The Philippine Journal of

OTOLARYNGOLOGY HEAD & NECK SURGERY

Vol. 20 Nos. 1-2 2005

OFFICIAL PUBLICATION OF THE PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD & NECK SURGERY, INC.

TABLE OF CONTENTS

CASE REPORTS

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY

Founded in 1981

Guidelines for Authors
THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

Unit 2512, 25th Floor, Medical Plaza Ortigas Condo
San Miguel Avenue, Ortigas Center
Ortigas, Pasig City
Telefax: 633-2783, Telephone: 633-8344

Authors:

Title page, Subtitle (if any).
First name, middle initial, last name of each author (with highest academic degrees).
Name of Department and Institutions to which work shouldbe attributed.
Disclaimers (if any); and Acknowledgement of Financial Support.

Manuscript:

Submit original copy and two duplicates (with diskette of manuscripts and figures using Microsoft Word 2000-Windows 98, Windows ME or Windows XP)
Type, double spaced (including references, legends, footnotes), unspecified length
Include date of presentation at scientific meeting
Author's telephone number and FAX number
References in the text should be superscripts in order of appearance
References with more than three authors should be presented as the first three authors followed by et al.

Abstract:

A 5-10 sentences abstract to precede article in case reports or a structured abstract that states the objectives, study design, setting, results and conclusions.

All manuscripts and other editorial matter should be addressed to Charlotte M. Chiong, MD, Editor-in-chief. The Philippine Journal of Otolaryngology-Head and Neck Surgery, PSO-HNS, Unit 2512, 25th Floor, Medical Plaza Ortigas Condo, Ortigas, Pasig City

Philippine Journal of Otolaryngology-Head and Neck Surgery
Volume 20 Nos. 1-2, 2005

EDITORIAL

This will be my last year as editor-in-chief of the Philippine Journal of Otolaryngology-Head and Neck Surgery. Even as chief resident at the University of the Philippine-Philippine General Hospital in 1990 I had nurtured dreams of being able to one day work for the PJO-HNS and I have to thank Dr. Joselito C. Jamir for all the encouragement and mentorship in research as well as then president of PSO-HNS Dr. Generoso T. Abes who initially appointed me to this honored position as well as successive presidents Dr. Edgardo C. Rodriguez Jr., Dr. Cesar V. Villafuerte Jr. and Dr. Felix P. Nolasco, all provided able leadership in the Philippine Society of Otolaryngology-Head and Neck Surgery for a much stronger organization and ever improving quality of ENT care afforded to the Filipino populace. As we approach our 50th year, I am hopeful that the PJO-HNS would be given more support by the PSO-HNS and I would like to propose a new electronic era for the PJO-HNS within the PSO-HNS website for better access by all interested readers, perhaps downloadable as PDF with the prospect in the future as a source of revenues for the PSO-HNS. My profound gratitude of course goes to Solvay Pharma Philippines Inc. headed by Marcus P.M. Wondergem, and successive product managers Arlene Sayson, Indy Palaganas, Marco Bautista, Lruzel Carillo and Nenong Paguirigan who supported this journal during the past years. My thanks also to the editors who contributed time and effort in reviewing the papers and to the secretariat of the PSO-HNS Sharon Baraquiel, Melissa Baniqued and most especially to Ms. Melody T. Francisco who helped format all the materials these past years.

I vow to continue to support this journal even as I pass on the torch to a new group of editors. I am confident the journal will continue to survive despite fund limitations and it is my hope we can see the day that it becomes indexed by Medline as other reputable journals.

Mabuhay tayong lahat!

Charlotte M. Chiong, MD
Editor-in-Chief

ACKNOWLEDGEMENT

The editorial staff of the Philippine Journal of Otolaryngology-Head and Neck Surgery appreciates the full and unconditional support and assistance given by Mr. Marcus P.M. Wondergem and Solvay Pharma Philippines, Inc. without which this could not have been possible and Ms. Marnelli S. Paguirigan for facilitating everything.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 1-7 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

A COMPARATIVE STUDY ON THE EFFICACY OF CHITOSAN IMPREGNATED NASAL PACKING AND NORMAL SALINE SOLUTION IMPREGNATED PACKING ON WOUND HEALING OF THE NASAL MUCOSA IN RABBITS (ORYCTOLAGUS CUNICULUS)*

ALFRED B. BALAGTAS III, MD**
BENJAMIN S.A. CAMPOMANES JR., MD, FPSO-HNS***

ABSTRACT

OBJECTIVE:
General objective: To compare the efficacy of chitosan solution impregnated nasal packing with normal saline solution impregnated nasal packing on wound healing of the nasal mucosa in rabbits (*Oryctolagus cuniculus)*
Specific objective: To determine the difference between the effects of chitosan solution impregnated nasal packing compared with normal saline solution impregnated nasal packing on wound healing of the nasal mucosa in rabbits particularly on various aspects of wound healing as to epithelialization, vascularization, inflammation and fibrosis.
DESIGN: Experimental design
SETTING: Santo Tomas University Hospital
MATERIALS AND METHODOLOGY: This study is a randomized double blind clinical study. After giving the rabbits Ketamine HCl about 0.3-0.5 mm square area of the floor of the nasal mucosa was excised and sent for histopathology for baseline studies. Impregnated nasal packings where placed on the wounds and removed after forty eight hours. After two weeks about 0.3-0.5 mm of nasal mucosa was harvested on both nostrils and sent to the pathologist for review.
RESULTS: There were four parameters of wound healing that were evaluated in this study, namely epithelialization, vascularization, inflammation and fibrosis. A comparison of the effect of chitosan and NSS on wound healing were compared in each of these 4 parameters. Statistical tests showed that on the basis of epithelialization, chitosan was significantly better than that of NSS ($p<0.05$). Chitosan was also found to be significantly better than that of NSS in terms of inflammation ($p<0.05$) and fibrosis ($p<0.05$). There was no difference noted however in the aspect of vascularization between chitosan and NSS ($p>0.05$).
CONCLUSION: The chitosan solution impregnated nasal packing was found to be significantly better than the NSS solution impregnated nasal packing on three of the four parameters of wound healing that were evaluated in this study in terms of epithelialization, inflammation and fibrosis but there was no difference noted in the aspect of vascularization between chitosan and NSS solutions.

INTRODUCTION

Crab, lobster and prawn shells usually end up in the dustbin. Now scientists have converted this waste into a useful, biodegradable industrial product. Enzymes can convert a substance derived from crustacean shells, called chitosan, into a thickening agent, say Gregory Payne and his colleagues at the University of Maryland in Baltimore. This substance could find uses in paint manufacture, food, cosmetics and wound healing. The chitosan-based material comes from renewable sources, should be non-toxic, and could be made using benign industrial processes. It should also be biodegradable.

Chitin is a natural polysaccharide found particularly in the shell of crustacean, the cuticles of insects, and the cell walls of fungi. It has (1-4)-linked *N*-acetyl--glucosamine repeat units and is the second most abundant of polymerized carbon found in nature. Chitosan, the fully or partially

*1st Place, PSO-HNS Analytical Research Contest, December 2, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Sto. Tomas University Hospital
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, Sto. Tomas University Hospital

deacetylated form of chitin, is the most extensively used material. This natural material, chitosan has been proved to be invaluable materials in the field of biomedical engineering and biotechnology, with a wide variety of applications ranging from skin and vascular grafts to substrates for mammalian cell culture.

Chitosan is made from chitin, the main component of crustacean shells, Because so much chitin-rich food waste is discarded especially in Asian countries where people have seafood-rich diets - researchers have long sought to put it to good use. Thus, the need to know if chitosan is really effective when used in the healing process of the nasal mucosa must be sought.

OBEJECTIVE OF THE STUDY

General objective

To compare the efficacy of chitosan solution impregnated nasal packing compared with normal saline solution (placebo) impregnated nasal packing on wound healing of the nasal mucosa of rabbits (*Oryctolagus cuniculus)*

Specific objective

To determine the difference between the effects of chitosan solution impregnated nasal packing compared with normal saline solution (placebo) impregnated nasal packing on wound healing of the nasal mucosa of rabbits (*Oryctolagus cuniculus)* within the various aspects of wound healing such as epithelialization, vascularization, inflammation, and fibrosis.

METHODOLOGY

Design

The study is a double blind clinical trial-experimental design using repeated measures: Factor A will be treatment of chitosan solution and placebo on rabbits after making a nasal mucosal incision. Factor B will be the time- 0 day, 14 days. An incision on the floor of the nasal mucosa about 0.3-0.5 mm in area on both nostrils and were labeled as A1 and A2 respectively by a different person blinding the surgeon to where will be the chitosan solution and normal saline solution impregnated nasal packings be placed, afterwards chitosan solution and normal saline solution impregnated nasal packings were placed on both nostrils on all the rabbits and eventually the nasal packing was removed after two days. In two weeks, the rabbits were then subjected to have another incision exactly on the same incision site for histopathologic studies to compare the two sets of samples and again blinding the pathologist to what specimen was placed with normal saline and chitosan solution impregnated nasal packings respectively.

The outcome of this study was on the histopathologic method by a single Pathologist, investigator, and another person to label both impregnated packings and incision sites to eliminate observer bias. The design was made to be double-blind. Both solutions will be placed on identical containers and rabbits will be numbered and placed on separate cages after their nasal mucosa are injured and placed in a cage marked as cage A and cage B respectively.

Histopathologic data was determined on four aspects namely epithelialization, vascularization, inflammation and fibrosis wherein subjective data will be represented in terms of + or – depending on the degree. Data modification will follow. Statistical analysis to determine the differences between the treatments will be done using the Wilcoxon sign rank test. Statistical software to be used is SPSS version 10.

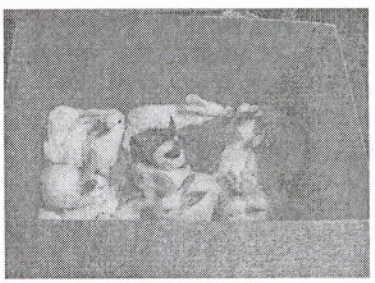


FIGURE 1
Picture of the twenty rabbits for the study

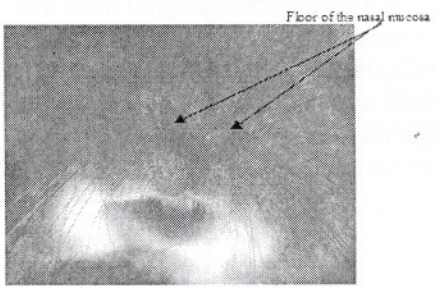


FIGURE 2
Close up view of the floor of the nasal mucosa after harvesting the specimen on the 1st day

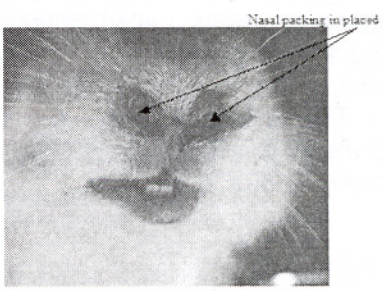


FIGURE 3
Nasal packing in placed after harvesting the specimen

RESULTS

A total of 21 rabbits were used in the study. One was used as a control and 20 were used as subjects, however 7 died before the end of the study period. Data layout is as follows:

	Epithelialization	Vascularization	Inflammation	Fibrosis
Control	-	-	+	±
Control	+	-	+	+
A1	+	±	+	+
A2	++	+	++	+
A3*	+++	++	+	+++
A4*	++	+	++	+++
B1	±	+	+	++
B2	±	+	+	++
B3*	+++	+	++	++++
B4*	++	++	+	++
C1	±	+	+	++
C2	±	+	+	++
C3*	+++	+	++	++++
C4*	++	+	+	+++
D1	+	+	++	++
D2	±	+	++	++
D3*	++	++	++	+++
D4*	+	+	++	++
E1	+	+	+	++
E2	±	+	+	++
E3*	+	+++	++	+++
E4*	+	+	++	++
F1	+	+	+	++
F2	+	+	+	++
F3*	+++	+	+++	+++
F4*	+	+	+	+++
G1	++	+	+	+
G2	+	+	+	++
G3*	+++	+	++	+++
G4*	+	+	++	++
H1	+	+	+	+
H2	+	+	+	+
H3*	+++	+	+	+++
H4*	++	+	+	++
I1	+	+	+	++
I2	++	+	++	++
I3*	+++	++	+	++++
I4*	+	++	+	++
J1	+	++	+	++
J2	+	++	+	++
J3*	+++	++	+	+++
J4*	+	++	+	++
K1	+	++	+	+++
K2	+	++	+	++
K3*	+++	++	++	++++
K4*	++	++	++	+++
L1	±	+	+	++
L2	+	+	+	++
M1	±	+	+	++
M2	±	+	+	++
N1	±	+	+	++
N2	++	+	+	++
O1	+	+	+	++
O2	+	+	+	++
O3*	+++	++	++	+++
O4*	+	+	+	++
P1	±	+	+	++
P2	±	+	+	++
P3*	+++	+	++	+++
P4*	++	+	+	++
Q1	±	+	+	++
Q2	±	+	+	++
R1	+	+	+	++
R2	+	+	+	++
S1	±	+	+	++
S2	+	+	+	++
T1	+	+	++	++
T2	+	+	+	++

Legend:
A1- R nasal mucosa taken on day 1
A2- L nasal mucosa taken on day 1
A3*- nasal mucosa taken on day 14 after placing a nasal packing impregnated w chitosan solution
A4*- nasal mucosa taken on day 14 after placing a nasal packing impregnated w/ normal saline solution

A total of 13 rabbits were subjected to statistical testing. The difference between the histopathologic grades between the initial and after 14 days were obtained to represent the degree of difference after the 14 day period.

Data was modified as follows:

Subjects	Epithelialization		Vascularization		Inflammation		Fibrosis	
	Chitosan	NSS	Chitosan	NSS	Chitosan	NSS	Chitosan	NSS
A	2	0	2	0	0	0	2	2
B	3	2	0	1	1	0	2	0
C	3	2	0	0	1	0	2	1
D	1	1	1	0	0	0	1	0
E	0	1	2	0	1	1	1	0
F	2	0	0	0	2	0	1	1
G	1	0	0	0	1	1	2	0
H	2	1	0	0	0	0	2	1
I	2	-1	1	1	0	-1	2	0
J	2	0	0	0	0	0	1	0
K	2	1	0	0	1	1	1	1
O	2	0	1	0	1	0	1	0
P	3	2	0	0	1	0	1	0

Results of the modified data were subjected to Wilcoxon sign rank test using SPSS ver 10 (see appendix).

