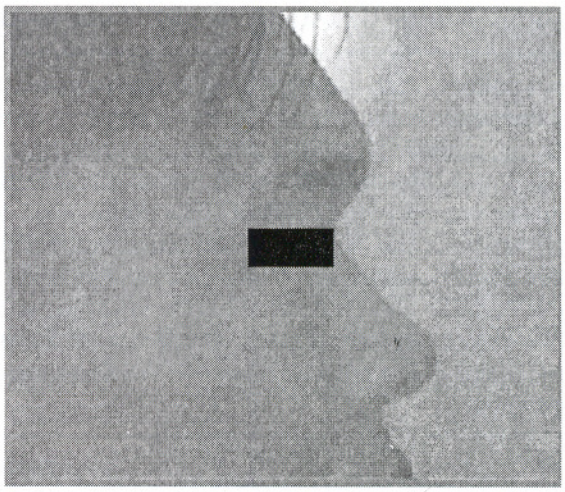
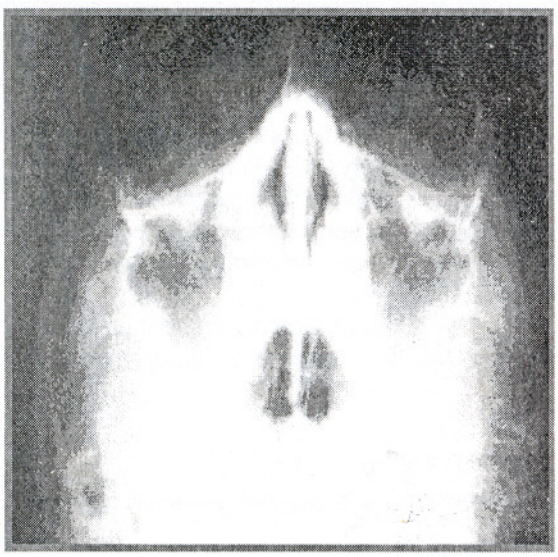


Fig. B Side view of patient at 22 years old showing frontal bossing



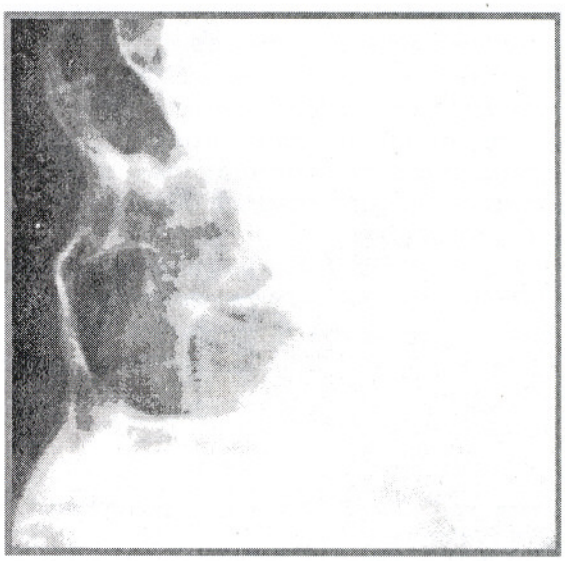
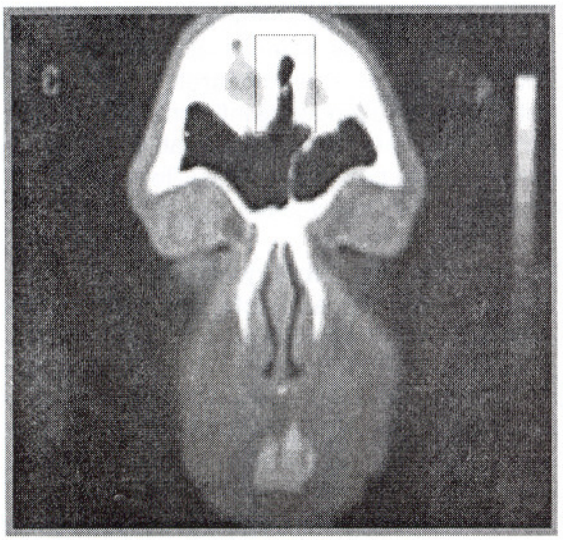


Figure C and D. Waters and Lateral view of the frontal sinus showing markedly enlarged and hyperaerated frontal sinus



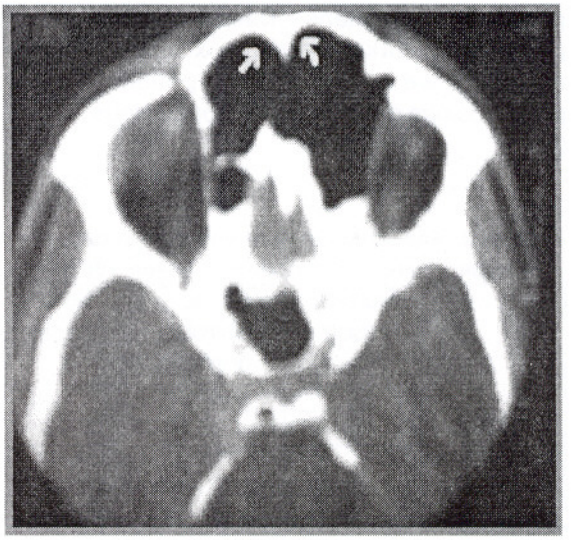


Figure E and F. Axial and Coronal CT scan images of the frontal sinus showing hyperaerated frontal sinus with superior extension to the frontal bone (inside rectangle) and frontal bossing (arrow) without bony erosion.

an unusually hyperaerated frontal sinus. Diagnosis of this patient will be presented in our discussion.

DISCUSSION

Our discussion is centered mainly on three significant issues. First is a diagnostic dilemma which we encountered with this patient. The second issue is on how abnormal expansion of the frontal sinus was acquired and thirdly, how to go about specific surgical management of his cosmetic defect.

1. How do we arrive at a diagnosis?

Several differential diagnoses of frontal bossing were considered which include systemic increase in growth hormone production such as acromegaly, congenital and infectious diseases or a localized sinus disease. Other differential diagnoses are listed in Table I.

Table I. Differential Diagnosis of frontal bossing

Mucocele
Pneumatocele
Fibrous Dysplasia
Acromegaly
Syphilis (congenital)
Sturge-Weber Syndrome
Cerebral atrophy
Frontal lobe atrophy secondary to radiation therapy

A localized sinus disease was highly entertained since all other possible differential diagnoses were not compatible with the clinical presentation of our patient. *Our initial diagnosis was that of a giant frontal sinus mucocele, however it was ruled out because tumors that can cause sinus cavity expansion have a soft tissue mass that fills the sinus. In our case, we found no apparent intrasinus pathology except for the unusually large hyperaerated frontal sinus.*

Urken et al in 1987 described extensively the nomenclature, pathology and symptoms of an abnormally large frontal sinus. He examined 100 frontal sinuses on plain caldwell film and established the upper limits of a normal frontal sinus[4]. This data has been utilized to help describe three categories of enlarged, aerated frontal sinuses namely: Hypersinus. Pneumosinus dilatans, and Pneumocele[5].

Hypersinus is a term that is introduced to described frontal sinuses which have developed beyond the upper limits of a normal frontal sinus (above 99th percentile) as defined by the measurements and statistical analysis of the frontal sinus made by Urken. The sinuses are well aerated and the walls are normal. There is no frontal bossing, intracranial extension, or ethmoid, nasal or orbital encroachment[5].

Pneumosinus dilatans refers to an aerated sinus which is abnormally expanded. No bony erosions or thinning of the sinus walls are noted. The sinuses are displaced outward to cause either frontal bossing, intracranial extension, or ethmoid , nasal or orbital encroachment[5]. It is this extension of the sinus beyond the normal boundaries of the frontal bone that differentiates pneumosinus dilatans from hypersinus[5].

In contrast, pneumocele refers to an aerated sinus with either focal or generalized thinning of the bony sinus wall. The feature that differentiates pneumosinus dilatans from the pneumocele is the loss of integrity of part, or all, of the bony sinus wall[5]. However, the symptoms are similar to those observed in patients with

pneumosinus dilatans. Based on this concept proposed by Urken, and by exclusion of other diseases, we diagnosed our patient to have pneumosinus dilatans of the frontal sinus. (Table 2)

Table 2. Radiographic differential diagnosis of hyperaerated frontal sinus (Urken 1987)

	Frontal bossing	Orbital, ethmoidal, or intracranial extension	Bony erosion
Hypersinus	_	_	_
Pneumosinus dilatans	+	+	_
Pneumocele	+	+	+
Our patient	+	+	_

(+) present ; (-) absent

Pneumosinus Dilatans is an extremely rare condition. This condition was first recognized by Meyes in 1898 but it was Benjamin who first assigned the name pneumosinus dilatans[2]. It was extensively reviewed by Lombardi et al in 1968[2]. The largest series was that of Bourdial who reported 51 cases although accurate details were only available in three cases[3].

Pneumosinus Dilatans is characterized by progressive expansion of one or more paranasal sinuses associated with characteristic enlargement of the affected sinus, but without evidence of localized bone or mucous membrane changes[2]. It may affect any of paranasal sinuses but it most often affects the frontal sinus[2]. Simultaneous involvement of two paranasal sinus were reported in only 2 cases[2,6]. The presentation depends on the sinus affected. In pneumosinus dilatans of the frontal sinus, there is an asymptomatic bony enlargement of the affected sinus as presented by frontal bossing. Patient may also complain of headache, diplopia and local pressure symptoms. In our patient, pressure pain and headache may be secondary to increased intrasinus pressure[2]. It may also be associated with change in atmospheric pressure such as diving, flying and nose blowing[7]. Diplopia, on the other hand, may be secondary to distraction of vision or displacement of orbital contents because of the gradually enlarging frontal sinus[7].

Diagnosis is made by clinical examination, exclusion of other causes, and confirmation by standard radiography, CT scan or MRI when the characteristic enlargement of the sinus is seen[8]. The diagnostic criteria include (1) the enlargement of an air cell or the whole sinus (2) the presence of only air in the abnormal space, and (3) the ballooning outward of the walls of the sinus[8].

Histologic examination of the mucosa and the bone of the anterior table of the frontal sinus will reveal a pseudostratified columnar epithelium with a moderate inflammatory reaction without any characteristic modification, especially with regard to bone analysis[8]. Ciliary activity of the mucosa is expected to be normal[8].

2. How did this pathology happen?

In normal subjects, there is a wide variation in the degree of development and pneumatization of the frontal sinus. At birth the frontal sinus is indistinguishable from the anterior ethmoid cells. Postnatal growth is slow and it can only be seen radiographically at around 6 years of age[9].

Enlow described the relationship between the cessation of frontal lobe growth and the development of frontal sinus[10]. Frontal lobe expansion ceases in its anterior growth by age 7 years at which the inner frontal table stops its forward migration. Any further development of the frontal bone occurs secondary to anterior growth of the outer table and pneumatization proceeds during this time[10].

Gray suggests that frontal sinus enlargement is linked to the appearance of the superciliary arches which are themselves affected by the mechanical stresses of mastication. Similarly, lengthening of the nasomaxillary complex and development of the primary molars are believed to influence frontal sinus enlargement[11].

Several authors suggested different theories regarding the mechanism of frontal sinus enlargement in patients diagnosed to have pneumosinus dilatans: (1) It has been suggested that pneumosinus dilatans or an enlarged aerated sinus results from a disturbance of the physiological mechanism that controls pneumatization[12]. The development of the sinuses is thought to be predominantly under the control of growth and sex hormones. The hormones promote osteoblastic activity within the bone allowing ingrowth and expansion of the sinus to occur. Overgrowth may occur in acromegalic subjects under the influence of a general growth factor or as a compensatory phenomenon in cases of agenesis of cerebral hemisphere[13,14]; (2) Several authors suggested a ball valve like air trapping mechanism operating at the sinus ostium that prohibits air pressure within the sinus to equilibrate with the environment leading to sinus expansion and increased intrasinus pressure, while allowing normal emptying of secretions[2] (Figure G). Harrison et. al. described a single case in which exploration of a frontal sinus revealed an enlarged ethmoidal air cell near the opening of

the nasofrontal duct[2,6]. In our literature search, there is only one case of frontal sinus ostium stenosis (Figure H); (3) Congenital abnormality has also been proposed as a possible mechanism so that unchecked development and growth of the sinus cavity and the meningeal cells leads to Pneumosinus dilatans[12]; (4) Wiggli et al. suggested that chronic pressure might induce a bone remodelling process with predominant osteoblastic activity. Sinus expansion might occur at the bone remodelling phase[13].

Other proposed mechanism for the development of enlarged sinus include infection caused by gas producing bacteria, abnormal sinus development and spontaneous drainage of a mucocele[7].

From this discussion, it seemed that there is no definite understanding of the factors that influence the development of the frontal sinus and which signal the normal cessation of sinus growth which produce the abnormally large frontal sinus in our patient. However, it is apparent that there is continuous growth of the frontal table and accumulation of air in the frontal sinus. The pathologic nature of this disease remains unclear. Abnormal sinus development seems to be more likely in our patient.

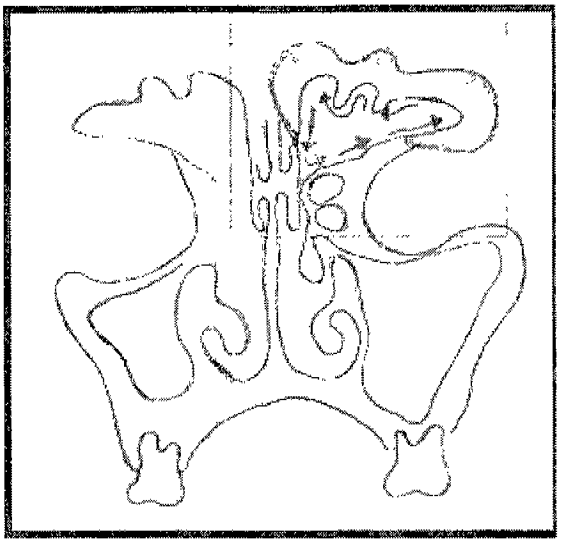


Figure G. Schematic illustration of an obstructed nasofrontal duct that allows normal passage of secretions but disallows ambient air to go inside the frontal sinus as described in the ball valve theory.

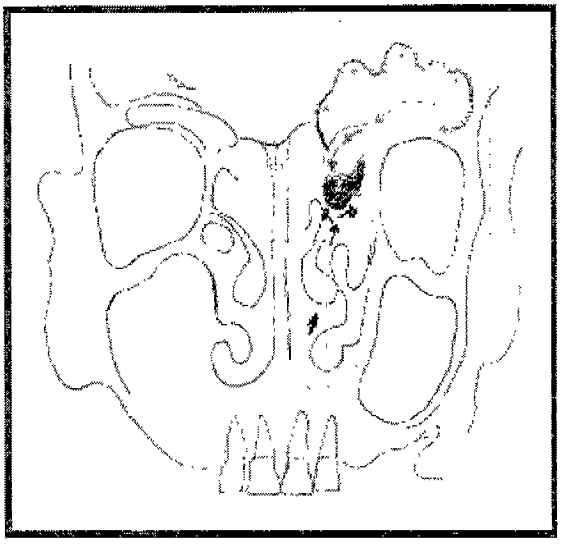


Figure H. Schematic illustration of a nasofrontal duct stenosis that cause increased intrasinus pressure.

3. How do we treat this patient?

Our patient came to our clinic because of cosmetic reason. He was hoping that his frontal bossing be remedied. Generally, no treatment is needed for an asymptomatic case of pneumosinus dilatans. Treatment by surgery is only indicated in cases of obvious cosmetic deformity, patients with ocular complications, or in cases with infection[1].

Endoscopic sinus surgery is a treatment option if a ball valve mechanism theory is entertained. This would eliminate the ball valve mechanism caused by increased pneumatization of the ethmoid air cells above the ostium frontalis as well as relieving obstruction in the sinus ostium.

However, in our literature search, the surgical treatment of choice is to do an osteoplastic flap, recession of the anterior wall with frontal sinus obliteration.[2,7,8] A bicoronal incision is made. The skin-tissue flap is lifted until the anterior wall of the frontal sinus is exposed. The deformed fronto-orbital bossing is removed and flattened. The mucosa of the sinus wall is stripped carefully from the bone. Osteoplastic correction is created by drilling the septa and allowing the frontal wall to be manipulated in its desired shape. Obliteration of the frontal sinus and nasofrontal duct is done using harvested fat from the abdomen. The flattened anterior wall is placed back to its original defect and is stabilized using microplates. This approach provided excellent access with a good cosmetic result and review of literature would suggest that recurrence after surgery was unlikely[2,7,8]. The operative technique is illustrated in Figures I to M.

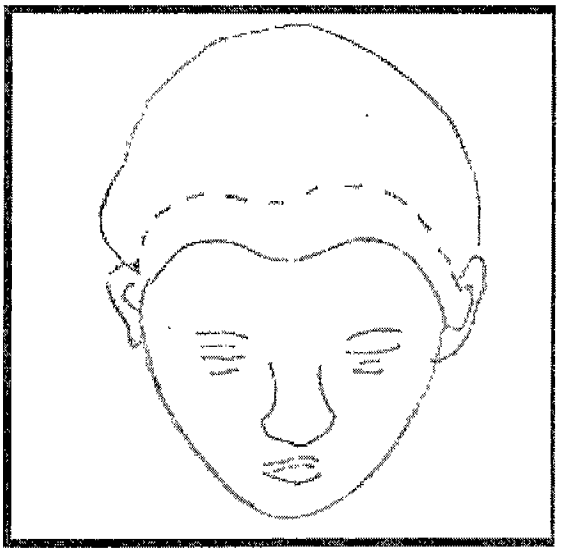


Figure I. A bicoronal incision is made in approaching the frontal sinus which is more cosmetically acceptable.

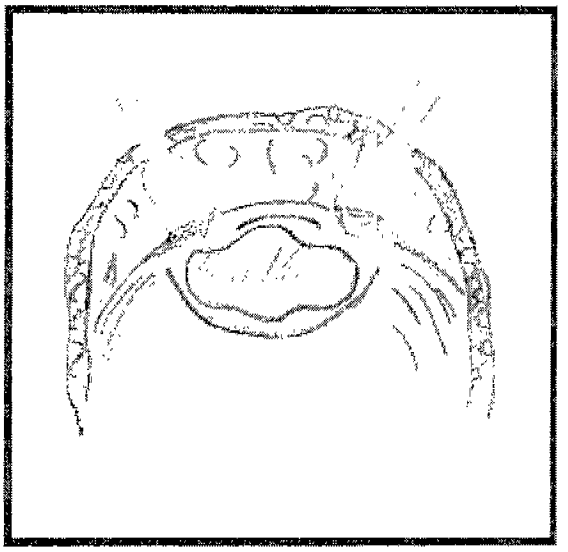


Figure J. A skin-soft tissue flap is lifted until the anterior wall of the frontal sinus is Exposed and identification of the perimeter of the sinus wall which is usually elevated in our patient.