There were four parameters of wound healing that were evaluated in this study, namely epithelialization, vascularization, inflammation and fibrosis. A comparison of the effect of chitosan and NSS on wound healing were compared in each of these 4 parameters. Statistical tests showed that on the basis of epithelialization, chitosan was significantly better than that of NSS ($p<0.05$). Chitosan was also found to be significantly better than that of NSS in terms of inflammation ($p<0.05$) and fibrosis ($p<0.05$). There was no difference noted however in the aspect of vascularization between chitosan and NSS ($p>0.05$).

DISCUSSION

Wound dressings before the 1960s were considered to be only the so-called passive products having a minimal role in the healing process. The pioneering research of Winter initiated the concept of an active involvement of a wound dressing in establishing and maintaining an optimal environment for wound repair. This awareness resulted in the development of wound dressings from traditional passive materials to functional active dressings, which, through the interaction with the wounds they cover, create and maintain a moist and healing environment. An ideal wound dressing should protect the wound from bacterial infection, provide a moist and healing environment and be biocompatible.

Polysaccharides, e.g. chitosan, have been considered to be advantageous in their application as a wound dressing material. Advantageous biological properties in the application as a wound dressing, namely biocompatibility, biodegradability, hemostatic activity, anti-infectional activity and the property to accelerate wound-healing. On the other hand, the application of chitosan hydrogels may effectively interact with and protect the wound, ensuring a good moist healing environment. Almost all of these studies were done on skin, artery, veins and lungs of animals and there were few studies done with the use of chitosan on the nasal mucosa.

There are many studies showing that chitin and chitosan accelerates wound healing in many clinical cases and some types of chitin remedies have already been marketed in Japan. In particular, Okamoto et al. reported that chitin and chitosan granules enhanced reepithalization and regenerated normal skins in open wounds[7]. But, chitin and chitosan were used in the forms of filament, powder, granule, sponge, and composite with cotton or polyester in most studies. Therefore, the accelerating effect of chitin or chitosan on wound healing could not be achieved completely due to relative low interaction between wound site and healing agents. Accordingly, to enhance wound healing ability, chitosan soluble in blood, body fluid, and saline solution, would be a prerequisite.

When the body is injured by accidental trauma, burn or cold exposure, or contact with chemical agents or foreign bodies, various growth factors with polypeptide type play a prominent role in the regulation of wound healing. These polypeptides are released by a variety of activated cells at the wound site, and they can stimulate cell proliferation, movement, and biosynthetic activity. Growth factors also chemo-attract new cells to the wound. Many growth factors have overlapping function and their various biologic effects are only beginning to be understood. For example, of the many cytokines that have been implicated in wound healing, TGF affects all phase of healing, including the inflammatory response and matrix accumulation. The topical application of TGF accelerates normal healing process. Epithelialization is directly stimulated by at least two growth factors: epidermal growth factor (EGF) and keratinocyte growth factor (KGF).

EGF is released by keratinocytes to act in an autocrine manner, whereas KGF is released by fibroblasts as a paracrine manner to stimulate keratinocyte division and differentiation. The major effect of EGF is to encourage cells to continue through the cell cycle. In wounds, EGF has also effect on epithelial cell, fibroblast, and endothelial cells. EGF is also chemotactic for epithelial cells and increases the secretion of collagens by fibroblast, which is an important step in tissue remodeling. Investigators have accelerated healing rates in wounds by adding exogenous EGF and TGF. In general, there are two methods applicable in remedying damaged skin. One is growth factor involved in wound healing, which be extracted from organism or biosynthesized, and then supplied to wound area. This method is used when the wound area is large and deep. The other is growth factor spontaneously induced from an adjacent wound area. This method is used when the wound area is small and superficial.

In the case of wound with large and deep wound, perfect remedy could be accomplished by additionally supplying growth factor. However, the process to extract or synthesize growth factor is not only difficult but the growth factor is easily susceptible to loss in activity, and its cost is very expensive. Furthermore, in the case of abnormal action, it has a possibility to cause transformation of normal cell. The effects of chitin [(14)-2-acetamido-2-deoxy-glucan] and its partially deacetylated derivatives, chitosan on the proliferation of human dermal fibroblasts and keratinocytes were examined in vitro.

Chitosan with relatively high degrees of deacetylation strongly stimulated fibroblast proliferation while samples with lower levels of deacetylation showed less activity. The stimulatory effect on fibroblast proliferation required the presence of serum in the culture medium suggesting that the chitosan may be interacting with growth factors present in the serum and potentiating their effect. Analysis of their effects on cells in culture may be useful as a screen for their potential activity in vivo as wound healing agents.

Another study was done by Hiroshi Ueno et al.[8] of Laboratory of Veterinary Surgery, Department of Veterinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Sapporo, Japan wherein they used the application of ultraviolet light (UV-) irradiation to a photocrosslinkable chitosan (Az-CH-LA) aqueous solution resulted in an insoluble, flexible hydrogel like soft rubber within 60 seconds. The chitosan hydrogel could completely stop bleeding from a cut mouse tail within 30 seconds of UV-irradiation and could firmly adhere two pieces of sliced skins of mouse to each other. In order to evaluate its accelerating effect on wound healing, full thickness-skin incisions were made on the back of mice and subsequently an Az-CH-LA aqueous solution was added into the wound and irradiated with UV light for 90 seconds. Application of the chitosan hydrogel significantly induced wound contraction and accelerated wound closure and healing. Histological examinations also have demonstrated an advanced granulation tissue formation and epithelialization in

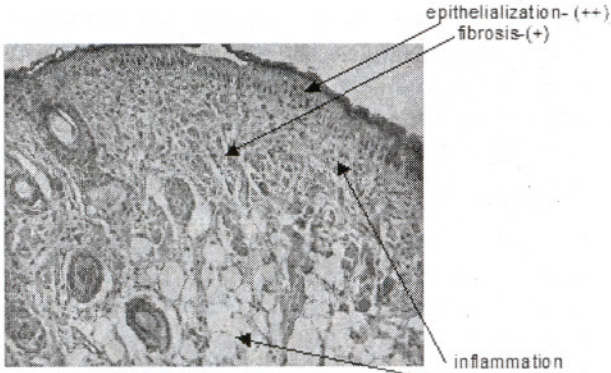


FIGURE 1: Low power view

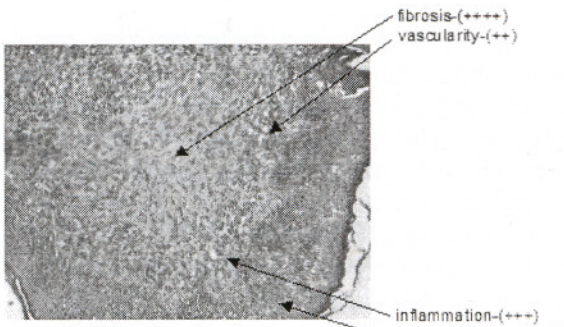


FIGURE 2: Scanning view

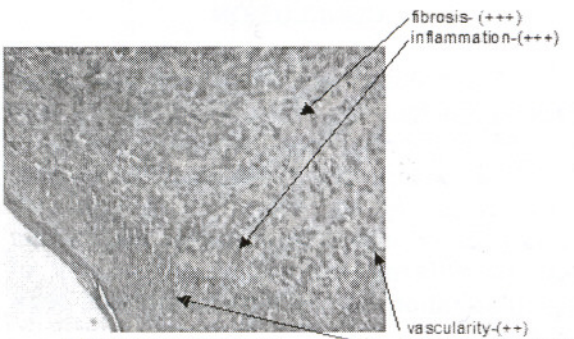


FIGURE 3: Low power view

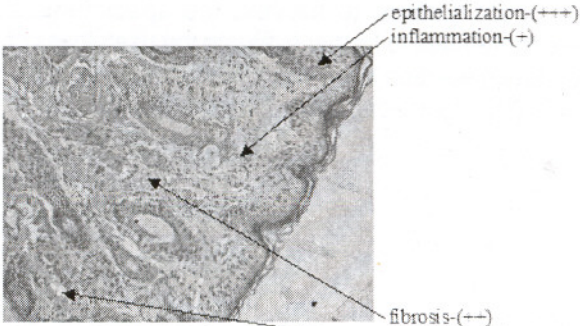


FIGURE 7: Low power view

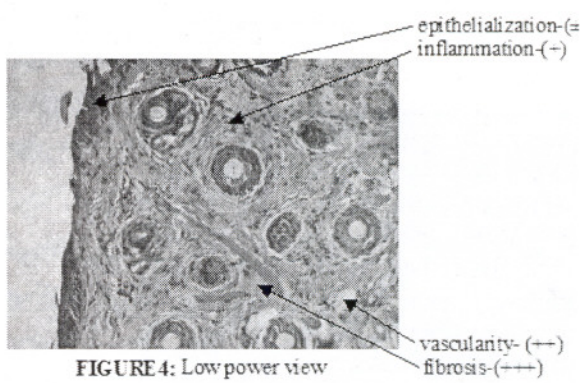


FIGURE 4: Low power view

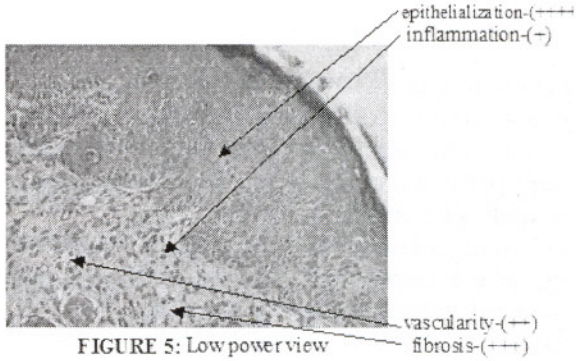


FIGURE 5: Low power view

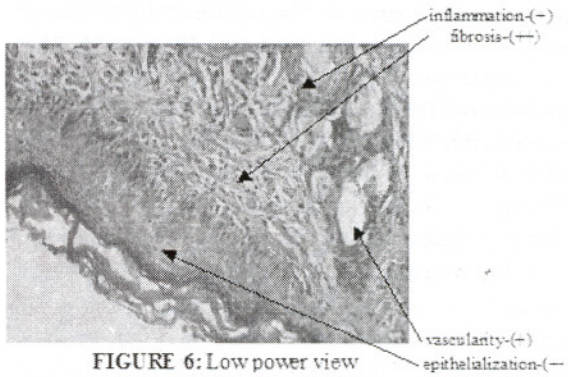


FIGURE 6: Low power view

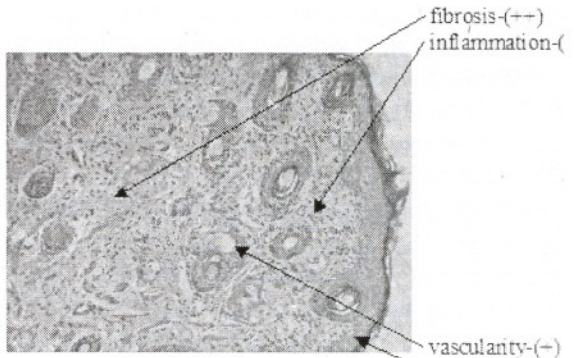


FIGURE 8: Low power view

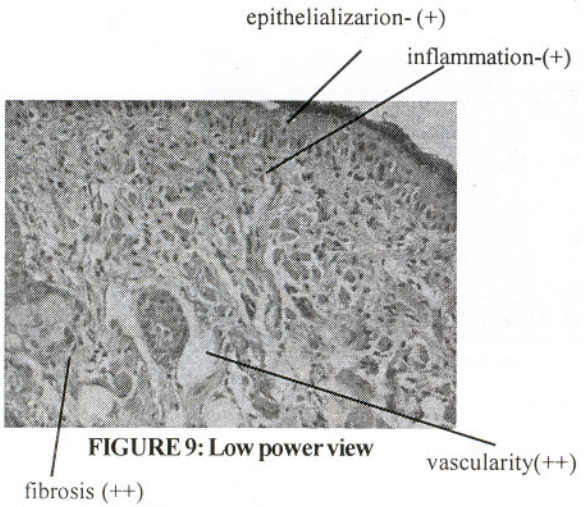


FIGURE 9: Low power view

the chitosan hydrogel treated wounds. The chitosan hydrogel due to its accelerating healing ability is considered to become an excellent dressing for wound occlusion and tissue adhesive in urgent hemostasis situations.

Another study was done by Kiyohaya Obara et al. of the Department of Surgery II, and the Research Institute, and the Department of Medical Engineering, National Defense Medical College, Namiki, Tokorozawa, Saitama, Japan entitled "photocrosslinkable chitosan hydrogel containing fibroblast growth factor-2 stimulates wound healing in healing-impaired *db/db* mice." wherein they also used the application of the chitosan hydrogel on both the mouse's tail and full thickness skin incisions which significantly induced wound contraction and accelerated wound closure and healing. Histological examinations also have demonstrated an advanced granulation tissue formation and epithelialization in the chitosan hydrogel treated wounds.

Another study was also done by Dong-Keon Kweon et al. of the Daeduk Research Institute, Hansbiomed. Co., Jeonmin-dong, Yuseong-ku, Daejeon , South Korea and the Department of Pathology, College of Medicine, Hanyang University, Gyomun-dong, Guri-si, Kyungi-do, South Korea and was entitled "Preparation of water-soluble chitosan/ heparin complex and its application as wound healing accelerator" wherein to make effective a wound healing accelerator, water-soluble chitosan (WSC)/heparin (CH) complex was prepared using WSC with wound healing ability and heparin with ability to attract or bind growth factor related to wound healing process. Water-soluble CH complex was prepared by the reaction between WSC and heparin, and then, by adding distilled water to it, ointment type with high viscosity was made. To evaluate the wound healing effect, full thickness skin excision was performed on the backs of the rat and then WSC and water-soluble CH complex ointments were applied in the wounds, respectively. After 15 days, gross and histologic examination was performed. Grossly, untreated control group revealed that the wound had well defined margin and was covered by crust. The second group treated with WSC ointment revealed small wound size with less amount of covering crust and ill-defined margin, which appeared to regenerate from margin. The third group treated with water-soluble CH complex ointment appeared to be nearly completely healed. Histology of each group was well correlated to gross findings. The third group shows nearly complete regeneration of appendage structure similar to normal in the dermis in contrast to control and second group with absence and less number of skin appendages, respectively.