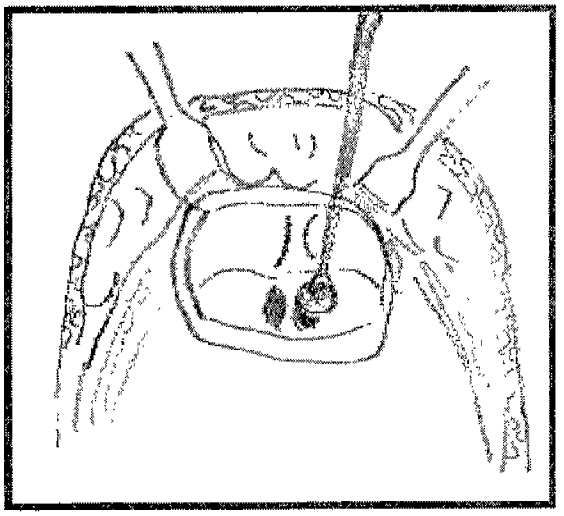


Figure K. Lifting of the anterior wall of the frontal sinus and drilling the intersinus septum to allow reshaping of the frontal sinus

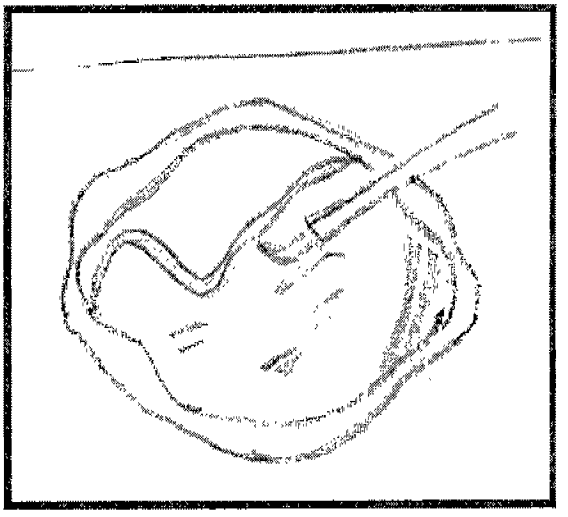


Figure L. The frontal sinus mucosa is stripped carefully from the bone.

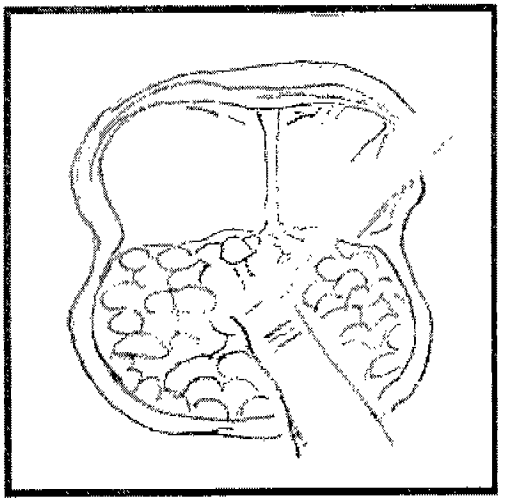


Figure M. Fat obliteration of the frontal sinus and nasofrontal duct using a harvested fat from the abdomen over the rectus muscle.

CONCLUSION

A patient who had an unusual cause of frontal bossing was presented in this case report. An abnormally hyperaerated frontal sinus was the cause of frontal bossing in our patient. He was diagnosed to have pneumosinus dilatans of the frontal sinus.

Increased intrasinus pressure, ball valve defect, increased growth hormone production and congenital malformations are some of the proposed mechanism by which this pathology happens. None of them has been proven and etiology of this condition remains unclear.

In our literature search, cosmetic deformity was the primary indication for surgery in patients with pneumosinus dilatans of the frontal sinus. Correction of the frontal bossing with creation of an osteoplastic flap with recession of the anterior table into the sinus and fat obliteration was standard treatment of choice in most patients.

BIBLIOGRAPHY

1. Daniels GH, Martin JB. Harrison's Principles of Internal Medicine. 13th edition., McGraw Hill p.1900, 1994
2. *Smith IM., Maran AGD, Haacke MA. Pneumosinus Dilatans. Ann Otol Rhinol Larynol 1987;96:210-212*
3. *Bourdial J, Lallement Y, Vergnon L, Fleider J. Pneumosinus Dilatans. Ann ORL 1968;7:726-730.*
4. Urken ML,Som PM, Lawson W,et al. Abnormally Large frontal Sinus I. A practical analysis method for its determination based upon an analysis of 100 Normal Patients. Laryngoscope 1987;97:602-605
5. Urken ML,Som PM, Lawson W,et al. Abnormally Large frontal Sinus II. Nomenclature, pathology and symptoms. Laryngoscope;1987:97:606-11
6. Jarvis JF. Pneumocele of Frontal and Sphenoid sinuses. J Larygol Otol 1774;88:785-93
7. Eskandary H, Kermani H, Reihani. Frontal sinus Pneumocele: A case report. Int. J Oral Maxillofac Surg 1999;28:179-80.
8. Klossek JM, Dufour X, Toffel P, Fontanel JP. Pneumosinus Dilatans: A report of three new cases and their surgical management. ENT-Ear,Nose, Throat Journal 2000; 79:48-51
9. Cummings CW, Fredrickson JM, Krause CJ. Otolaryngology Head and Neck Surgery. Mosby, St. Louis, 1998
10. Enlow DH. Handbook of Facial Growth. W.B. Saunders Co., Philadelphia, p.299,1985
11. Gray H. Anatomy of the Human Body. C. Clementine(Ed.).30th Ed.,Lea and Febiger, Philadelphia, p.299, 1985.
12. Hirst LW,Miller NR, Allen GS. Sphenoidal pneumosinus dilatans with bilateral optic nerve meningiomas.1979;51;402-407
13. Wiggli U, Oberson R. Pneumosinus Dilatans and Hyperostosis: Early sign of meningioma of the anterior chiamastic angle. Neuroradiology. 1982;8:217-21
14. Wen-Min Hsu, An-Guor Wang. Pneumosinus Dilatans associated with Orbital Neurilemmoma. Chinese Medical Journal(*Taipei*) 2002;65: 218-224

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HARLEQUIN ICHTHYOSIS*

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ABSTRACT

OBJECTIVES: To present the clinical features and etiopathogenesis of Harlequin Ichthyosis and to define the role of the Otorhinolaryngology – Head and Neck Surgery service in the management and care or the harlequin newborn.
DESIGN: Case Report
SETTING: Tertiary Government Hospital
RESULTS: A 7-day-old newborn male was referred to ENT-HNS service of a tertiary government hospital for evaluation. E.D. was noted to have thickened yellowish plate-like scales over the facial and body areas. Other abnormalities such as bilateral microtia (rudimentary ears) and ectropion (everted eyelids), nasal hypoplasia (flattened nose), eclabium, and contracture abnormalities of the appendages were also noted. On the 16th hospital day, the patient succumbed to sepsis and expired.
SUMMARY/CONCLUSION: The pathology of Harlequin Ichthyosis is secondary to defective lamellar granules and profilaggrin conversion defects which lead to abnormal keratinization. Impaired skin function led to the death of our patient on the second week of life. Management of Harlequin syndrome, as for all congenital anomalies, is multidisciplinary. ENT-HNS management encompasses: 1) ensuring upper airway patency; 2) ruling out coexisting bony and soft tissue abnormalities of the head and neck, and 3) weighing the feasibility of future ear/facial defect reconstruction.

INTRODUCTION

Shwyder and Ott referred to "ichthyoses" (Gr. fish) as a collection of skin diseases that display an excessive amount of superficial scaling.[1] These disorders may be congenital or acquired.

Harlequin Ichthyosis is the most severe form of congenital ichthyosis with an incidence of one in 300,000 births. [2]

The massive thick hyperkeratotic plaques in these newborns, consequentially give rise to abnormalities of the eyes, ears, nose, lips, chest wall, and limbs. The 'harlequin' baby truly has a face and costume of a clown. The head and neck manifestations of the harlequin newborn baby syndrome are of interest to the otorhinolaryngologist.

This case report deals with our recent clinical experience in the care and management of a harlequin baby.

OBJECTIVES

The objectives of the study are the following:

1.To present the clinical features and etiopathogenesis of Harlequin Ichthyosis.

2.To define the role of the Otorhinolaryngology - Head and Neck Surgery service in the management and care of the harlequin newborn.

CASE REPORT

A 7 day old male was referred to ENT – HNS service of a tertiary government hospital in Quezon City for evaluation of multiple congenital anomalies.

E.D., newborn male, was born preterm (34 weeks age of gestation) to a 34 year old (gravida 6 para 5) via normal spontaneous delivery at home assisted by a midwife. He had a good cry. He did not exhibit signs of respiratory difficulty

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or cyanosis. Noisy or labored breathing was not noted. E.D. had greasy yellow plate-like adherent scales distributed all over the body and multiple facial abnormalities prompting consultation in a tertiary government hospital in Quezon City for evaluation.

Maternal history revealed an upper respiratory tract infection for two weeks on the second trimester of pregnancy with subsequent intake of Cotrimoxazole 800:160 mg/capsule BID for 7 days. The mother also had a urinary tract infection on her third trimester of pregnancy for which Amoxicillin was taken. Symptoms of her illnesses abated with medications. Mother had irregular prenatal check ups since third month of pregnancy at a local health center. Prenatal check ups throughout the pregnancy totaled to 3. Mother denies any exposure to neither radiation nor intake of prohibited drugs.

Family history was negative for congenital anomalies, asthma, pulmonary tuberculosis, diabetes mellitus, or hypertension. Parents are not consanguineous (related to each other by blood).

Physical examination revealed an infant weighing 2200 grams. The patient's cardiac rate was 143 beats per minute, respiratory rate of 64 cycles per minute, and temperature was 38.3°C.

The clinical appearance of the baby was striking. The scaly skin consisted of yellow plaques. There was a note of massive, hard, thickened, waxy, shiny plates noted to be separated by deep red fissures. (Figure 1) Bleeding was noted upon removal of the scales. Baby Boy E.D. had the face and apparel of a clown or a court jester. (Figure 2)

FIGURE 1. Baby Boy E.D., Whole body profile

On examination of the ears, both pinnae were noted to be rudimentary and underdeveloped (microtia). The external auditory canals were noted to be patent. The tympanic membrane could not be visualized. (Figure 3)

Examination of the nose revealed a flattened nasal dorsum (nasal hypoplasia). The nostrils were found to be patent. Noisy or labored breathing was not appreciated by the examiner. Good airflow through the nostrils was noted. (Figure 4)

FIGURE 2. Harlequin Ichthyosis

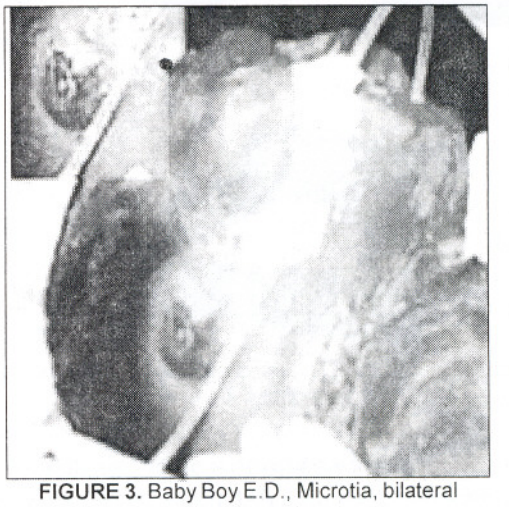

FIGURE 3. Baby Boy E.D., Microtia, bilateral (right ear seen here)

Examination of the oral cavity disclosed outwardly protruding upper and lower lips (eclabium) and hyperplastic gingivae. There were cleft lip nor palatal defects. Good suck was noted.

The examination of neck was unremarkable.

Other findings noted: 1) Examination of the eyes revealed bilateral ectropion. 2) Examination of the extremities revealed encasement of limbs in thick yellowish plaques. Limb mobility was poor to absent. Toes and fingers of the infant were noted to be hypoplastic. (Figure 5)

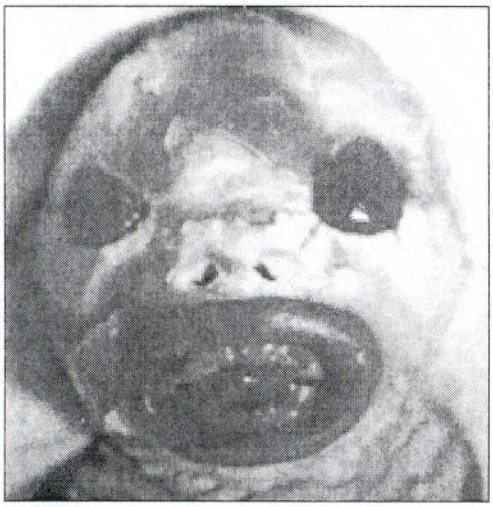

FIGURE 4. Baby Boy E.D., Facial profile showing nasal hypoplasia, ectropion and eclabium

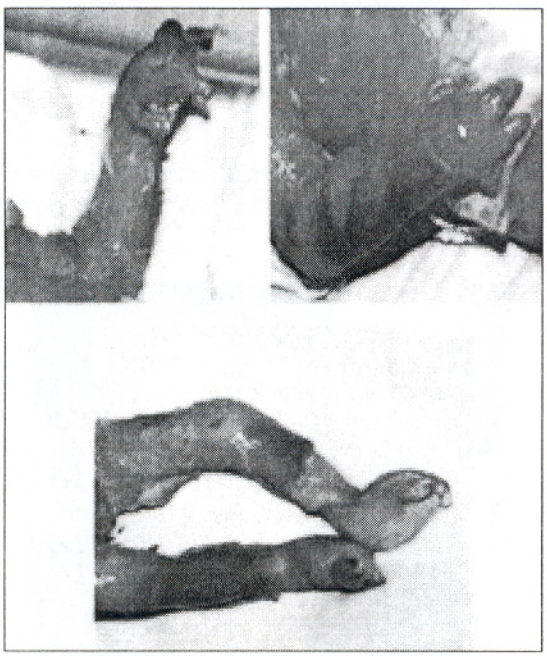

FIGURE 5. Baby Boy E.D., Limb profile

Patient was given a diagnosis of Microtia (rudimentary pinnae), AU; nasal hypoplasia, and eclabium (as part of Harlequin baby syndrome) by ENT service. The immediate plan of the service consisted of maintaining the patency of the nostrils and external auditory meati. Service also requested for craniofacial and neck CT scans to rule out other congenital anomalies of the head and neck (e.g. EAC stenosis, inner ear developmental anomalies, choanal atresia, bony craniofacial cleft defects and neck abnormalities, etc). Craniofacial and neck CT scans were unremarkable. (Figure 6)

The patient was being cared for at the Neonatal Intensive Care Unit (NICU) at the time of referral. In addition to careful monitoring of vital signs, hydration, and electrolytes, Baby Boy E.D. was placed in a humidified incubator to offset dehydration. (Figure 7) Pediatrics service had earlier referred the patient to the Dermatology and Ophthalmology services of the same institution.

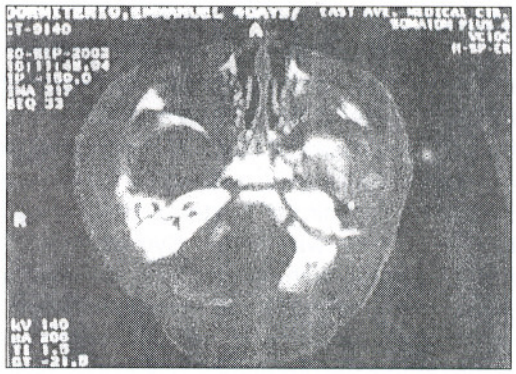

FIGURE 6a. Baby Boy E.D., Cranial CTscan (left of the temporal bone and nasal cuts)

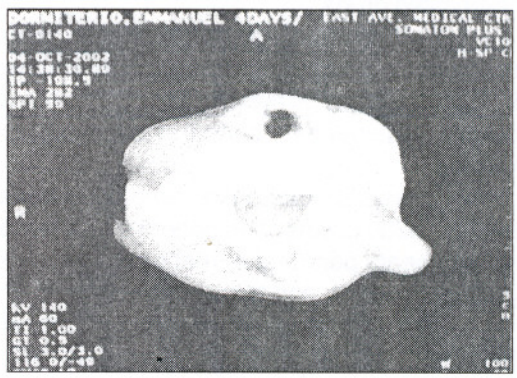

FIGURE 6b. Baby Boy E.D., Cervical CT scan

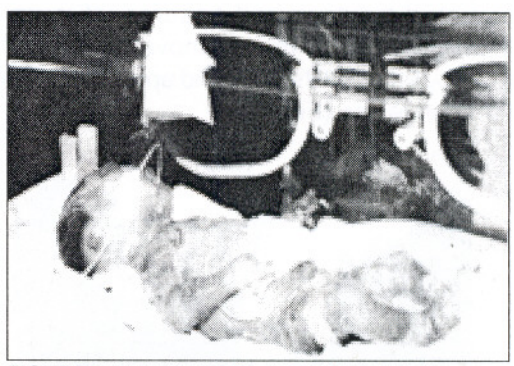

FIGURE 7. Baby Boy E.D., Inside the incubator

The assessment of the Dermatology service was harlequin ichthyosis and the plan of the service consisted of application of petroleum jelly lubricants (Vaselina blanca, liberally 3 times a day and bath oils), keratolytics (Nutraplus lotion, applied liberally 2 times a day), adequate hydration and proper antibiotic coverage. Plate-like scales had started to peel off from the 7th day of life revealing erythematous fissures. A 2 mm punch biopsy of the skin of the right thigh was done which demonstrated *compact orthohyperkeratosis, plugging of dilated follicular ostia, focal granular layer absence and thinning,*

slight papillomatosis, mild acanthosis, and a superficial perivascular lymphocytic infiltrate - findings consistent with Harlequin Ichthyosis. (Figure 10)

Assessment of the Ophthalmology service was bilateral ectropion. Management of the service consisted of Hypomellose lubricant eye gel, applied to the exposed eye tissues every 12 hours and Erythromycin ointment strip to both eyes at bedtime.

Episodes of oliguria and temperature instability plagued the patient throughout the course in the ward. He was intubated on the 12th hospital day due to respiratory failure. On the 16th hospital day (16th day of life) Baby Boy E.D. succumbed to sepsis.