In the field of Otorhinolaryngology, nasal packing has been used so often especially after nasal surgery (functional endoscopic sinus surgery, septoplasty, rhinoplasty). It is also being used to control profuse nasal bleeding secondary to trauma. The development of chitosan solution combined with the nasal packing as an alternative for hemostasis and to accelerate wound healing postoperatively would give the surgeon an edge in managing their patients and shorten the patient's hospital stay if proven effective.

CONCLUSION

The chitosan solution impregnated nasal packing was found to be significantly better than the NSS solution impregnated nasal packing on three of the four parameters of wound healing that were evaluated in this study in terms of epithelialization, inflammation and fibrosis but there was no difference noted in the aspect of vascularization between chitosan and NSS solutions.

RECOMMENDATION

A larger sample size and a bigger nasal mucosal surface to harvest the specimens is recommended to further evaluate the usefulness of chitosan solution in wound healing because of the difficulty of surgically acquiring this specimens.

BIBLIOGRAPHY

1. Mattioli-Belmonte M, MuzzarelliB, Muzzarelli RAA. "Chitin and chitosan in wound healing and other biomedical applications". Carbohydr Eur 1997(19Dec): 30-36
2. Shigemasa Y, Minami S. "Applications of chitin and chitosan for biomaterials". Biotechnol Gen Eng Rev 1995; 13:383-420
3. Muzzareli RAA, Biagini G. "Role and fate of exogenous chitosans in human wound tissues". Ed Chitin Enzymology, Eur Chitin Soc 1993, Ancona
4. Ishihara, Masayuki. "Photocrosslinkable chitosan hydrogel as a wound dressing and a biological adhesive". Trends in glycoscience and glycotechnology vol. 14 no. 80 (November 2002) pp. 331-341
5. Yong-Woo Cho, Yong-Nam Cho, Sang-Hun Chung, Gyeol Yoo, "Water-soluble chitin as a wound accelerator". Biomaterials, Vol. 20 (22) (1999) pp. 2139-2145
6. Ishihara M, Ono K, Sato M, Nakanishi K, Saito Y, Yura H, Matsui T, Hattori H, Fujita M, Kikuchi M, Kurita A. "Acceleration of wound contraction and healing with a photocrosslinkable chitosan hydrogel". Wound Repair Regen. 2001 Nov-Dec; 9 (6): 513-21
7. Okamoto Y, Shibazaki K, Minami S, Masuhashi A, Tanioka S, Shigemasa Y., "Evaluation of chitin and chitosan on open wound healing in dogs". J Vet Med Sci. 1995 Oct; 57(5): 851-4
8. Ueno H, Mori T, Fujinaga T., "Topical formulations and wound healing applications of chitosan"., Adv Drug Deliv rev. 2001 Nov 5; 52(2): 105-15

APPENDIX

NPar Tests

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
EPITHNSS - EPITH	Negative Ran	11[a]	6.73	74.00
	Positive Rank	1[b]	4.00	4.00
	Ties	1[c]		
	Total	13		
VASCNSS - VASCI	Negative Ran	4[d]	3.25	13.00
	Positive Rank	1[e]	2.00	2.00
	Ties	8[f]		
	Total	13		
INFNSS - INFCHI	Negative Ran	6[g]	3.50	21.00
	Positive Rank	0[h]	.00	.00
	Ties	7[i]		
	Total	13		
FIBNSS - FIBCHI	Negative Ran	10[j]	5.50	55.00
	Positive Rank	0[k]	.00	.00
	Ties	3[l]		
	Total	13		

a. EPITHNSS < EPITHCHI
b. EPITHNSS > EPITHCHI
c. EPITHCHI = EPITHNSS
d. VASCNSS < VASCCHI
e. VASCNSS > VASCCHI
f. VASCCHI = VASCNSS
g. INFNSS < INFCHI
h. INFNSS > INFCHI
i. INFCHI = INFNSS
j. FIBNSS < FIBCHI
k. FIBNSS > FIBCHI
l. FIBCHI = FIBNSS

Test Statistics[b]

	EPITHNSS - EPITHCHI	VASCNSS - VASCCHI	INFNSS - INFCHI	FIBNSS - FIBCHI
Z	-2.818[a]	-1.518[a]	-2.333[a]	-2.919[a]
Asymp. Sig. (2-tai	.005	.129	.020	.004

a. Based on positive ranks.
b. Wilcoxon Signed Ranks Test

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol 20 Nos.1-2 14-24 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

HEAD AND NECK RECONSTRUCTION USING FREE FLAPS*

ELIAS T. REALA, MD**
SAMANTHA S. CASTANEDA, MD, FPSO-HNS***
JOSELITO F. DAVID, MD, FPSO-HNS***
DANIEL M. ALONZO, MD, FPSO-HNS****
JESUS RANDY O. CANAL, MD, FPSO-HNS*****

ABSTRACT

BACKGROUND: Free flap reconstruction was first introduced in 1959 and has since been used for reconstruction of various defects in the head and neck. It has been shown to be the most reliable and efficient way of restoring tissue in the head and neck region secondary to surgical or traumatic defects. It has allowed single stage reconstruction of even complex defects with high flap viability rates. Here in the Philippine setting, free flaps have not been the reconstructive option of choice. It is viewed as a special option for selective cases not amenable to pedicled reconstruction.
OBJECTIVE: To describe the experience of one microvascular team in head and neck reconstruction using free flaps from 1996 to March 2004.
DESIGN AND SETTING: Retrospective chart review of all patients who underwent free flap reconstruction of head and neck defects from 1996 to March 2004 at six tertiary hospitals in Manila.
PATIENTS AND METHODS: A total of 69 patients who underwent 71 free-flap reconstructions of the head and neck for various pathologies and with a range of bony and soft tissue defects from 1996 to March 2004 were included in the study. All free flap reconstructions were done by only one microvascular team. The success and viability of free tissue transfer, length of hospital stay, length of operation, complications and morbidities encountered and functional outcome based on length of time to removal of the nasogastric tube and decannulation were reviewed.
RESULTS: Of the 71 free flap reconstructions that were performed, 64 flaps were viable leading to an overall success rate of 90%. The first 36 cases had a success rate of 86 % while the subsequent 35 cases had a success rate of 94%. Average length of hospital stay was 24 days and the average length of operation was 13 hours 40 minutes. There were 6 mortalities secondary to medical problems and 7 patients had major surgical complications. Twenty-one patients (29 %) did not have any complication post-operation. Average time post-operation to decannulation was 14 days while return to oral diet was noted at 17 days post-operation. There were 8 patients who were discharged with either a nasogastric tube or percutaneous endoscopic gastrostomy. The results are at par with the review of literature reviewed.
CONCLUSIONS: The success of the use of free flaps in head and neck reconstruction was demonstrated in this series. There were minimal complications noted. All patients were decannulated with majority able to return to an oral diet.

INTRODUCTION

Head and neck reconstructive surgeons face many challenges left by trauma, developmental abnormalities and surgical extirpation of large tumors. The key to a successful outcome for these patients is to determine which type of reconstruction will best suit the defect by restoring the pre-morbid state to as close as possible. The use of microvascular free tissue transfer in head and neck cancer patients has been widely accepted as an important method of reconstruction in the past few decades. The ability to harvest a large amount of soft tissue and bone with a reliable blood supply allows for larger cancer resections to be repaired with good functional and cosmetic outcome. The

*1st Place, PSO-HNS Descriptive Research Contest, December 01, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Jose R. Reyes Memorial Medical Center
***Fellow, Head and Neck Microvascular Training Consortium
****Chairman, Department of Otorhinolaryngology-Head and Neck Surgery, The Medical City Hospital
*****Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, Jose R. Reyes Memorial Medical Center

success rates have been gradually improving over the years to greater than 95% today. [1,2,3,4] Studies also have shown fewer complication rates with free tissue transfer compared to pedicled reconstructions. [1,5,6,7 8]

In the Philippine setting, most reconstructive surgeons prefer pedicled flaps because of their determinate blood supply, robust size and versatility. There has been limited enthusiasm for applying free flaps for reconstruction of head and neck defects. It has been relegated to the reconstructive option of last resort because of perceived technical difficulty in anastomosis leading to flap necrosis, increased complication rates, prolonged length of operation and hospital stay. This supposedly translates to increased patient costs with minimal benefit.

The purpose of this study was to review the experience of one microvascular team in head and neck reconstruction using free flaps from 1996 to March 2004. The success of the free flap, length of operating time, length of hospital stay and complications were described. In addition to this, the functional aspect of the reconstruction was reviewed based on length of time post-operation to resumption of oral diet and length of time to decannulation.

PATIENTS AND METHODS

The medical records of 69 patients who underwent a total of 71 free flap reconstructions done by one microvascular team in a tertiary hospitals from 1996 to March 2004 were reviewed. The patients ranged in age from 7 to 76 years (mean age, 44 years). There were 34 males and 35 females most of the malignant cases were patients in their 5th and 6th decade while the benign cases were patients in their 2nd and 3rd decade. There were 67 primary reconstructions and 2 secondary reconstructions. (Table 1) Secondary reconstruction in this study was defined as reconstruction not done at the same time as the surgical excision.

TABLE 1
Profile of Patients N=69

Sex	No. of Patients
Male	34
Female	35
Age	
0-19	7
20-39	20
40-59	25
60-69	14
> 70	3
Reconstruction done	
Primary	67
Secondary	2

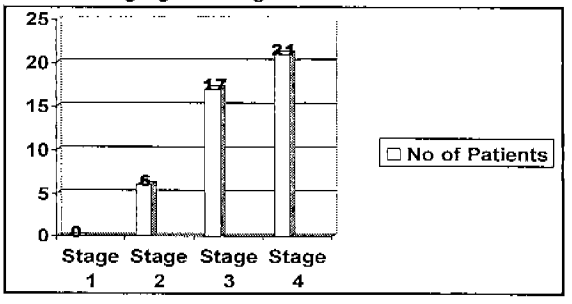
Majority of the patients underwent reconstruction for resection of squamous cell carcinoma. The most common benign pathology was ameloblastoma. (Table 2)

TABLE 2
Pathologic Diagnosis of Cases Leading to Resection and Reconstruction N = 69

Pathologic Diagnosis	No. of Patients
Squamous cell Carcinoma	35
Mucoepidermoid Carcinoma	2
Metastatic Follicular Carcinoma	1
Ameloblastic Carcinoma	1
Malignant Peripheral Nerve Sheath Tumor	1
Malignant Mixed Tumor	1
Malignant Spindle Cell Carcinoma	1
Dermatofibrosarcoma protuberans	1
Adenoid cystic Carcinoma	1
Ameloblastoma	18
Hemangioma	1
Osteoid Osteoma	1
Recurrent Ameloblastoma	1
Recurrent Neurofibroma	1
Eosinophilic Granuloma	1
Osteoradionecrosis	1
Tuberculosis	1

Of the classifiable tumors, 55% of the flaps were used to reconstruct defects that arose after the resection of Stage 3 or Stage 4 cancers. (Table 3) Two cases underwent radiotherapy prior to resection and reconstruction using free flaps.

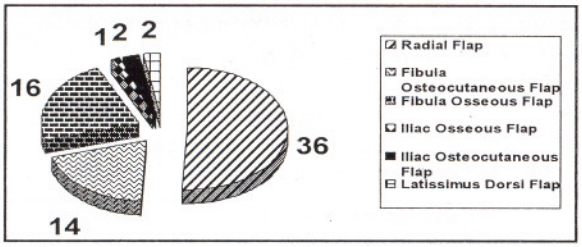
TABLE 3
Staging of Malignant Cases N=44



There were 71 free flaps used with the radial forearm flap used in 36 (50%) of the cases involving purely soft tissue defects (Table 4). Almost all of the bony defects were reconstructed using the fibular free flap (43%). There were three cases (4%) where the iliac crest was used in reconstructing the bony defect.

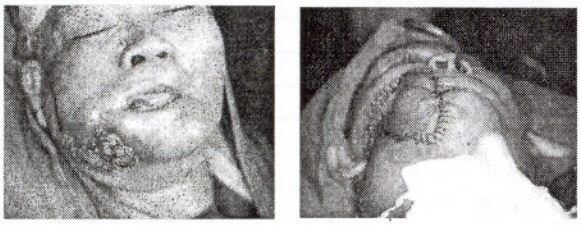
Two patients underwent two simultaneous free flap reconstructions. One patient had Stage IV gingival carcinoma involving the mandible,

TABLE 4
Distribution of Free Flaps used for reconstruction



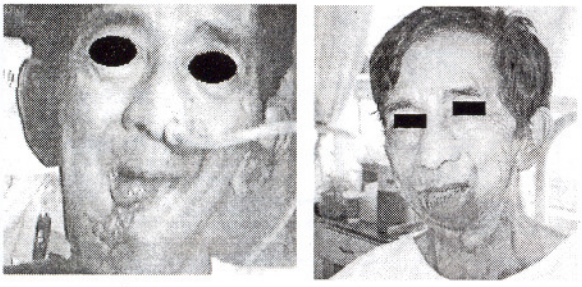
buccal mucosa and cheek skin. The radial forearm flap was used to reconstruct the buccal mucosa and cheek skin while the fibular osseous free flap was used to restore mandibular continuity. (Figure 1) The other patient had a Stage IV floor of mouth

FIGURE 1
Patient with gingival carcinoma Stage IV on the left, before the operation and on the right, immediately after the operation.



carcinoma involving almost the entire anterior 2/3 of the tongue, floor of the mouth, mandible and skin of the mentum. The radial forearm flap was used to reconstruct the tongue and floor of the mouth while the fibular osteocutaneous free flap was used to restore the mandible and skin over the mentum. (Figure 2)

FIGURE 2
Patient with floor of mouth carcinoma Stage IV left, before the operation and on the right, after the operation



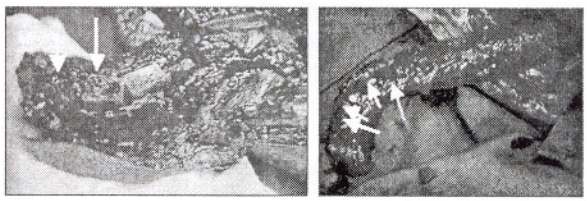
All osseous flaps were used to reconstruct the mandible. The defects were classified according to the scheme of Urken[1], based on the anatomic portions of the mandible: condyle (C), ramus (R), body (B), symphysis (S) and hemisymphysis to the midline (Sh). (Table 4) In one case, the tumor involved almost the entire mandible except for the condyle.(Patient #56,Appendix) There were 5 patients who had primary insertion of osseointegrated implants. (Figure 3)

TABLE 4
Mandibular Defects N=33

Mandibular Defects	No. of Patients
S	2
BS	3
BSB	10
RB	1
RBSh	6
RBS	2
RBSB	1
CRB	1
CRBSh	4
CRBS	1
CRBSB	1
CRBSBR	1
Primary insertion of osseointegrated implants	5

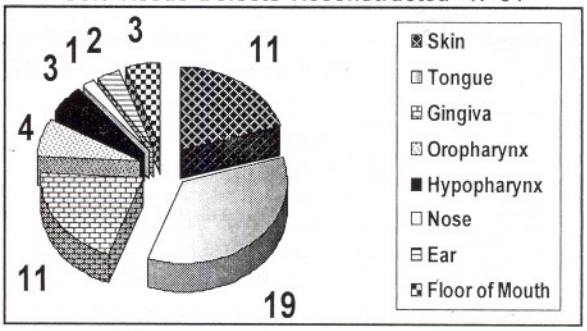
From Urken, 1991[9] C-condyle R-ramus B – body S-symphysis Sh-hemisymphysis

FIGURE 3
Patients with Osseointegrated implants (white arrow)



There were 54 cases with soft tissue defects. The majority of these defects were glossectomies (19 patients). A good number of cases involved the gingiva and the skin. (Table 5) There were varying sizes of cutaneous flaps used to reconstruct these defects with the smallest 3 cm x 6 cm and the largest 10 cm x 15 cm. (Appendix)

TABLE 5
Soft Tissue Defects Reconstructed N=54



All patients underwent pre-operation medical clearance. Allen's test was performed on all patients who were candidates for radial forearm free flap reconstruction. Initially, angiography was used to assess the vascular supply of the lower extremities in patients who were candidates for fibular free flap

reconstruction. This was later replaced by color flow doppler ultrasonography which has proven to be a reliable, safe, non-invasive, cost-effective alternative.[10, 11]

A two-team approach was used in all of the primary tumor resection cases. One team would harvest the flap to be used for the reconstruction while the other team would simultaneously resect the tumor. All microvascular anastomoses used nylon 9-0 in an interrupted hand suture technique.

The superior thyroid artery was the most frequently used recipient artery while the common facial vein was the recipient vein most often used. No vein graft was used in this series. Thoughtful flap selection and optimal flap design were emphasized to avoid the need for a vein graft. There was one case of a sensate flap wherein the lateral antebranchial nerve was anastomosed with the lingual nerve.(Table 6) End to end anastomosis was the most common technique used. No intra-operative or post-operative anticoagulants were used.

TABLE 6
Recipient Vessels Used N=71

Recipient Vessels	No. of Cases
Artery	
Superior Thyroid	39
Facial	26
Transverse cervical	2
Lingual	3
External Carotid	1
Vein	
Superior thyroid	5
Common facial	45
External jugular	19
Lingual vein	1
Middle thyroid	1
Nerve – Lateral antebranchial nerve to lingual nerve	1

A closed suction drain was used in the majority of cases while passive drainage was used if the suction drain could not be placed a distance from the anastomosed vessels. The patients were brought to the recovery room immediately after the operation where a physician monitored the flap hourly for the first 24 hours. Soft tissue flaps were monitored clinically based on capillary refill, color, temperature and dermal bleeding to pinprick test. The osseous flaps were monitored clinically based on the presence of infection and mobility of the bone segments. The clinical assessment of the flap's viability was noted to be a reliable way to determine flap success or failure. The clinical assessment was continued up to the day of discharge and on subsequent follow-up to determine continued flap viability.

The length of operation, hospital stay, complications, length of time post-operation for removal of the nasogastric tube and decannulation were tabulated. Descriptive statistics were used to summarize pertinent data information.

RESULTS

Free Flap Success

Of the 71 free flap reconstructions, there were 7 flap failures (10 %). There were no revisions of the anastomosis done. The first 36 cases had a success rate of only 86%. The next 35 cases had a success rate of 94%.(Figure 4 & 5) Out of the 7 flap failures, 1 patient had pre-operative radiotherapy and 1 patient had a secondary reconstruction of the mandible. The over-all success rate for the 5 patients with osseointegrated implants was 100%, but only 2 patients had the resources to secure the abutments and subsequent dental prosthesis.

FIGURE 4
Above is patient # 54 (Appendix) with ameloblastoma, left mandible and below is the patient 1 month post-operation

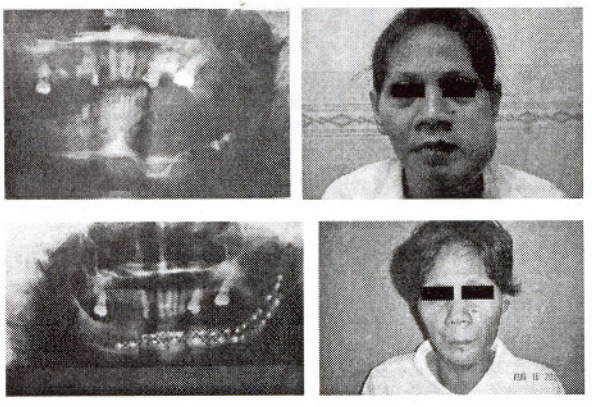
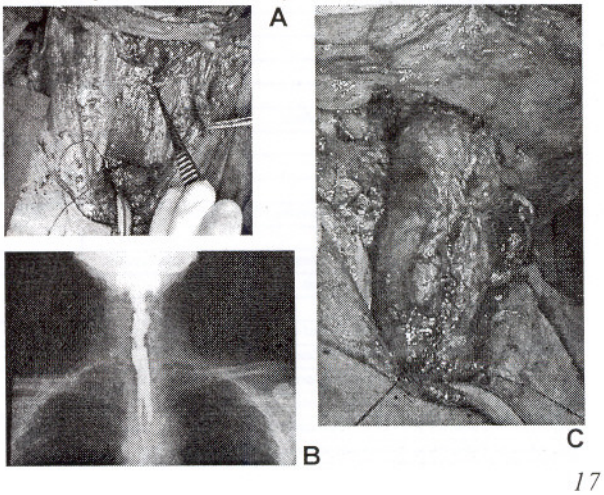


FIGURE 5
Patient # 53 (Appendix) with hypopharyngeal carcinoma who underwent total laryngopharyngectomy (A) with radial forearm free flap reconstruction (B).Barium swallow of the patient 1 month post-operation (C).



Perioperative Complications

The complications were divided into surgical and medical perioperative complications. A complication was classified as perioperative if it occurred within 30 days from the time of surgery. The surgical complications were further divided into major and minor complications. Major complications were defined as life threatening complications or those that necessitated emergent return to the operating room such as expanding hematoma, partial flap necrosis and total flap necrosis. Minor complications involved post-operative morbidities that did not require another operative procedure or that would have resolved with conservative management such as seromas, minor local infections and fistulas.

There were 3 patients in this series who suffered a myocardial infarction post-operation that resulted in their death. Pulmonary embolism was the cause of demise in 2 patients and pneumonia in 1 patient. The mortality rate was noted to be 9 %. (Table 7) All flaps remained well perfused until the time of the patients' demise. It should be noted that the 7 patients were classified as American Society of Anesthesiology status scale (ASA) 2 prior to the surgery and did not have any pulmonary or cardiac problems prior to the operation.

TABLE 7
Surgical and Medical Complications

Complications	No. of Cases
Death	6
Myocardial infarction	3
Pneumonia	1
Pulmonary Embolism	2
Surgical Complications	
Major	
Flap Failure	7
Partial Flap Necrosis	1
Pneumothorax requiring chest tube thoracostomy	1
Evacuation of hematoma under general anesthesia	3
Dehiscence requiring another flap	2
Plate fracture	1
Temporomandibular joint (TMJ) dislocation	1
Minor	
Wound Infection	7
Hematoma/ seroma	2
Dehiscence	7
Limping after harvest	2
Necrosis with Debridement	4
Orocutaneous fistula	4
Marginal mandibular nerve paresis	3
Medical Complications	
Cardiac – Hypertension	2
Respiratory – Pneumonia	6
Metabolic – hypocalcemia, hypokalemia, fluid overload	9
Renal – acute renal failure	1
Gastrointestinal – Upper Gastrointestinal Bleeding, Stress Gastritis	7
Dermatologic - Bed sores, phlebitis	7
Neurologic – seizures	3
Psychiatric – anxiety reaction, Post-op Depression	3
Number of Patients with Surgical Complications (Major)	7 (10%)
Number of Patients with Surgical Complications (Minor)	25 (37%)
Number of Patient with Medical Complications	22 (32%)
Number of Patients with both Medical and Surgical Complications	15 (22%)
Number of Patients w/o Complications	21 (29%)

Length of Hospital Stay

Hospital stay was determined as the number of days between the date of operative procedure and the date of discharge. The median length of hospital stay was noted to be 24 days with a minimum of 8 days for uncomplicated cases and a maximum of 69 days for a patient with flap failure (Patient # 34, Appendix). The 6 patients who expired were not assessed in terms of length of hospital stay.

Length of Operation

The operative time was determined as the difference between the first cutting time to the last stitch time. This includes the resection and reconstruction if the reconstruction is primary. The average length of the operation was noted to be 13 hours and 40 minutes with a range of 8 hours to 24 hours and 10 minutes.

Removal of Nasogastric tube (NGT) and Decannulation

There were 57 of the 69 patients who had surgery of the upper digestive tract requiring a nasogastric tube. After surgery, patients took nothing orally for a minimum of 6 days to allow for adequate intraoral healing. Tube feedings were maintained until patients were able to achieve adequate oral intake. The average time for removal of the nasogastric tube was noted to be 17 days post-operation. Eight patients (14%) were discharged with a nasogastric tube or percutaneous endoscopic gastrostomy tube in place with a plan of resumption of oral feeding at a later post-operative period or to supplement nutrition. These eight patients all had malignant pathology. (Table 8)

TABLE 8
Length of Time (days) Post-operation – Nasogastric tube removal and Decannulation

NGT removal N = 49 (Range)	17.6 (5 – 42)
Decannulation N = 31 (Range)	14.01 (4 - 38)

Note: 8 Patients were discharged with an NGT/PEG

There were 31 patients who had tracheotomies in the post-operative period. All patients were decannulated prior to discharge. The average time post-operation for decannulation was noted to be 14 days with a range of 4 to 38 days. (Table 8) No patient required subsequent repeat cannulation for airway insufficiency.

DISCUSSION

Free tissue transfer is a reliable technique for head and neck reconstruction. The over-all free flap success rate was noted to be 90 %. This is

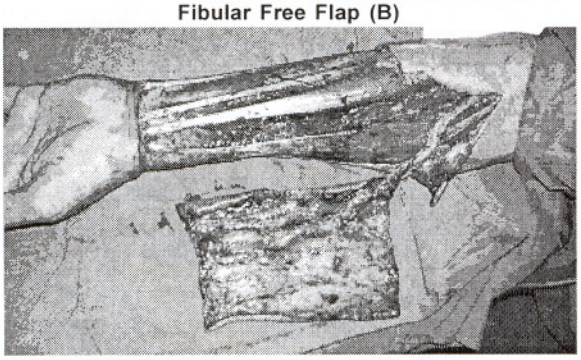
comparable to other series of free flap reconstructions in the head and neck. (Table 9) The microvascular surgeons' learning curve, manifested by increased free flap failure[12] is also evident in our series. The first 36 cases had a flap success rate of only 86% while the next 35 cases had a success rate of 94%.

In this study, the fibular free flap was used for 91% of mandibular reconstruction while the radial forearm flap was used in 95% of purely soft tissue defects. (Figure 6) These flaps were usually chosen because of ease of dissection, a long and large-caliber pedicle and lack of donor site morbidity. [13]

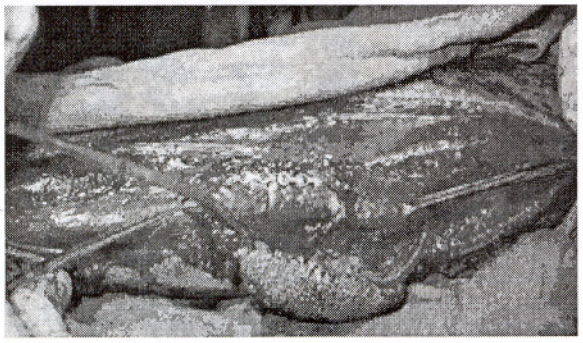
TABLE 9
Free Flap Success Rates

Author of the Study	No. of Patients	Free Flap Success Rates
Kroll, 1996[13]	854	96.30%
Blackwell, 1997[12]	81	94.90%
Urken, 1998[14]	210	96%
Hidalgo, 1998[15]	716	98%
Singh,1999[16]	200	98%
Ryan, 2000[17]	97	91%
Serletti, 2000[18]	100	92%
Haughey, 2001[4]	241	95%
Alonzo and David, 1998[19]	21	90%

FIGURE 6
Radial Forearm Free Flap (A) and Fibular Free Flap (B)



A



B

Another possible reason for the increase in success rate of free flap reconstruction in the latter half of the series was better pre-operative selection of patients and monitoring of patients post-operation.