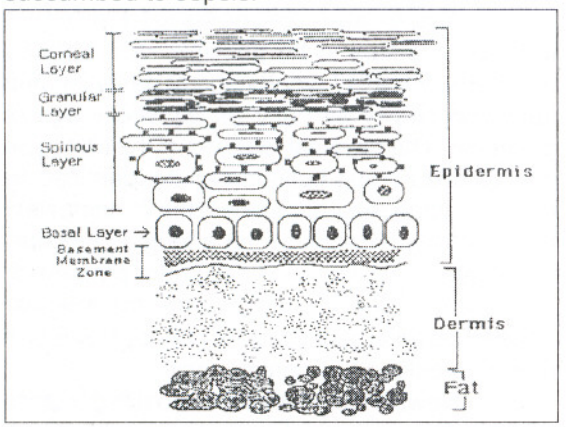

FIGURE 8. Layers of skin - schematic diagram (from Schwyder et al. "All about Ichthyosis", Pediatrics Dermatology)

FIGURE 9. Stratum corneum: Two compartment model illustration "bricks" and "mortars" (from Schwyder et al. "All about Ichthyosis", Pediatrics Dermatology)

DISCUSSION

The disorders of cornification (ichthyoses) comprise acquired and inherited disorders characterized clinically by generalized scaling and histologically by hyperkeratosis.[3]

Harlequin ichthyosis is the most severe form of congenital ichthyosis.[4] A little more than 100 cases have been reported internationally. It occurs randomly without predilection to race or sex. Two cases have been reported locally one in

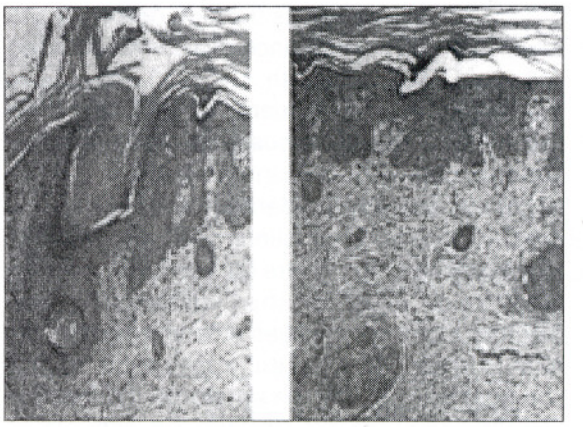

FIGURE 10. Harlequin Ichthyosis, Baby Boy E.D. -skin biopsy (courtesy of the Department of Dermatology, EAMC)

Davao and another at JRMMC. The authors were not able to retrieve hospital records of the 2 local cases. To the authors' knowledge, this is the first case report dealing with the head and neck manifestation of the disease (after conducting literature search through the MEDLINE). Au and Predniville have linked consanguinity and family history of ichthyosis, severe skin disorders, and intrauterine or neonatal deaths to the pathogenesis of Harlequin Ichthyosis.[5] The above risk factors were absent from E.D.'s historical data.

The disease is characterized by profound thickening of the keratin layer of the fetal skin. The skin as we know is the heaviest single organ in the human body constituting about 16% of the total body weight. [6] It is composed of two layers: the epidermis (5 layers – stratum corneum, lucidum, granulosum, spinosum, basale) and the dermis (2 layers – papillary and reticular). (Figure 8) The skin functions for 1) protection against injury, dessication, and infection (2) body temperature regulation (3) UV radiation and absorption (4) Vitamin D synthesis and (5) as a receptor for external environmental stimuli (touch, temperature, pain). Absence of the skin is held to be incompatible with life. Abnormal integumentary structure such as seen in Ichthyosis Congenita or harlequin syndrome leaves the newborn susceptible to temperature dysregulation, metabolic abnormalities, respiratory difficulties, and systemic infection leading to mortality in the first weeks of life. Roberts in 1989, reported a case of a harlequin fetus living up to 9 years of age. [7] More recently in 1998, Singalavanija et al of Thailand reported another harlequin baby on her third year of life. [4] The prolonged survival of the 2 infants was attributed to good neonatal intensive care, topical emollients, and oral Etretinate. Etretinate is a retinoid known to accelerate keratinization.

Ichthyosis arises through defects in the production and maintenance of a normal cornified cell compartment, or both. [3] In 1983, Peter Elias proposed a two compartment model of the stratum corneum. [1] The squamous cells are the 'bricks' and surrounding the bricks is the lipid rich 'mortar'. (Figure 9) Accordingly, derangements of normal brick and mortar production/maintenance result in abnormal keratin layers (strata corneum – the superficial layer of the epidermis). Two biomolecular abnormalities affecting both bricks and mortar have been implicated in the pathogenesis of harlequin syndrome. 1) Defective lamellar granules (2) Profilaggrin conversion defects. [5]

The lamellar granules are intracellular granules that originate from the golgi apparata of keratinocytes in the stratum corneum. These granules are responsible for secreting lipids to maintain the skin barrier.

The other abnormality involves the abnormal conversion of profilaggrin to filaggrin (structural cytoskeletal proteins found in the keratohyalin granules of the stratum granulosum of the epidermis) via phosphorylation defect. Abnormal keratohyalin structure results in poor internal support for the stratum corneum envelope.

The two defects are responsible for the disordered keratinization leading to the production of abnormal skin form with impaired function. In 1999, Akiyama ascribed the biomolecular abnormalities to enzymatic aberrations – specifically transglutaminase gene 1 mutations and reduced activity of serine/threonine protein phosphatase. [8]

The affected neonate is born with a massive horny shell of dense plate-like scales which hinders the normal body part development. Secondary contraction abnormalities of the eyes (ectropion), ears (microtia), mouth (eclabium), nose (nasal hypoplasia), and appendages (flexion contractures, circumferential constriction) ensue. All these classic features of harlequin syndrome were present in Baby Boy E.D.

The harlequin baby derives the monicker from "Harlequin"- a character in the Italian comedic theatre form, "Commedia dell'Arte", which *flourished during the Renaissance period. Harlequin had a cat-like mask, a colorful patched costume, and a wooden sword.*[9] (Figure 2)

A skin biopsy from any cutaneous tissue demonstrates characteristic histopathologic and ultrastructural findings in Harlequin Ichthyosis. Histologically, the stratum corneum is thick and compact. Hyperkeratosis may be more marked around hair follicles compared to interfollicular epidermis. Parakeratosis and orthokeratosis may be present, particularly on the fingers and toes. Cells within the stratum corneum are abnormally keratinized. Inflammatory cells may infiltrate the papillary dermis. Electron microscopy reveals absent or abnormal lamellar granules within the granular layer keratinocytes. Lamellae are absent in the intercellular spaces between the granular cell layer and cornified cell layer. Densely packed lipid droplets and vacuoles are seen within cytoplasm of the aberrantly cornified cells of the stratum. Keratohyalin granules may be absent, normal, or abnormally small and globular. Keratin intermediate filaments within granular cells may have reduced density. [5] The skin biopsy obtained from the Baby Boy E.D.'s right thigh by Dermatology service yielded consistent findings. (Figure 10)

A prenatal diagnosis of Harlequin Ichthyosis is said to be possible with amniotic fluid sampling at 17 weeks age of gestation and fetal skin biopsy as early as 20 weeks age of gestation. The physical features of the harlequin infants and keratin buildup can be identified by prenatal ultrasonography late in the 2nd trimester.[5] Prenatal identification of the affected child may allow parents and physician to better prepare for the infant's delivery. In this case, the irregular and few prenatal consultations of Baby Boy E.D.'s mother preclude any contingency.

Newborn care is of foremost importance in the management of harlequin ichthyosis. It entails careful monitoring and support of vital signs (blood pressure, temperature) and electrolytes, maintenance of adequate hydration and nutrition and prophylaxis for infection (Fulminant sepsis remains the most common cause of death in these infants).[5] These are optimally done in the neonatal intensive care unit. Holistic management of the case of harlequin baby newborn with a multitude of anatomic and functional defects entails a multidisciplinary approach - as with the other congenital anomalies. For this case, consultations with Dermatology, Otorhinolaryngology, and Ophthalmology were made.

The head and neck manifestations of harlequin syndrome make the otorhinolaryngologist – head and neck surgeon a vital member of the team. ENT-HNS management in this case encompasses three concerns, (in order of priority):

1) Ensuring patency of the upper airway (particularly of the nostrils)

2) Ruling out concomitant bony and soft tissue abnormalities of the head and neck region (e.g. choanal atresia, ear abnormalities, craniofacial pathology, etc.)

3) Weighing the feasibility of future reconstruction of the auricular (microtia) and facial

defects (nasal hypoplasia and eclabium).
Ensuring the patency of the nostrils is the first priority of the otolaryngologist because newborns are obligate nasal breathers. Baby E.D. had good airflow through the nostrils suggesting patency at the level of the nose. However, it was important to provide care instructions for nostrils (normal saline solution and topical antibiotic ointment) because of the some scale encroachment on these orifices.