The perioperative mortality was noted to be 9% mostly due to medical complications such as myocardial infarction and pulmonary embolism. This is higher than mortality rates of only 1.5-4.7 % in other free flap series.(Table 10) A study by Chiang in 2002 showed that myocardial infarction (MI) had an over-all incidence of 3.6% among patients undergoing microvascular head and neck reconstruction but early recognition of MI and aggressive treatment led to a mortality rate of only 1%. They noted that variables such as patient age, gender, operative time, blood loss, intra-operative fluid gain, tumor stage and ASA classification did not have any significant correlation on the development of MI.[21] Another study showed that mortality is more common in patients with previous myocardial infarction or steroid medication. [20] In our patients, they were classified as ASA 2 and did not have any cardiac problems pre-operation. It is important to have vigilant cardiac and peri-operative monitoring even in the absence of medical co-morbidity and immediate management to prevent post-operative mortality.

TABLE 10
Perioperative Mortality Rates in Free Flap Patients

Author	No. of Patients	Mortality Rates
Simpson, 1996[13]	150	4.70%
Urken, 1998[14]	210	1.50%
Singh, 1999[16]	200	1%
Serletti, 2000[18]	100	3%
Haughey,2001[4]	241	2.10%
Chiang, 2002[13]	193	1%

Patients with head and neck malignancies are high-risk patients since these patients are usually in the later decades of life and have cardiac, pulmonary and vascular co-morbidities associated with their long-term consumption of alcohol and tobacco. There were 7 patients who had major surgical complications but which were duly addressed and resolved up to the time of discharge. Twenty nine percent of patients did not have any morbidity. Age was not noted to be a significant factor in the development of surgical complication, medical complication or reconstructive failures.[18] They noted that the American Society of Anesthesiology (ASA) status scale and length of surgery statistically affect the development of post-operative surgical and medical complication. On the other hand, the study by Haughey stated that age is a significant factor in development of major complication. A large volume of crystalloid (>7 liters) administered during surgery, smoking two weeks

prior to surgery and loss of more than 10% of body weight was also significant.[4] Another study stated that age did not impact on complication rate but when complications do occur, they tend to be more severe in older patients.[16] Thus, careful monitoring and management of perioperative co-morbid conditions, preparation of the patient for the procedure and fluid balance should be addressed to increase effectiveness and safety of the microvascular free tissue transfer.

The case of flap necrosis of half of the cutaneous paddle of a fibular osteocutaneous free flap could be due to the inadequate blood supply from the perforator. It was noted that there were only 2 perforators supplying the skin paddle. (Patient 64, Appendix) The case of temporomandibular dislocation of the neo-condyle was probably secondary to tumor expansion of the glenoid fossa. On panorex examination, the ameloblastoma involved the condyle. This could have been probably avoided if the patient was placed on intermaxillary-mandibular fixation several weeks post-operation to allow for fibrosis around the neo-condyle. Subsequent plate fracture ensued due to the use of a splint by the patient to correct the malocclusion. The splint added stress to the junction of the neo-mandible and the native mandible causing plate fracture. (Patient 65, Appendix)

It is also important to note that although there was only one microvascular team performing surgery, the support teams varied per hospital, the support staff might have been growing in synchronization with the surgical team. In an ideal situation, a dedicated support staff fully versed in the care and management of patients undergoing free flap reconstruction may lessen complications and mortalities.

The patients stayed in the hospital at an average of 24 days considering that most patients required large surgical resections and complex reconstruction. The length of hospital stay was greatly affected by the occurrence of various complications. The data on length of stay and length of operation is important in consideration of cost of the procedure. Cost-identification studies have demonstrated that free tissue transfer consumes more resources to perform the procedure but this one investment is offset by the paucity of post-operative complications leading to a shorter hospital stay.[5,6,8] Other studies have shown that free tissue transfer is more costly with no difference in length of hospital stay but is associated with improved long term benefit that is difficult to measure[1,2] They concluded that the intangible benefit of earlier resumption of oral intake and reduced requirement for enteral tube feedings was satisfactory justification for the additional costs of free flap reconstruction.[7]

Most patients were able to resume an oral diet 15 days after major head and neck surgery. This is comparable to the study by Ryan where patients were started on oral feeding after 10 days.[17] Patients also were decannulated at 14 days post-operation. All patients were decannulated. Thus our study supports that a functional, secure airway can be regained in a timely fashion even in advanced disease states without long term tracheotomy. This was also borne out by the study of Skoner wherein even stage IV oropharyngeal cancer patients who underwent extensive resection and reconstruction with free flaps had 100% decannulation within 2 weeks.[3]

It is recommended that further studies be done to determine the factors associated with complications in free flap reconstruction. Comparison of no reconstruction, pedicled reconstruction and free flap reconstruction of mandibular defects in terms of functional outcome such as speech, swallowing and mastication would also be useful.

CONCLUSION

This study has shown that free tissue transfer is a reliable and safe way of reconstructing defects in the head and neck. There is a 90% over-all success rate with minimal complication. All of the patients were decannulated with majority able to resume an oral diet.

BIBLIOGRAPHY

1. Brown MR, McCulloch TM, Funk GF, Graham SM and Hoffman HT. Resource Utilization and Patient Morbidity in Head and Neck Reconstruction. Laryngoscope. 1997. Vol 107(8):1028-1031.
2. Disa JJ, Pusic AL, Hidalgo DH, Cordeiro PG. Simplifying Microvascular Head and Neck Reconstruction: A Rational Approach to Donor Site Selection. Annals of Plastic Surgery. 2001. Vol 47(4):385-389.
3. Blackwell KE. Unsurpassed Reliability of Free Flaps for Head and Neck Reconstruction. Archives of Otolaryngology Head and Neck Surgery. 1999. Vol 125 (March): 295-299.
4. Haughey BH, Wilson E, Kluwe L, Piccirillo J, Frederickson J, Sessions D and Spector G. Free Flap Reconstruction of the Head and Neck: Analysis of 241 cases. Otolaryngology-Head and Neck Surgery. 2001. Vol 125(1):10-17.

5. Chepeha DB, Annich G, Pynnonen MA, Beck J, Wolf GT, Teknos TN, Bradford CR, Carroll WR and Esclamado R. Pectoralis major Myocutaneous Flap vs. Revascularized Free Tissue Transfer. Archives of Otolaryngology-Head and Neck Surgery. 2004.Vol 130 (Feb):181-186.
6. Kroll SS, Evans GR, Goldberg D, Wang B,Reece GP, Miller MJ, Robb GL, Baldwin, BJ and Schusterman MA. A Comparison of Resource Costs for Head and Neck Reconstruction with Free and Pectoralis Major Flaps. Plastic and Reconstructive Surgery. 1997.Vol 99 (5):1282-1286.
7. McCrory, AL and Magnuson S. Free Tissue Transfer versus Pedicled Flap in Head and Neck Reconstruction. Laryngoscope. 2002. Vol 112 (Dec):2161-2165.
8. Petruzzelli GJ, Brockenbrough JM, Vandevender D and Creech SD. The Influence of Reconstructive Modality on Cost of Care in Head and Neck Oncologic Surgery. Archives of Otolaryngology-Head and Neck Surgery. 2002. Vol 128 (Dec):1377-1380.
9. Urken ML, Weinberg H, Vickery C, Buchbinder D, Lawson W, Biller HF. Oromandibular reconstruction using microvascular composite free flaps: report of 71 cases and a new classification scheme for bony, soft tissue and Neurologic defects. Archives of Otolaryngology-Head and Neck Surgery. 1991. Vol 117:733-744.
10. Futran, ND, Stacj Jr BC and Payne LP. Use of Color Doppler flow imaging for pre-operative assessment in fibular osteoseptocutaneous free tissue transfer. Otlaryngology-Head and Neck Surgery. Dec 1997. 660-663.
11. Smith RB, Thomas RD and Funk GF. The role of angiography in patients with abnormal results on pre-operative color flow Doppler studies. Archives of Otolaryngology –Head and Neck Surgery. 2003; 129 (July):712-715.
12. Blackwell KE, Brown MT and Gonzalez D. Overcoming the Learning Curve in Microvascular Head and Neck Reconstruction. Archives of Otolaryngology-Head and Neck Surgery. 1997; (123(12):1332-1335.
13. Kroll SS, Schusterman MA, Reece GP, Miller MJ, Evans GR, Robb GL and Baldwin BJ. Choice of Flap and Incidence of Free Flap Success. Plastic and Reconstructive Surgery. 1996. Vol 98(3):459-463.
14. Urken ML, Buchbinder D, Constantino PD, Sinha U, Okay D, Lawson W and Biller HF. Oromandibular Reconstruction using Microvascular Composite Flaps. Archives of Otolaryngology-Head and Neck Surgery. 1998. Vol 124 (Jan):46-55.
15. Hidalgo DA, Disa JJ, Cordeiro PG and Hu Q. A Review of 716 Consecutive Free Flaps for Oncologic Surgical Defects: Refinement in Donor-Site Selection and Technique. Plastic and Reconstructive Surgery. 1998. Vol 102(3):722-732.
16. Singh B, Cordeiro PG, Santamaria E, Shaha AR, Pfiser DG and Shah JP. Factors Associated with Complications in Microvascular Reconstruction of Head and Neck Defects. Plastic and Reconstructive Surgery. 1999. Vol 103 (2):403-411.
17. Ryan MW and Hochman M. Length of Stay after Free Flap Reconstruction of the Head and Neck. Laryngoscope. 2000. Vol 110 (Feb):210-216.
18. Serletti JM, Higgins JP, Moran S and Orlando GS. Factors Affecting Outcome in Free Tissue Transfer in the Elderly. Plastic and Reconstructive Surgery. 2000. Vol 106 (July):66-70.
19. David JF and Alonzo DM. Oromandibular Reconstruction using Microvascular Free Flaps. Philippine Society of Otolaryngology Journal. 2001.
20. Simpson KH, Murphy PG, Hopkins PM and Batchelor AG. Prediction of outcomes in 150 patients having microvascular free tissue transfers to the head and neck. British Journal of Plastic Surgery. 1996. Vol 49:267-273.
21. Chiang S, Cohen B and Blackwell K. Myocardial Infarction after Microvascular Head and Neck Reconstruction. Laryngoscope. 2002. Vol 112 (Oct):1849-1852.
22. Rosenthal EL and Dixon SF. Free Flap complications: when is enough, enough? Current Opinion in Otolaryngology and Head and Neck Surgery. 2003. Vol 11:236-239.

23. Tsue TT, Desyatnikova SS, Deleyiannis FW et al. Comparison of cost and function in reconstruction of the posterior oral cavity and oropharynx: free vs. pedicled soft tissue transfer. Archives of otolaryngology-Head and Neck Surgery. 1997. Vol 123:731-737.

24. Skoner JM, Andersen PE, Cohen JI, Holland JJ, Hansen E and Wax MK. Swallowing function and tracheotomy dependence after combined modality treatment including free tissue transfer for advanced-stage oropharyngeal cancer. Laryngoscope. 2003. Vol 113 (Aug):1294-1298.

APPENDIX

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
1	TP	43/M	- s/p partial maxillectomy (4/95), L - s/p cobalt tx (35 sessions) 95 - 96 chemotx SCCA, WD, maxilla - ST IV	30 days	16 hrs 35 mins	- Orbital exenteration, L; total maxillectomy, R w removal of *scar tissue L cheek w latissimus* dorsi FF recon (2/17/96) soft tissue - 12 x 8 cm
2	LV	54/M	FOM SCCA w neck mets T3N1Mo St III	NA	15 hrs	Wide excision w SND w radial forearm FF recon (5/1/96) Soft tissue 9 x 8 cm
3	DS	67/M	SCCA well-differentiated, BAC, L T2NoMo St II	30 days	14 hrs	Wide excision L w MRND w lth latissimus dorsi flap recon (6/2/96) Soft tissue 10 x 12 cm
4	EC	49/F	*Tongue SCCA, L* T2N1Mo St III	25 days	15 hrs	Tracheostomy, hemiglossectomy, MRND, L w radial FFF recon (10/8/96) Soft tissue - 9 x 6 cm
5	GS	64/M	Tongue SCCA w ell diff ,T3NoMo St III	22 days	15 hrs	Tracheostomy, hemiglossectomy w MRND ,R w radial FFF recon (12/12/96) Soft tissue 9 x 6.5 cm
6	RP	25/M	Ameloblastoma, R	17 days	17 hrs	Tracheostomy, segmental mandibulectomy (RBSh) w fibular osteocutaneous FF recon (12/19/96) Soft tissue - 11 x 4.5 cm
7	EB	51/F	Ameloblastoma acanthomatous type	28 days	13 hrs 45 mins	*Tracheostomy, Segmental* mandibulectomy (BS) w fibular osteocutaneous FF recon (3/31/97) Soft tissue - 4.5 x 5 cm
8	IT	63/M	Transglottic R , SCCA T3N2cMo St IV	23 days	14 hrs 35 mins	Laryngopharyngectomy w MRND, B w radial FFF recon (4/10/97) Soft tissue : 15 x 10 cm
9	AP	64/F	Gingival SCCA, gr I T4N1Mo St IVa	32 days	13 hrs	Tracheostomy, wide excision w lth segmental mandibulectomy (RBSh) w RND, R w fibular osseous FF & radial FFF recon (4/8/97) Radial 9 x 10 cm
20	CC	55/F	SCCA,WD FOM T4NoMo St IV	NA	15 hrs	Tracheostomy, wide excision w segmental mandibulectomy (BSB), bilat SOND w recon using iliac crest osseocutaneous free flap (5/19/98) Soft tissue 7 x 4 cm
21	AL	19/F	Chronic mucocutaneous fistula 2ndary to prob to TB	26 days	14 hrs	Debridement w recon using radial FFF w calvarial bone grafting (6/16/98) Soft tissue 5 x 8 cm
22	CC	58/F	*BMT s/p total parotidectomy* w FN sacrifice w segmental mandibulectomy; Temporal bone CA (metastatic) malignant mixed tumor T4N1Mo St IV	17 days	10 hrs 25 mins	Petrosectomy with excision of external area AD with radial forearm free flap recon (8/4/98) Soft tissue 8 x 10 cm
23	SR	43/F	Tongue SCCA,WD, R T3N2aMo St IVa	19 days	10 hrs 15 mins	Tracheostomy, Hemiglossectomy; SOND L MRND R w radial FFF recon (9/30/98) Soft tissue 13 x 9 cm
24	OB	54/M	Adenoid cystic CA ,FOM s/p wide excision w marginal mandibulectomy w tongue flap recon (June '98) Secondary ankyglossia T2NoMo St II	11days	10 hrs	Release of ankyloglossia w radial FFF recon (12/17/98) Soft tissue 8 x 9 cm
25	PG	54/M	Ameloblastoma s/p recon w medpor	15 days	15 hrs	*Segmental mandibulectomy* (BSB) w fibular osseocutaneous FF recon (5/5/99)
26	BC	77M	Tongue CA T4NoMo St IV	NA	12 hrs	Tracheostomy, hemiglossectomy w SOND, R w radial FFF recon (7/2/99) Soft tissue 6 x 9 cm
27	AO	32/F	Recurrent ameloblastoma	12 days	11hrs 5 mins	- Segmental mandibulectomy (S) w fibula osseous FF recon (9/6/99)
28	RP	62/M	SCCA, MD Tonsil R, T4N2Mo St IV, NIDDM, HPN Asthma	NA	15 hrs	Tracheostomy Wide excision RND, R (2/Y00) W radial FFF recon Soft tissue , 8 x 6 cm
29	DV	52/M	Dermatofibrosarcoma protuberans L cheek s G1 T2bNoMo St IIa	8 days	8 hrs 20 mins	*Wide excision w radial FFF* recon (3/06/01) Soft tissue 9 x 8 cm
30	MS	18/F	Malignant spindle cell neoplasm, manible, G1 L T2bNoMo St IIa	27 days	14 hrs 20 mins	Segmental mandibulectomy (BSB) w fibula osteocutaneous FF recon (5/22/01) w OI