Craniofacial and cervical CT scans were requested in this case **to rule out bony and soft tissue abnormalities of the head and neck region**. CT scan is an essential imaging modality for assessment of head and neck pathologic conditions. Its advantages include high spectral resolution, excellent soft tissue contrast discrimination of fat, muscle, bone, and other soft tissue that may compromise plain film exam. [10] The patient's CT scan was negative for choanal atresia, ear abnormalities, and cervical pathology. (Figure 6)

It was important to rule out internal ear abnormalities in our harlequin baby with bilateral microtia. The external and middle ears develop from a common block of tissue, chiefly the 1st and 2nd branchial arches such that EAC and middle ear atresia/stenosis should be ruled out in patients with microtia. [11] (Figure 11) CT scan at the level of the temporal bones would reliably rule out the pathology. The modality did so in this case. (Figure 6) Invariably, assuming the presence of a normal EAC and the middle ear in this case can be done with good amount of confidence – knowing that microtia in Harlequin Ichthyosis is not a primary pathology. Its occurrence is rather secondary to the taut, unyielding skin deterring normal outward growth and development of the auricle.

Although the inner ear is rarely involved in microtia [10], the infant's hearing may be objectively assessed by auditory brainstem response (ABR) for a complete evaluation of the auditory system. No ABR procedure was done on our patient.

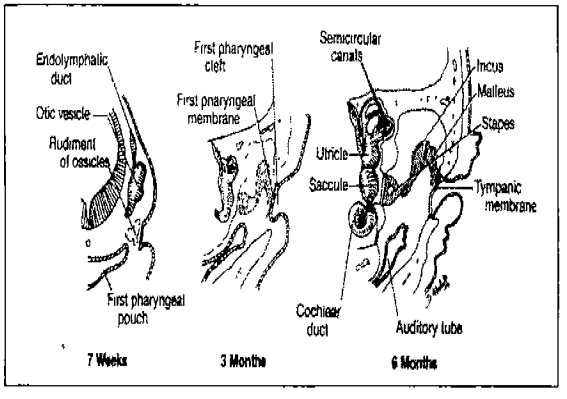

FIGURE 11. Development of the ear (from Johnson, Kurt E., "Human Developmental anatomy")

Feasibility of future ear and facial reconstruction merits discussion for a comprehensive ENT management approach to the case. There have been no reports on reconstructive work/surgery in infants affected with Harlequin Ichthyosis. As for the issue of future reconstruction, the authors would like to cite the three salient considerations:

1) Limited life expectancy (just a few weeks after birth) of newborns with this rare disorder precludes reconstruction. Management should focus on optimum newborn care. Surgery can be a potentially grave insult to the compromised harlequin baby.

2) Some of the abnormalities in harlequin newborns, particularly the
ectropion and eclabium, have been reported to resolve with subsequent replacement by large thin scales with surrounding erythema. [12] An expectant management stance may thus be reasonably advocated.

3) The amenability to cosmetic surgery of a harlequin newborn's skin with its excessive epithelialization is questionable. Wound healing may turn out to be abnormal. This presumption remains to be verified by wound healing studies on the integument of harlequin newborns.

SUMMARY

Baby Boy E.D. presented with classic features of Harlequin Ichthyosis: generalized plate-like scales, bilateral microtia and ectropion, nasal hypoplasia, and eclabium, and contracture abnormalities of the extremities (flexion contractures and circumferential constriction). The pathology is secondary to abnormal keratinization.

Impairment of skin function led to the death of our patient on the second week of life. Management of harlequin syndrome, as for all congenital anomalies, is multidisciplinary. ENT-HNS management encompasses 1) ensuring upper airway patency; 2) ruling out coexisting bony and soft tissue abnormalities of the head and neck; and 3) weighing the feasibility of future ear and facial defect reconstruction.

BIBLIOGRAPHY

1. T. Shwyder, and F. Ott. All About Ichthyosis. Pediatric Dermatology. 1991; 835-857.
2. Dolunay Gurses, Ilknur Kilic, Merve Baskan. A Case of Harlequin Fetus with

Psoriasis In His Family. The Internet J of Pediatrics and Neonatology.ISSN:1528-8374.2002.1-7
3. Williams ML. Ichthyosis: Mechanisms of Disease. Pediatric Dermatology. Dec 1992
4. Singalavanija S., Sangtawesin V., Horpoapan S., Ratrisawadi V. Harlequin Baby: A Case Report. Journal of the Medical Association of Thailand. 81(5): 365-70, May, 1998.
5. Sheila Au, et al. Ichthyosis Fetalis. E Medicine Oct 2001.
6. Gartner, LP, JL Hiatt. and JM Stram. Cell Biology and Histology, 3rd ed. Baltimore: Williams and Wilkins, 1998.
7. Roberts LJ. Long Term Survival of a Harlequin Fetus. Journal of the American Academy of Dermatology. August, 1989. 335-9.
8. Akiyama M. The Pathogenesis s Severe Congenital Ichthyosis of the Neonate. Journal of Dermatological Science. 21: 96-104, Sept., 1999.
9. Delpiano R. Carnival of Venice-Harlequin.1998.
10. Bailey BJ. Ed. Head and Neck Surgery Otolaryngology. 2nd ed. USA:Lippincott-Williams and Wilkins, 2002.
11. Rothschild, MA.et al. Syndromic and other Congenital Anomalies of the Head and Neck. The Otolaryngologist Clinics of North America. 33 (6): 1353, 2000.
12. Behrman: Nelson Textbook of Pediatrics, 16th ed. Philadelphia: Saunders, 2002.

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MASSIVE UPPER AIRWAY HEMANGIOMA IN AN ADULT*

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MELFRED L. HERNANDEZ, MD, FPSO-HNS***

ABSTRACT

OBJECTIVE: To report a unique and unusual presentation, and the ensuing management dilemma of a 20-year old female with a seemingly benign antero-lateral neck mass, later seen to be part of a massive mucosal hemangioma of the upper aerodigestive tract extending to the naso-pharynx, oro-pharynx, and laryngo-pharynx and soft tissues of the anterior neck.
STUDY DESIGN: Case report.
SETTING: Tertiary care center.
PATIENT: One.
RESULTS: A massive, mucosal hemangioma with a unique and unusual manifestation in the upper aerodigestive tract, contiguous with the soft tissues of the neck is presented. The management options (non-surgical and surgical) that may or may not be applicable to this patient are discussed. Non-surgical modalities like steroids and interferon therapy maybe inadequate. Surgical interventions seem to have risks that may far outweigh the benefits desired if applied to this particular patient. In any instance of intervention, the philosophy of 'primum non nocere' is invoked.
CONCLUSION: Hemangiomas can occur in any area of the body, even in areas that are least likely expected. Upper aerodigestive hemangioma may pose a risk for massive bleeding, upper airway obstruction and death, with and without intervention, more so as it grows in enormous size and locally invade contiguous vital structures and tissue spaces.

INTRODUCTION

Majority of cases of hemangioma appear during the first 6 weeks of life. The first sign is a macular patch, blanched spot or localized area of telangiectasia, surrounded by a halo. Fully-grown hemangiomas are rarely present at birth. Seventy percent (70%) to ninety percent (90%) become apparent between the 1st and 4th weeks of life. Overall, eighty five percent (85%) are manifest by the close of the first year of life (1).

A hemangioma either rapidly proliferates in the early months of life as a localized tumor in a single area, or proliferates simultaneously in several sites throughout the body. Eighty percent (80%) occur as an isolated lesion, whereas 20% are multiple hemangiomas. The head and neck region of the body is the most commonly involved, followed by the trunk and the extremities. The most common site for deep hemangiomas in the head and neck region is within the masseter muscle.

In infants, subglottic hemangioma is a potentially life threatening entity that must be recognized and managed early. Hemangioma remains to be the most common tumor of infancy (2). On the other hand in adults, laryngeal hemangiomas are usually seen in the supraglottic and/or glottic areas of the larynx, and are often polypoid or pedunculated. They rarely present with respiratory distress and thus are usually observed until further progression.

Although these tumors are benign, they may present significant problems to the patient if they impinge upon important anatomic structures, especially the eye or the respiratory tract.

Review of literature would report mostly subglottic hemangioma in infants, as this is one of the recognized causes of pediatric upper airway obstruction. The management, therefore, is developed around this entity. Only one case of a cavernous hemangioma of the larynx in the adult was found in the literature, located in the supraglottic area and presented with airway obstruction. (3)

A case of a massive upper airway mucosal hemangioma in a 20-year old patient is presented to show its unique location and enormous extent, and seemingly benign behavior, which would all have bearing in the approach to

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CASE REPORT

This is the case of a 20-year old female patient from Sto. Tomas, Batangas who consulted with the chief complaint of an anterior neck mass. At 8 years of age, the patient noted a soft, non-tender right lateral neck mass, which was very slowly enlarging. No skin discoloration on the area of the mass was seen. She had slight voice change perceived as a decrease in volume. No frank hoarseness was noted. There were no episodes of dyspnea, dysphagia or bleeding from the mouth. She consulted various physicians but no definite diagnosis was given. The mass gradually enlarged, and 5 months prior to consult, there was a rapid increase in the size of the right lateral neck mass to a 3 x 3 x 3-centimeter soft, non-tender anterior neck mass, with no associated aerodigestive complaints (dyspnea nor odynophagia). However, there was one episode of minimal bleeding (< 1 teaspoon of blood) which spontaneously resolved. An oropharyngeal mass was seen on oral examination when she consulted a local physician.

A computed tomography (CT) scan of the oropharynx and neck was done. Based on the characteristics of the lesion on CT (intensely enhancing on contrast, no osseous erosions), hemangioma was then considered. She was then referred to our institution for further management. Review of systems revealed no further symptoms. Past medical and family medical history proved to be non-contributory. The patient was born at home full term via spontaneous vaginal delivery with an unremarkable perinatal history. She has no known relatives presenting with a similar illness. She presently works as an office clerk and had no problems coping with her activities of daily living.

Physical examination of the oral cavity showed a purplish, irregular mass occupying the right oropharynx (Figure 1), with no ulcerations or signs of infection.

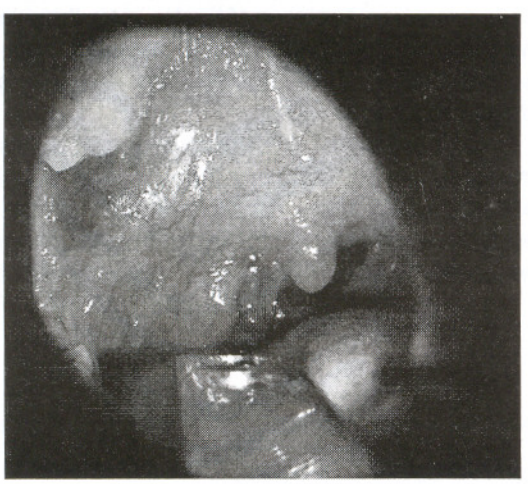

FIGURE 1. Purplish mass occupying the oropharynx.

An approximately 5 x 5 x 5-centimeter soft compressible mass was seen in the anterior neck that seemed to extend to the right lateral neck area.

Rigid nasopharyngoscopy (0° Storzä nasal endoscope) revealed that the mass has also extended upwards into the right nasopharyngeal area.

The CT scan showed a large enhancing mass at the right deep posterior cervical region extending from the nasopharynx, oropharynx, larynx and supraclavicular region. There was encasement of the carotid and jugular vessels, with displacement and compression of the airway. (Figure 2)

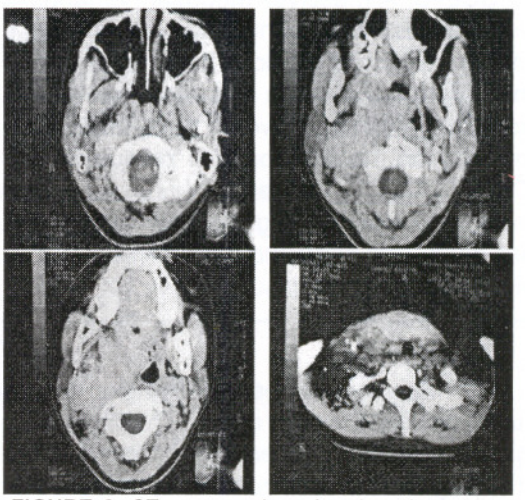

FIGURE 2. CT scan series showing the mass occupying the nasopharynx, oropharynx and the neck.

Videolaryngoscopy (Kayä Digital System) was also done showing an oropharyngeal mass extending inferiorly to the hypopharynx and larynx, with involvement of the arytenoids and vocal cords bilaterally. (Figure 3)

Considering all of the findings, the impression for this case is a massive mucosal hemangioma in the nasopharynx, oropharynx and larynx, with extension to the right antero-lateral neck area.

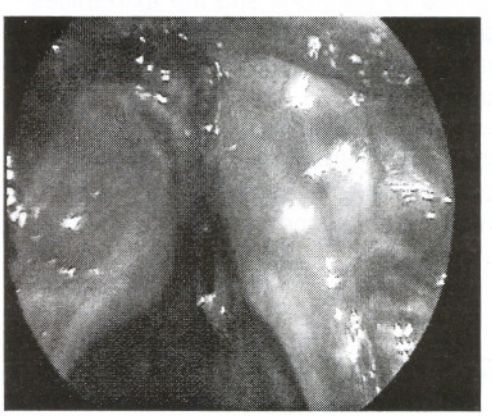

FIGURE 3. Videolaryngoscopy of the larynx showing the extent of the hemangioma.

DISCUSSION

There are several questions that may arise in relation to a case like this: (1) what is the natural course and pathophysiology of growth of a ***long-standing mucosal hemangioma*** (~12 years), and its pattern of spread in the surrounding tissues — is this a kind of invasion of other structures akin to most cancers, or is it just a benign extension to contiguous structures?; (2) what would be the constellation of symptoms and manifestations of such a massive mucosal hemangioma during the early stages that would signal to the patient and family that the illness is serious, and can progress over time to a point of no return in its management?; (3) when should the head and neck surgeon intervene, and what will be the goals of management?; and lastly (4) are there enough armamentarium in the management of such a case without much post-operative morbidity and mortality?

In general, hemangiomas are the most common head and neck neoplasms in children, mainly cutaneous, solitary, rather than multifocal, and affecting females more than males. These are usually seen in the first month of life, grow rapidly in the first year, and involute over the next few years in approximately 90% of cases without treatment (4). Capillary hemangioma, a type of hemangioma, is present in as many as 2.6% of all newborns. During the first year of life, they exhibit a rapid growth phase and the lesions become raised, dome-shaped to polypoid and bright red to deep purple. After the first year of life, they enter a quiescent phase, followed by a period of spontaneous involution. By the age of 5, 50% of these lesions have spontaneously resolved; 70% resolve by the age of 7 years. If they have not involuted by 7 years of age, they are unlikely to do so. Lesions located on the mucous membranes of the upper lip appear to exhibit the poorest chance of spontaneous resolution. (2) This case definitely does not fit the usual case of a hemangioma, probably belonging to the ten percent (10%) of cases that persist, in addition to being a mucosal, multifocal hemangioma. Why do hemangiomas persist? This question is still unanswered as even the etiology of hemangioma remains obscure.

How did the hemangioma of the patient come about? Was it present at birth as is the usual case, but remained undetected (by the patient, her parents, and health practitioners as well) or did it really arise after several years (at eight years of age) and rapidly grew in size thereafter? The second option may raise eyebrows or the possibility of a new theory, considering the time-honored dictum that 'hemangiomas are present at birth'. Where did the primary lesion originate — from the nasopharynx, oral, laryngo-hypopharynx or within soft tissues around the neck? Or did it arise simultaneously along those areas? By what mechanisms did this occur? Definitive answers to these questions might be difficult considering that the illness of the patient went undocumented until the appearance of an antero-lateral neck mass. In more developed countries, this case may have been diagnosed at birth. In the light of current knowledge (which is scanty at this point) of the natural course of mucosal hemangioma of the upper aerodigestive tract, the answers to the questions might be valuable in our understanding of its etiology, and possibly, definitive treatment.

The patient came complaining of the anterior neck mass, and not of the symptoms one may experience in having a naso-pharyngeal, oro-pharyngeal, laryngo-hypopharyngeal mass or lesion.Possibly the hemangioma did not reach the critical size needed to produce either of the following symptoms of discomfort: (1) nasal obstruction, (2) 'hot potato voice', (3) dysphagia, (4) foreign body sensation, (5) hoarseness, (6) dyspnea, and (7) bleeding in any of the areas involved. Why was it that the hemangioma proliferated much in the soft tissues of the neck, encasing great blood vessels, and producing a significant bulge in the antero-lateral neck, rather than significantly obstructing the upper aerodigestive tract, and thus, could have been life threatening? These questions are asked, but answers may not be become available until the molecular basis for the occurrence of hemangioma, particularly of mucosal hemangioma, has been fully elucidated.

In this case, the patient had an unremarkable perinatal and childhood course. The presence of the anterior neck mass was not alarming enough to seek specialized medical consult. The previous consults they had did not reveal the presence of the hemangioma. The mass was undetected and undocumented.

Diagnosing such a case may not be entirely difficult, considering the availability of various diagnostic studies. Among these, direct visualization techniques using rigid nasopharyngoscopy and video-laryngoscopy of the upper aerodigestive tract and computed tomography were done as cost-effective methods for the patient, in order to delineate the extent of the lesion.

Other modalities advocated in the literature are the following: (1) ultrasonography (with Doppler flow study), (2) magnetic resonance imaging (MRI), and if necessary, (3) angiography. All of the above methods may provide an adequate

picture of the extent of the lesion, although each of these may have their own advantages and disadvantages.

Ultrasonography will differentiate slow-flow malformations (specifically venous or lymphatic anomalies) from hemangioma if done by experienced hands. MRI, which is more expensive, is highly sensitive and specific, and provides more information in showing the extent of involvement within tissue planes as well as flow characteristics of the lesion. In either the proliferative or involutive phase, hemangiomas can be differentiated from AVM. Furthermore, slow-flow anomalies can be subcategorized as capillary, lymphatic, venous or combined forms. The most difficult lesions to distinguish with MRI are lymphatic, venous, lymphatovenous malformations. These, however, can usually be discriminated by administration of intravenous gadolinium and repetition of the T-weighted sequence. CT with contrast enhancement may not distinguish slow flow from fast flow unless dynamic scanning is done. There may still be a place for CT evaluation of intraosseous vascular lesions. Angiography still has a well-deserved place in the diagnosis of vascular anomalies. Today, it is usually a part of the management of an AVM, via superselective embolization, or performed before surgical extirpation and reconstruction. Venous angiography, on the other hand, is needed for sclerotherapy of venous malformations.

Having delineated the extent of the lesion, the more important work of the day is determining the goals of management for this patient and alleviating her from discomfort brought about by the lesion. The crucial questions are: when should we intervene? What kind of intervention is warranted in this case? What will be the consequences of these interventions?