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
10	GD	40/M	Tongue SCCA T4N1Mo St IV	22 days	17 hours	Total anterior glossectomy w RND w radial FFF recon (4/29/97) Soft tissue : 9 x 8 cm
11	DM	49/M	Oropharyngeal CA w neck mets, T3N1Mo St II	33 days	20 hrs 30 mins	- wide excision of oropharyngeal mass w neck dissection w radial FFF recon (6/03/97) soft tissue : 6 x 8 cm
12	CM	52/F	SCCA, MD, hard palate St III	15 days	11 hrs 30 mins	Palatectomy w radial FFF recon (6/10) Gastrostomy (6/7/97) Soft tissue 8 x 10 cm
13	DC	71/F	SCCA, gr I soft palate T3N2cMo St IVa	14 days	19 hrs	Tracheostomy, MRND Type III, L Type I, R excision of Oropharyngeal mass w RFFF recon (7/24/97) Soft tissue : 4 x 7 cm
14	EA	60/F	Hypopharyngeal SCCA,WD, L (circumferential mass displaces cricord and thyroid cartilage to the L. L vocal cord compressed, involves L vallecula) St III	36 days	16 hrs 45 mins	Total laryngopharyngectomy w RFFF recon (9/26/97) Soft tissue 15 x 10 cm
15	PR	48/F	Metastatic Follicular tumor, R mandible St IV	32days	13 hrs	Segmental mandibulectomy (RBSh) w fibular osseous FF recon (9/11/97)
16	RV	21/F	Hemangioma, L mandible	26 days	14 hrs 5 mins	Tracheostomy, Segmental mandibulectomy (CRB) with iliac crest osseous free flap recon(10/02/97)
17	PD	59/F	Ameloblastic CA s/p mandibulectomy ('84) - 9x9x12 cm mass (-) trismus St IV	29 days	13 hrs 25 mins	Wide excision w/ segmental mandibulectomy (BS) w iliac osseomusculocutaneous free flap recon (1/02/98) - soft tissue : 6 x 8 cm
18	RC	54/M	SCCA WD, tongue R, with bilat neck mets T2NoMo St II	28 days	15 hrs	Tracheostomy, Hemiglossectomy, MRND type III, R, SOND, L w RFFF recon (15th HD) (1/27/98) soft tissue . 11 x 7 cm
19	LS	47/F	Mucoepidermoid CA, low grade FOM, T3N1Mo St III	14 days	15 hrs	Tracheostomy, Wide excision, of FOM w marginal mandibulectomy, R w SND, radial FFF recon (2/26/98) Soft tissue : 6 x 4 cm

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
31	MA	24/F	Eosinophilic granuloma R body	12 days	11hrs 30 mins	Segmental mandibulectomy (RBS) w fibular osseous FF recon (5/30/01) w OI
32	TMA	9/F	Ameloblastoma mandible, L	14 days	8 hrs 25 mins	Segmental mandibulectomy (RB) w fibular osseous FF recon (6/5/01)
33	RE	45/M	Ameloblastoma	12 days	15 hrs	Segmental mandibulectomy (S) w fibular osteocutaneous FF recon w OI (7/10/01) Soft tissue 4 x 6cm
34	LS	66/F	SCCA gr I FOM T2NoMo St II - HPN St III	69 days	20 hrs	- Tracheostomy mandibulectomy (BSB) SOND R w fibula osteocutaneous free flap recon (8/28/01) - removal of fibula/GA with recon using PMMF (9/7/01) - primary closure of FOM (10/10/01) soft tissue 10 x 5 cm
35	SB	59/F	Tongue CA WD T2N1Mo St III pleomorphic adenoma L SMG	14 days	13 hrs 50 mins	Tracheostomy Hemiglossectomy w RND L w radial FFF recon (10/18/01) Soft tissue 10 x 12 cm
36	LP	28/F	Ameloblastoma R	21days	14 hrs 35 mins	Tracheostomy segmental mandibulectomy (CRBSh) w fibula osseous FF recon w OI (11/14/01)
37	NC	38/F	Ameloblastoma ant	25 days	14 hrs 15 mins	Segmental mandibulectomy (BSB) w fibular osseous free flap recon w OI on plans (11/02)
38	AB	37M	SCCA WD tongue w neck mets T4N2aMo St IVa	47 days	24 hrs 10 mins	Tracheostomy total glossectomy RND L SND (Level IA, IB) R w radial FFF recon (2/8/02) Soft tissue 10 x 14 cm
39	JQ	33/M	Ameloblastoma R	14 days	16 hrs	Segmental mandibulectomy (CRBSB) w fibular osteocutaneous FF recon (2/15/02) Soft tissue 3 x 8 cm
40	CM	53/M	SCCA WD T4NaMO St IV s/p superior maxillectomy w/ orbital exenteration	8 days	7 hrs	Orbitomaxillary reconstruction using radial FFF (2/22/02) Soft tissue 10 x 12 cm
41	RZ	32/M	Ameloblastoma	12 days	15 hrs	Segmental mandibulectomy (RBSh) w condylar re-implantation w fibular osseous FF recon(8/26/02)

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
42	MB	38/F	Mucoepidermoid CA T4N0M0 oral cavity St IV	34 days	13 hrs 30 mins	Tracheostomy Wide excision w segmental mandibulectomy (RBSB) R w fibular osteocutaneous FF recon (8/6/02) Soft tissue 6 x 8 cm
43	MG	25/F	Rhabdofibrosarcoma maxilla (T2bN0)s/p maxillectomy s/p radio th Osteoradionecrosis L	31days	16 hrs	Tracheostomy partial maxillectomy w excision of skin w radial forearm free flap recon (10/8/02) Soft tissue 10 x 12 cm
44	JO	65/F	SCCA WD tongue w neck mets T3N1M0 St III	18 days	10 hrs 55 mins	Tracheostomy 3/4 glossectomy SOND R w radial FFF recon (10/24/02)
45	AP	59/F	SCCA WD tongue L T3N1M0 St III - neg for tumor all nodes - margins clear	45 days	11hrs 37 mins	Tracheostomy SOND L hemiglossectomy w marginal mandibulectomy w radial FFF recon (10/28/02) Soft tissue 10 x 9 cm
46	TT	58/F	SCCA FOM WD StIVA T4N2Mo	35 days	15 hrs	Tracheotomy hemiglossectomy w marginal mandibulectomy w SOND B w radial FFF recon (11/5/02) Soft tissue 10 x 9 cm
47	JC	58/M	SCCA Tongue (lat portion) T3N0M0 St III	22 days	12 hrs 45 mins	Tracheostomy SOND R hemiglossectomy R w radial FFF recon (11/15/02) Soft tissue 9 x 10 cm
48	RF	49/M	SCCA WD lat tongue L T4N0M0 St IV	36 days	13 hrs 15 mins	Tracheostomy ¾ glossectomy SOND L Level I R w radial FFF recon (2/13/03) soft tissue 8 x 10
49	SD	17/F	Osteoid osteoma R mandible	22 days	12 hrs 50 mins	Segmental mandibulectomy (BS) w fibular osseous FF recon (2/27/03)
50	RB	22/M	Ameloblastoma R	36 days	13 hrs 38 mins	Segmental mandibulectomy (BSB) w fibular osseous FF (4/1/03)
51	NF	7/F	Ameloblastoma L	54 days	10 hrs 40 mins	Segmental mandibulectomy (CRBS) w fibular osseocutaneous FF recon (4/16/03) Soft tissue 3 x 6 cm
52	FN	57/M	SCCA tongue lateral aspect of tongue R T3N1M0 Stage III	30 days	12 hrs 45 mins	Tracheostomy hemiglossectomy with supraomohyoid neck dissection R and radial forearm free flap reconstruction (5/13/03) Soft tissue 5 x 10 cm

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
53	VM	62/F	Hypopharyngeal SCCA , well diff T3N1Mo St III	56 days	15 hrs 5 mins	Total laryngopharyngectomy w lateral neck dissection B w Radial FFF recon (7/22/03) Soft tissue . 10 x 10 cm
54	DM	39/F	Ameloblastoma L	19 days	10 hrs 40 mins	Segmental mandibulectomy (RBS) w fibular osseous FF recon (7/29/03) w condylar implantation
55	AS	26/M	Ameloblastoma, R	18 days	12 hrs 20 mins	Segmental mandibulectomy (CRBSh) w fibular osseous FF recon (8/5/03)
56	JB	29/F	Malignant peripheral nerve sheath tumor G3 T2aNoMo St III	23 days	15 hrs 5 mins	Tracheostomy, total mandibulectomy (CRBSBR) w wide excision of lip and cheek masses w fibula osteocutaneous FF recon (8/26/03) Soft tissue : 4 x 12 cm
57	EO	58/M	SCCA, WD tongue R T3N2cMo St IV	18 days	14 hrs 30 mins	Tracheostomy Total glossectomy (ant 2/3) w RND R SND L w radial FFF recon (9/9/03) Soft tissue 8 x 12 cm
58	IB	27/F	Ameloblastoma L plexiform and acanthomatous variant	9 days	8 hrs 40 mins	Segmental mandibulectomy (CRBSh) w fibular osseous FF recon (9/4/03)
59	JN	67M	SCCA well differentiated floor of the mouth T4N2B M0 Stage IV	49 days	21hours 30 mins	Composite resection of the floor of the mouth, total anterior glossectomy segmental mandibulectomy (BSB) ,PEG radial forearm free flap recon and fibular osseocutaneous FF recon (10/15/03) Radial 8 x 12 cm Fibula 4 x 6 cm
60	JF	63/M	SCCA WD, cheek T4NoMo St IV	NA	9 hrs 40 mins	Wide excision w SOND R w radial FFF recon (10/28/03) Soft tissue 8 x 6 cm
61	WL	18/M	Tongue SCCA with neck mets, L St IV T4N2cM0	23 days	14 hrs 35 mins	Tracheostomy Hemiglossectomy L, w SOND B w radial forearm flap recon/ CA (11/3/03)
62	ADC	28/F	Ameloblastoma, L	13 days	8 hrs 30 mins	Segmental mandibulectomy (RBSh) w fibular osseous FF recon (11/7/03) w condyle re-implanted
63	BE	63/M	SCCA, WD, nose T2NoMo St II	8 days	8 hrs	Wide excision w radial FFF recon (11/11/03) Soft tissue 6 x 7 cm
64	JA	23/M	Ameloblastoma ant	38 days	12 hrs 40 mins	Tracheostomy, Segmental mandibulectomy (BSB) w fibular osteocutaneous FF recon (11/14/03) Soft tissue 4 x 6 cm

No	Name	Age/Sex	Diagnosis	Length of Hospital Stay	Length of OR	OR done
65	JG	29/M	Ameloblastoma, R	15 days	11 hrs	Segmental mandibulectomy (CRBSh) w fibula osseous FF recon (11/28/03)
66	JR	23/M	Ameloblastoma, R	10 days	13 hrs 20 mins	Segmental mandibulectomy (RBSh) w condyle re-implanted (1/9/04) w fibular osseous FF recon
67	RS	76/F	Tongue SCCA, WD, R s/p IMRT & cobalt tx (2003) w residual T3NoMo St III	12 days	9 hrs 50 mins	Tracheostomy, PEG, ¾ glossectomy w radial FFF recon (2/9/04) Soft tissue : 11 x 8 cm
68	SM	63/M	Gingival CA w neck mets bilat T4N2cMo St IVa	NA	14 hrs	Wide excision, segmental mandibulectomy (BSB) w SOND, bilat w fibular osteocutaneous recon (3/12/04) Soft tissue ; 5 x 5 cm
69	AL	17/M	Recurrent Neurofibroma s/p excision w inferior mandibulectomy (2003)	14 days	16 hrs 30 mins	Excision w segmental mandibulectomy (BSB) w fibular osteocutaneous FF recon (3/19/04) Soft tissue : 3 x 6 cm

FF- Free Flap FFF- Forearm Free Flap OI- Osseointegrated Implants

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos 1-2 25-30 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

A CROSS-SECTIONAL SURVEY ON THE AWARENESS AND BASIC KNOWLEDGE ON NEWBORN HEARING SCREENING OF OBSTETRIC AND PEDIATRIC RESIDENTS*

LUCIA AMYCEL T. IGNACIO, MD**
MILDRED B. OLVEDA, MD***
EDUARDO C. YAP, MD, FPSO-HNS***

ABSTRACT

OBJECTIVES: To determine whether the obstetric and pediatric residents are aware of newborn hearing screening; To determine whether the obstetric and pediatric residents are knowledgeable regarding newborn hearing screening; To compare the results as a function of the type of training institution (private or government)
STUDY DESIGN: Cross sectional study
SETTING: Randomly selected tertiary hospitals in the National Capital Region
METHODOLOGY: A structured questionnaire pertaining to the awareness and basic knowledge of newborn hearing screening was distributed to tertiary hospitals in the National Capital Region (NCR) of the Republic of the Philippines. All obstetric and pediatric residents of each of the tertiary hospitals were the respondents of this study. Frequencies were determined from the respondent's responses to the questionnaire.
RESULTS: Out of 175 questionnaires distributed, there were 134 respondents (86 pediatrics and 48 ob-gyne) Eighty (93%) pediatric residents were aware of newborn hearing screening but only 43 (50%) of pediatric residents were knowledgeable of the hearing test. Thirty five (73%) of obstetric residents were aware of newborn hearing screening and only 5 (10%) were knowledgeable about the hearing test. Majority of those who were knowledgeable are from private institutions (79.2%) as compared to respondents from government institution (20.8%).
CONCLUSION: A majority of obstetric and pediatric residents were aware of the newborn hearing screening but only a third of respondents had basic knowledge of the hearing test. Of those who were knowledgeable, most were training in private institutions where the machine was available. It is essential for the physician to be both aware and knowledgeable about newborn hearing screening to counsel and educate parents about the importance of early identification of and intervention for congenital or newborn hearing problems. A program to provide more knowledge regarding newborn hearing screening among pediatric and obstetric residents should be therefore developed.

INTRODUCTION

The efficiency of newborn hearing screening programs in the early identification of congenital hearing loss has long been recognized. Without such programs, the average age of identification of hearing loss is 1 to 2 years.[1] However, despite its efficiency the delayed identification of hearing impaired infants continues.

Approximately 1 to 3 in every 1000 infants is born deaf. A higher prevalence is found among high-risk infants and infants with craniofacial defects with 2 to 4 deaf infants per 100 live births.[2] According to the literature, hearing loss is the most common congenital disorder in newborns, 20 times more prevalent than most metabolic diseases, for which all newborns are screened as validate by law.

Newborn hearing screening programs have been mandated into law in the United States and in most developed countries. In the Philippines however, the program is still in its infancy. The newborn hearing screening program aims to identify hearing impaired and deaf infants at an early age in order to initiate appropriate clinical intervention. The primary justification for early identification of hearing impairment in infants relates to the impact of hearing impairment on speech and language acquisition, academic achievement, social development and further difficulties in adulthood.

*3rd Place, PSO-HNS Descriptive Research Contest, December 01, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Ospital ng Makati
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, Ospital ng Makati

Although newborn hearing screening programs are good in theory, there are certain barriers to their effective implementation. A most frequently unrecognized aspect of failure of program implementation is the physicians' lack of knowledge of the program.[3]

In April 2004, the Philippine Pediatric Society in collaboration with the Philippine Society of Otorhinolaryngology-Head and Neck Surgery released a policy statement in support of newborn hearing screening for high risk and non high risk infants. Cognizant of the vital role of primary care physicians, the policy emphasized their role to promote the importance of hearing screening, to counsel and educate parents of high risk infants and to encourage compliance and follow-up.[4]

While primary care physicians hold a key role in the early identification of the hearing impaired infant, obstetricians and pediatricians are in the forefront of neonatal care. Their awareness of and knowledge on newborn hearing screening are essential in educating the parents in the importance of the early identification and early intervention of infants with hearing loss. This premise is that by which this study was conducted.

This study aims to determine the awareness and knowledge of pediatric and obstetric residents regarding newborn hearing screening. This study also aims to compare the results according to the type of training institutions (private or government).

METHODOLOGY

A cross-sectional survey was conducted among tertiary hospitals in the National Capital Region (NCR) from June 1, 2004 to August 31, 2004. Sampling was done by single-stage stratified random selection of tertiary hospitals with an established department of pediatrics and/or department of obstetrics and gynecology with a formal residency training program but not necessary accredited by the Philippine Pediatric Society (PPS) or Philippine Obstetric & Gynecological Society (POGS). One tertiary hospital was selected from each of the cities and all pediatric and obstetric residents of these hospitals were included in the study.

Data was collected using a structured self-administered questionnaire (see Appendix A). Each of the participants was given a 10-item questionnaire form and was instructed to answer the questions accordingly. Accomplished questionnaires were retrieved by volunteer personnel. A total of 175 pediatric and obstetric residents participated in this study, but only 134 questionnaires were returned fully accomplished. Response rate was 76.6%.

The questionnaire consisted of two parts. In the first part, the respondents were asked about their awareness of the newborn hearing screening program. Those who answered affirmatively to the first question are asked to complete the second part of the questionnaire. The second part consisted of questions that test the participants' basic knowledge on newborn hearing screening.

Determination of awareness of newborn hearing screening was done by asking whether the respondent had heard of newborn hearing screening. An answer of yes categorizes them as an *aware* respondent.

Determination of basic knowledge of newborn hearing screening was done by tabulating correct responses to the questions on (1) the specific type of hearing screening test used, (2) the best time to administer the test, (3) the accuracy of the hearing test, (4) whether the test is technically difficult to administer and (5) whether it causes discomfort to the child.

In this study, auditory brainstem response (ABR) and otoacoustic emission (OAE) are the only hearing tests considered. The best time to administer the hearing test is during the first week of life. An affirmative answer for the question of accuracy and negative answers for the question of technical difficulty and discomfort are counted. If all five questions were answered correctly, the respondents are termed *knowledgeable*. If any of these questions were answered incorrectly, then the respondent maybe using supposition or guesswork in answering the questionnaire and are categorized as *not knowledgeable*.

The baseline characteristics of the respondents were also obtained. These include age, sex, marital status, year of graduation from medical school, number of years in residency training and their type of training institution (private or government).

Database management and analysis were performed using the software SPSS version 10.0. All responses were tallied and results compared.

RESULTS

A total of 134 respondents were included in this study. Table 1 shows the baseline characteristics of the respondents. Among the respondents, there were 86 (64.2%) pediatric residents and 48 (35.8%) obstetric residents. The mean age for both groups was comparable. There are more female (n=119) than male (n=15) respondents. Married respondents comprised (55) 41% while single respondents were (79) 59%. There were 73 respondents from private institutions and 61 are from government institutions.

TABLE 1
Characteristics of the Respondents

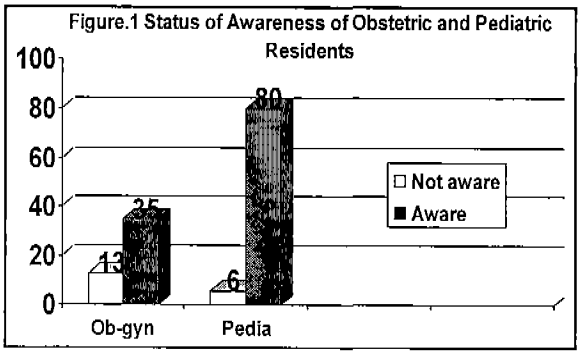
	Ob-gyn n = 48	Pediatrics n = 86	TOTAL
Age			
Mean Age	28.2	28.4	-
Age range	26-33	26-32	
Sex			
Males	5	10	15 (11.2%)
Females	43	76	119
Civil status			
Single	28	51	79 (59%)
Married	20	35	55 (41%)
Institution			
Private	28	33	73 (54.5%)
Government	20	53	61 (45.5%)

In the status of awareness (Table 2), a total of 115 (85.8%) respondents answered yes to the question: *Have you heard of newborn hearing screening?* while 19 (14.2%) gave a negative answer. Of the 115 aware respondents, 80 are pediatric residents (69.6%) as compared with 35 obstetric residents (30.4%).

TABLE 2
Status of Awareness of Obstetric and Pediatric Residents

	Not aware	Aware	Total
Ob-gyn	13	35	48
Pedia	6	80	86
Total	19 (14.2%)	115 (85.8%)	134 (100%)

Figure I shows the distribution of aware and not aware respondents according to specialty training.

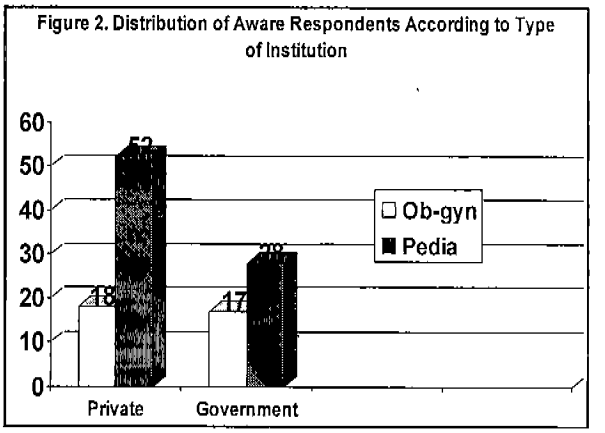


More respondents from the private institutions (60%) were aware of the newborn hearing screening than those in the government institutions (40%). Overall, more pediatric residents either from private or government institutions were more aware than obstetric residents (Table 3).

TABLE 3
Distribution of Aware Respondents According to Specialty Training and Type of Institution

	Aware		Total
	Private	Government	
Ob-gyn	18	17	35
Pedia	52	28	80
Total	70 (60%)	45 (40%)	115 (100%)

Figure 2 shows the graphical presentation of the above data.



In Table 4, 50% of aware respondents claimed that they have learned about newborn hearing screening from fellow doctors. Other sources of information are from medical school, hospital staff and media (medical journals, internet and/or television).

TABLE 4
Source of information of newborn hearing screening

Source	Number of Respondents (Percentage)
Doctors	68 (50.7%)
Medical school	26 (9.4%)
Hospital staff	9 (6.7%)
Media (medical journals, internet, tv)	12 (9.0%)

The basic knowledge of aware respondents was determined. Among the 115 aware respondents only 48 (41.7%) are considered knowledgeable while 67 (58.3%) are not knowledgeable. Table 5 shows the distribution of knowledgeable and not knowledgeable respondents according to specialty training. A larger proportion of obstetric residents (85.7%) as to compared to 46.2% of pediatric residents are not knowledgeable of the newborn hearing screening test. More than half (53.8%) of pediatric residents are knowledgeable of the screening test. Overall, there are more not knowledgeable respondents (58.3%) than knowledgeable respondents (41.7%).

TABLE 5
Status of Knowledge of Aware Obstetric and Pediatric Residents

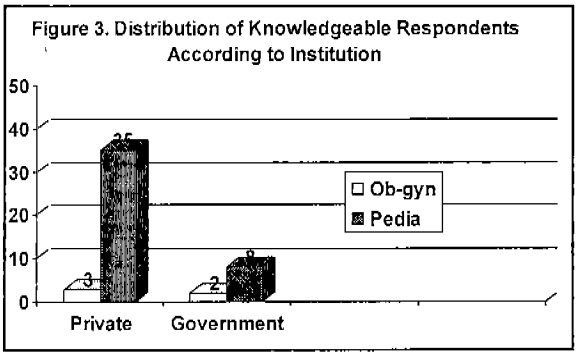
	Knowledgeable	Not knowledgeable	Total
Ob-gyn	5 (14.3%)	30 (85.7%)	35
Pedia	43 (53.8%)	37 (46.2%)	80
Total	48 (41.7%)	67 (58.3%)	115 (100%)

The distribution of knowledgeable respondents according to the type of institution is presented below (Table 6). Higher proportions of knowledgeable respondents belong to private institutions (79.1%) and are mostly pediatric residents as mentioned above. Only 20.9% knowledgeable respondents are from government institutions.

TABLE 6
Distribution of Knowledgeable Respondents According to Type of Institution

	Knowledgeable		Total
	Private	Government	
Ob-gyn	3	2	5 (10.4%)
Pedia	35	8	43 (89.6%)
Total	38 (79.1%)	10 (20.9%)	48 (100%)

Figure 3 shows the graphical representation of the above table.



DISCUSSION

The Taskforce on Newborn and Infant Hearing estimates that out of 1000 live births, 1 to 3 infants are born with hearing loss. In the presence of associated risk factors, the prevalence increases to 2 to 4 per 100 live births.[2] This is more common than the other metabolic diseases screened at birth: congenital hypothyroidism (28 per100,000), congenital adrenal hyperplasia (2 per 100,000), phenylketonuria (3 per 100,000), and galactosemia (2 per 100,000).

In countries where a Universal Newborn Hearing Screening Program (UNHSP) is in place, a large proportion of hearing impaired infants is identified early. More commonly, congenital hearing loss maybe unrecognized at birth especially if there are no accompanying characteristics associated with a syndrome and/or craniofacial anomalies. Recognition of children with congenital hearing loss is usually at age 1-2 years when the parents or care giver notice a delay in speech and language development.[1]

As early as 1965, the Babbidge Report recommended the development and nationwide implementation of a "universally applied procedure for early identification and evaluation of hearing impairment."[5] However, it was not until 1993 that the National Institutes of Health recommended "all newborns be screened for hearing loss before leaving the hospital."[6] This allowed several newborn hearing screening programs to gain footholds in several states in the US where they were eventually mandated into law.

The objective in establishing a universal newborn hearing screening is to identify as early as possible those infants born with hearing loss. More importantly, after identification, the child should be referred to an otolaryngologist for further evaluation of hearing loss, institution for correct amplification via hearing aids or cochlear implants and rehabilitation with educational and communicative therapies.

Several studies have shown that early identification allows a child with hearing loss to develop good language acquisition and communication skills. A landmark study by Yoshinaga-Itano and Sedey et al in 1998 compared receptive and expressive language abilities in children who were identified at various age groups. This study established the critical period of identification of infants with hearing loss at 6 months of age. Children identified from birth to 6 months of age had significantly higher total language quotients than those children identified at 7 -12 months or older.[7]

In the policy statement of the Joint Committee on Infant Hearing in 2000, the role of the pediatrician and other primary care physicians is to work in partnership with families to have access to general information on child development and specific information on hearing loss and language development.[8]

It is clear that pediatricians and other primary care physicians play a pivotal role in the implementation of the newborn hearing screening programs. As such, it is imperative that they be equipped with adequate awareness of the program and at least basic knowledge on the newborn hearing screening test.

In this study, we determined the awareness and basic knowledge of pediatric and obstetric residents on the newborn hearing screening test. The participants were the pediatric

and obstetric residents of randomly selected tertiary hospitals (private and government) in the National Capital Region. Baseline characteristics of respondents were comparable. Larger proportions of the participants were from private hospitals and were pediatric residents.