In summary, she presently complains of an antero-lateral neck mass (which may be cosmetically displeasing for her) and devoid of any upper airway complaint, whether discomfort, or obstruction. Other than that, there are no life-threatening symptoms at the moment that warrant aggressive intervention. But would it be prudent to intervene now, as others may argue, when the lesion might even progress to critical proportions? In the instance that an intervention will be pursued, what would it be then and what instance are these justified? There are several aspects in the nature of the patient's case that needs attention in deciding the interventions for this patient, namely: (1) whether it is a hemangioma or a vascular malformation, there is a great possibility of bleeding in the future as it grows and spreads, and considering the enormous extent of the lesion, massive bleeding leading to exsanguination, upper airway obstruction, aspiration and death may happen, (2) the possibility of upper airway obstruction due to the mass effect of the lesion as it grows is also a threat, (3) the patient is presently asymptomatic except for the antero-lateral neck mass, and currently has a satisfactory quality of life, and (4) control of such massive lesions of hemangioma have variable outcomes, and may even produce unwanted consequences (such as death) for the patient. especially for invasive procedures.

In the event of the first two issues, namely massive bleeding and upper airway obstruction, it will be difficult to secure an airway either through a naso-/oral endotracheal intubation or tracheotomy, considering the lesion will be traversed and violated in both instances (upper aerodigestive tract and soft tissues of the neck), and may cause more bleeding that may not be controlled.

The patient is presently comfortable with her life, although the anterior neck mass worries her. Considering that the lesion has a benign process as opposed to a malignant neoplasm, a mediocre intervention that would produce more consequences affecting her quality of life would not be justified.

Conservative management of hemangioma among pediatric patients includes corticosteroid and interferon-a-2a therapies, and the effectiveness of such use in adults remains unknown. If the patient will be given such, is purely an experimental decision. And considering the prohibitive cost, the uncertainty in the outcome cannot be justified.

Since first reported in 1967, high-dose corticosteroid therapy remains to be the primary pharmacologic agent for control of life-threatening hemangiomas. Early and prompt decision to proceed with drug therapy should be made. There is empiric evidence that the young proliferating hemangioma is far more responsive to corticosteroid therapy than is a lesion in an older infant. Corticosteroids (prednisone) 2-3 mg/kg per day for 2-3 weeks will elicit a response in sensitive lesions within 7-10 days. A 30-60% response is typical, but is variable to excellent in 30%, doubtful in about 40%, and absent in about 30% of cases. Intravenous corticosteroids maybe used in infants with respiratory complications. There is no evidence, however, that the response is more likely or more profound with intravenous than with oral administration. In one series (4), nine out of their ten subglottic hemangioma patients responded clinically to systemic steroids.

The antiangiogenic properties of interferon (IFN)-g-2a were discovered fortuitously when the

recombinant drug was used to manage patients with AIDS. It is observed to inhibit endothelial proliferation and angiogenesis, and is now used in recombinant form in complicated lesions of hemangioma refractory to steroid treatment, as such lesions are often fatal prior to involution. A dose of 1-3 million U/ml per body surface area is administered as a single daily subcutaneous injection. Local and systemic complications are decreased and length of time to involution is shortened in about 90% of patients. Therapy is sustained for about 9-14 months to avoid re-growth (reversible by re-introduction of treatment). White and others observed remarkable regression of pulmonary angiomatosis in a 7-year old boy after IFN-g-2a therapy. However, much is still to be learned of this kind of therapy. In one study (5), interferon a-2a was administered in 15 patients with life-threatening airway hemangiomas, who failed to respond to systemic steroids and/or laser therapy. Eleven (11) out of their 15 patients have completed therapy and are doing well. Another prospective study on the use of interferon a-2a (6), showed 6 out of their 10 patients who had marked (>50% reduction in hemangioma size) after ~ 20 months of treatment. However, a rebound effect was observed in one case (7) after treatment was abruptly interrupted. A conclusion from these studies states that life-threatening airway lesions unresponsive to conventional treatment should be considered for a trial of interferon-a-2a. However, no follow-up studies on these patients to assess long term regression or possible recurrence have been reported. Dosage and administration parameters are still to be established.

Cryotherapy of subglottic hemangiomas has also been tried by Adzick et.al (8) in two (2) infants with complete upper airway obstruction, showing that cryotherapy promoted rapid hemostasis, controlled local surgery injury, with subsequent rapid healing of tissues with minimal fibrosis and preservation of lumen without stricture. However, they concluded that this specific modality be reserved for selected smaller hemangiomatous lesions of the subglottic area.

Other management techniques reportedly tried were the application of potassium-titanyl-phosphate (KTP) laser in the management of subglottic hemangioma (9). In Madgy's study, all of their six patients had significant clinical relief after laser treatment.

These treatment trials are mostly based on experience with infants. There are no proven management protocols for adults, as hemangiomas are usually seen in the first year of life.

Steroid administration was tried on this patient by virtue of its accessibility and availability, and proven efficacy in infants. The patient was started on steroids 2mg/kg/day for one week but no observable regression in the size of the mass was noted. The steroids had to be stopped as the patient started gaining weight and had beginning edema and joint pains.

Interferon is available in one tertiary hospital. However, it must be considered that the interferon dosage increases with increasing body surface area (1-3 million U/ ml per body surface area). The trial of interferon a-2a was deferred because of its unproven efficacy and prohibitive cost which was beyond the patient's means.

Another option for the patient, though invasive, was identification of the feeding vessels through angiography, and subsequent embolization of the mass. However, it is foreseen that if the lesion would slough off due to the arrest of its blood supply, it can obstruct the airway of the patient, and might cause severe respiratory embarrassment. Another caveat is that once embolization has been performed, it is inevitable that medical therapy that is suppose to shrink the mass would be useless, due to the arrested blood supply. Insertion of a prophylactic tracheotomy was also considered as bleeding might be a problem later on and respiratory obstruction might result. Since the hemangioma also involves the larynx, further bleeding might ensue from endotracheal intubation. In addition, a tracheotomy or cricothyroidotomy cannot be done because of the obstructing anterior neck mass that appears to be contiguous with the upper airway hemangioma.

Outright excision of the mass is another option for this patient as proposed by some experts. Establishing the airway of whatever type, for administration of general anesthetics, will be the initial problem as this may induce rupture of the lesion and trigger profuse bleeding at the start. Continuous sedation is not advised considering the planned massive surgery on the patient. Assuming that the patient was provided an airway for the operative procedure, the mass is so extensive and dangerously located that adequate excision with appropriate margins would be difficult, and might compromise other vital structures such as the major arteries, veins and nerves around the pharyngeal and neck areas. These options were deferred as their complications may again, not justify the uncertainty of the final outcome that the patient may incur.

Hence, we are faced with the dilemma of doing and not doing anything for the patient. In whatever perspective we may look, there is really a 'Sword of Damocles' hanging above the patient's head, whether or not we intervene in the case.

CONCLUSION

A 20-year old female complaining of an antero-lateral neck mass is presented, with massive upper airway lesions in the nasopharynx, oropharynx, and hypo-laryngopharynx characteristic of a mucosal hemangioma.

Variably different from the usual presentation of hemangiomas (cutaneous and singular focus), the enormous extent of the multifocal lesions to include even the soft tissues of the neck would signify the possibility of its aggressiveness, producing life-threatening conditions later on. On the other hand, the appearance of the antero-lateral neck mass as the main and only chief complaint remains to be considered. Thus, considering the gamut of treatment options available for the patient, the pros and cons of intervening are presented. The trial of steroid therapy was unsuccessful, and the use of interferon remains experimental and the cost formidable. More invasive interventions are difficult and pose risks of life-threatening complications that may far outweigh their probable benefit. In this case, the dictum of *primum non nocere* might be more prudent.

The nature and extent of the mass as well as its prognosis were disclosed to the patient and her family. No other interventions were tried at the moment, although efforts to present the case to the local and international scientific community are underway. The case remains to be unresolved up to this day.

BIBLIOGRAPHY

1. Cummings, C.W. Otolaryngology Head and Neck Surgery 3rd ed. Mosby-Year Book, Inc. 1998.
2. Lee, K. J. Essential Otolaryngology 7th ed. Appleton and Lange. 1999 .
3. Zamarro, Lopez, Ruiz, Ruiz, Jimenez, Urbiola. Cavernous hemangioma of the larynx in the adult. Apropos of a case.[abstract] (Article in Spanish)
4. Thawley, Panje, and Batsaki's. Comprehensive Management of Head and Neck Tumors 2nd ed. W. B. Saunders Co. 1999.
5. Al-Sebeih and Manoukian J., 2000. Systemic Steroids for the Management of Obstructive Subglottic Hemangioma. [abstract] J Otol 29 (6);361-6.
6. Anger J, Carneiro RG, Pinus J, Ernesto JM, Faiwichow G. 1998. The Rebound Effect in the Treatment of Complex hemangioma with Interferon a-2a. [abstract] Rev Paul Med 116(5):1826-8.
7. Bauman NM, Burke DK, Smith RJ. 1997. Treatment of Massive or Life threatening hemangiomas with recombinant a-2a interferon. [abstract] Otolaryngology Head Neck Surgery 117(1):99-110.
8. Ohlms LA, Jones DT, 1994. Interferon a-2a therapy for airway hemangiomas [abstract]. Ann Otol Rhinol Laryngol 103(1); 1-8.
9. Adzick NS, Strome M, Gang D. 1984. Cryotherapy of Subglottic Hemangioma [abstract] J Pediatric Surg 19(4);353-7.
10. Madgy D, Ashan SF, Kest D. Stein I. 2001. The application of KTP- laser in the management of subglottic hemangioma [abstract] Arch Otolaryngology Head Neck Surgery 127(1):47-50.