Majority of physician respondents in this study claimed that they were aware of the newborn hearing screening program but only about 40% of them had basic knowledge of the hearing screening test itself. Their most common source of information being their fellow doctors that they had interaction with such as colleagues and mentors; other sources of information cited were the teachings from medical school, medical journals, internet and /or television.

This study also shows that pediatric residents were more knowledgeable than obstetric residents. As evidenced by a higher percentage of aware pediatric resident respondents who answered all 5 basic questions correctly (hence, knowledgeable) as compared to obstetric respondents. It is evident also at this point, that more respondents from the pediatric resident group were aware of the hearing screening test. A likely explanation for this is the pediatric residents' close encounter with the newborns and broader knowledge on newborn care as opposed to obstetric residents who are more concerned with maternal care. Although the care of the infants falls within the realm of pediatrics, the obstetricians share this responsibility with the pediatricians during the perinatal period. They are better able to identify potential risk factors for infant hearing loss even before birth and are in the best position to counsel the parents on the necessity of early identification and early intervention provided they have basic knowledge of the newborn hearing screening.

This study also shows that respondents from private institutions are more aware and more knowledgeable than respondents from government hospitals. The probable reason for this is that private institutions are more likely to have the machines used for hearing screening. These private medical centers have the means to procure the ABR or OAE machines. This maybe the reason why some hospitals are able to conduct newborn hearing screening in their institution making their resident staff knowledgeable about newborn hearing screening programs. In contrast, majority of the government hospitals do not have the facilities to conduct newborn hearing screening.

In summary, pediatric residents are more aware and more knowledgeable than obstetric residents on newborn hearing screening. Residents training in private institution seem to be more aware and more knowledgeable than those training in the government institutions. Based on our results, we assume that pediatric residents training in private institutions are more aware and knowledgeable on newborn hearing screening test than their obstetric counterparts.

The proportion of respondents who are aware and knowledgeable of the hearing screening test is only 41.7%. Over-all this represents 35.8% (48 out of 134) of the total number of respondents. This proportion is quite low compared to the 64.2% (86 out of 134) respondents who are either aware but not knowledgeable or neither aware nor knowledgeable of the hearing screening test.

Our findings suggest a need to strengthen the pediatric and obstetric residents' awareness and knowledge on newborn hearing screening. There is a need for education and information dissemination about newborn hearing screening at the level of residency training.

CONCLUSION

Only a small proportion of our respondents were aware and knowledgeable of the newborn hearing screening. Pediatric residents training in private institutions were more aware and more knowledgeable of the hearing screening test.

It is essential for the physician to be aware and knowledgeable about newborn hearing screening to counsel and educate parents about the importance of early identification and intervention of infant hearing loss.

RECOMMENDATIONS

There should be a move to promote newborn hearing screening among primary care physicians. Since half of respondents learned about newborn hearing screening from their fellow doctors, an ENT specialist in their institution should be invited to conduct seminars and demonstrations on newborn hearing screening. Medical journals were also cited as source of information about newborn hearing screening program. More studies on newborn hearing screening should be done.

Upon doing the survey, the author has learned that some physicians has heard of newborn hearing screening only after joining residency training program. In this case, the Philippine Pediatric Society and the Philippine Obstetrics & Gynecological Society have a role in advocating newborn hearing screening to their training institutions. There should be more mention of newborn hearing screening during society meetings and conventions.

The Philippine Society of Otorhinolaryngology – Head and Neck Surgery with

its knowledgeable members should promote the importance of early identification and prompt initiation of intervention. Collaboration with other medical societies and private organizations will enable the society to reach a wider audience.

Efforts should be made by primary care physicians and specialists to convince the local and national health authorities on the value of neonatal hearing screening program in order to convince the latter for support and assistance.

BIBLIOGRAPHY

1. Harrison M, Roush J. Age of suspicion, identification, and intervention for infants and young children with hearing loss: a national study. Ear and Hearing 1996; 17: 55-62.
2. Task Force on Newborn and Infant Hearing. Newborn and infant hearing loss: detection and intervention. Pediatrics Feb 1999; 103 (2): 527-530.
3. Kanne, TJ, Schaefer L, Perkins JA. Potential pitfalls of initiating a newborn hearing screening program. Archives of Otolaryngology – Head and Neck Surgery 1999; 125: 28-32.
4. Philippine Pediatric Society, Inc. Neonatal Hearing Screening. Philippine Pediatric Society Policy Statement series 2004; (1) 5. URL: http://www.pps.org.ph/policy_statements/hearing_screening.pdf
5. Babbidge. Education of the Deaf in the United States: Report of the Advisory Committee on Education of the Deaf. Washington, DC: US Government Printing Office, 1995.
6. National Institute of Health Consensus Statement. Early identification of hearing impairment in infants and young children, 1993; 11(1): 1-24.
7. Yoshinag-Itano C, Sedey AL, Coulter DK, Mehl AL. Language of early and later identified children with hearing loss. Pediatrics. 1998; 102:1161-71.

Joint Committee on Infant Hearing. Year 2000 position statement: principles and guidelines for early hearing detection and intervention programs. 2000; 106(4): 798 – 817.

APPENDIX A

Hearing Test Questionnaire

Name: _____ Age _____ Sex: _____
Civil Status: _____ Year Graduated from Medical School: _____
Institution. _____ Department: _____ Year Level: _____

1 Have you heard of newborn hearing screening?
[ ] Yes
[ ] No
(if your answer is yes please answer the proceeding questions)

2. Where did you here about newborn hearing screening?
[ ] Doctors
[ ] Medical school
[ ] Hospital staff
[ ] Media (medical journals, internet, television)
[ ] Patients
[ ] Others
[ ] I don't know

3 What hearing test for the newborn do you know? _____**

4. Is newborn hearing screening being done in your institution?
[ ] Yes
[ ] Not available

5 When is newborn hearing screening usually administered?**
[ ] Within first 24 hour of life
[ ] First week of life
[ ] First month of life
[ ] First year of life
[ ] During period of language acquisition

6. This test is highly accurate in detecting hearing loss**
[ ] Yes
[ ] No

7. This test is not widely accepted because it is technically difficult to administer**
[ ] Yes
[ ] No

8 This test causes discomfort on the part of the newborn **
[ ] Yes
[ ] No

9 This test is expensive and is an added expense on the part of the patient
[ ] Yes
[ ] No

(** questions pertaining to test the knowledge of respondents)

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 31-38 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

CONDYLAR AUTOGRAFT WITH FIBULAR FREE FLAP FOR MANDIBULAR RECONSTRUCTION*

MINNIE UY-YAO, MD**
SAMANTHA S. CASTANEDA, MD, FPSO-HNS***
JOSELITO F. DAVID, MD, FPSO-HNS***
DANIEL M. ALONZO, MD, FPSO-HNS****

ABSTRACT

DESIGN: Surgical Innovation
SETTING: Academic Tertiary Hospital
OBJECTIVE: The objective of the study was to describe an alternative technique using a condylar autograft in conjunction with a fibular free flap in mandibular reconstruction and to prospectively assess the functional outcome in terms of inter-incisal distance, lateral excursion, maximum protrusion, occlusion, type of diet, speech and mandibular contour.
METHODOLOGY: All patients who underwent segmental mandibulectomy with fibular free flap reconstruction done by one microvascular team from 1997 to 2004 were reviewed. From a total of 38 patients who underwent fibular free flap reconstruction, 7 patients who had condylar disarticulation, rigid fixation using miniplates to the fibula then replacement into the glenoid fossa were identified but 2 patients were excluded due to poor follow-up. Functional outcomes in terms of inter-incisal distance, lateral excursion, maximum protrusion, occlusion, type of diet, speech and mandibular contour were assessed post-operatively. Presence of tumor recurrence was also noted.
RESULTS: Five patients were included in the study. The inter-incisal distance was noted to be 31 mm (± 12.5) with maximum protrusion of 1.4 mm (± 0.9). For those with right hemimandibulectomy (n=2), the right lateral excursion was 2.34mm (±3.3) and left lateral excursion was 1.66mm (± 2.35). For those with left hemimandibulectomy (n=3), the right lateral excursion was 8.17m (±2.25) and left lateral excursion was 3 mm (±2.65). Four out of 5 patients had normal diet with excellent intelligible speech. The same 4 patients had good mandibular contour with a Class I occlusion as assessed by a dentist. The only patient with fair outcome had a mucoepidermoid carcinoma of the floor of the mouth with extensive soft tissue reconstruction aside from the bony reconstruction. No patient had tumor recurrence.
CONCLUSION: The use of condylar autograft in conjunction with fibular free flaps holds promise as a way to restore temporomandibular function in mandibular reconstruction.

INTRODUCTION

Segmental mandibular defects secondary to trauma, malignancy or congenital tumors have a major impact on form and function of the lower face. Without reconstruction, mastication, deglutition, speech and cosmesis may be severely affected. Defects of the mandibular symphysis, body and ramus have been adequately addressed by osseous free flap reconstruction.[1] However, in some cases, the resection is high up on the ramus leaving only a small piece of condyle. For such cases, several options have been reported in the literature. Nahabedian advocated in situ plating of the condyle to the fibula to preserve the blood supply to the condyle.[2] Hidalgo would remove the condyle and plate it to the fibula. He would place a suture around the joint capsule edge and tie it around the condyle. He maintained the patient on intermaxillary fixation for 10 to 14 days post-operatively.[3,4] Wax, on the other hand, would just contour the end of the fibula, attach a permanent suture through the articular disk to anchor the neo-condyle in the joint space. They had two cases of plating the condyle to the fibula but noted no functional benefit for the patient.[5]

Is there an alternative technique of reconstruction of high mandibular ramus defects without tumor involvement of the condyle? This

*1st Place, PSO-HNS Poster Session on Surgical Innovation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Jose R. Reyes Memorial Medical Center
***Fellow, Head and Neck Microvascular Training Consortium
****Chairman, Department of Otorhinolaryngology-Head and Neck Surgery, The Medical City Hospital

paper presents our technique of reconstruction using the condyle as an autograft without suturing of the capsule or post-operative intermaxillary-mandibular fixation. The potential advantages of this technique are:

1) Use of the condyle with its unique shape and exact fit into the glenoid fossa would minimize dislocation from the fossa.

2) Technically easier application of rigid fixation

3) Facilitates inspection to determine presence of gross tumor pathology in the condyle

4) Shorter operating time

5) Faster oral rehabilitation

General Objective

The purpose of this paper is to report our experience in mandibular reconstruction using condylar autograft with fibular free flap.

Specific Objectives

To assess functional outcomes of our patients based on interincisal distance, lateral excursion, maximum protrusion, occlusion, type of diet, speech, mandibular contour and presence of tumor recurrence.

Significance of the Study

The significance of the study is to offer an alternative method of reconstruction for patients with tumor involvement of high ascending ramus but with oncologically safe condyle.

PATIENTS AND METHODOLOGY

Charts of patients who underwent segmental resection of the mandible with fibular free flap reconstruction by one microvascular team from 1996 to 2004 were reviewed. Patients whose tumor-free condyles were resected, fixed to the end of the fibular free flap and inset into its native position within the glenoid fossa were identified. From a total of 38 fibular free flap mandibular reconstructions, 7 underwent condylar autograft but 2 patients were excluded due to poor follow up.

Reconstructive Technique

A two-team approach was used for all cases. One team extirpated the tumor and the other team simultaneously harvested the fibula. The excision team used a visor incision to expose the mandible. A subperiosteal dissection was utilized to expose the tumor. (Figure 1) Care was taken to dissect the articular cartilage off the condyle to decrease bleeding and preserve the articular cartilage. In all cases, the articular disc was preserved. Once the tumor was resected, the reconstruction team assessed oncological margins (Figure 2) thru gross inspection of the condyle and the quality of the bone, discarding the condyle when in doubt.

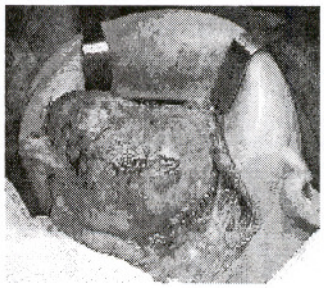


FIGURE 1: Dissection of tumor

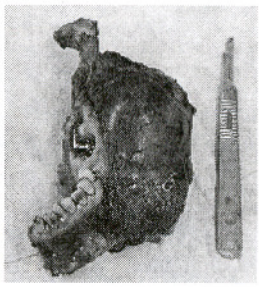
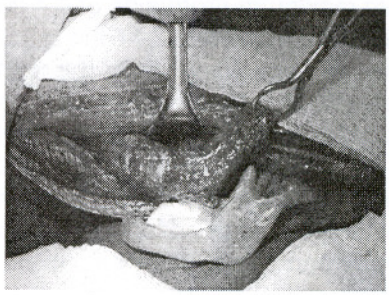


FIGURE2: Resected part of the mandible with condyle attached

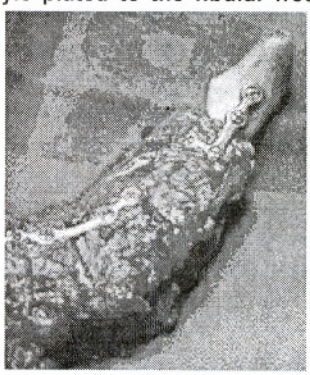
A pre-fabricated mandibular template was used to help in contouring the fibula with closing osteotomies (Figure 3) and to duplicate the height of the contralateral mandible. If tumor-free, the condyle was resected from the diseased mandible

Figure 3
Mandibular template with contoured fibula



and plated to the fibula. (Figure 4) At least 1 cm of tumor-free condyle had to be preserved to allow rigid fixation with at least two screws and one or two straight miniplates or an L plate to the fibula in the sagital plane.

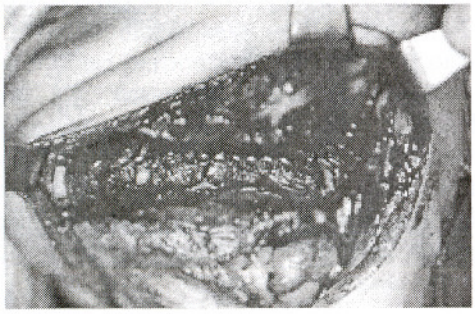
FIGURE 4
Condyle plated to the fibular free flap



An occlusal splint and intermaxillary-mandibular fixation was used in all patients to

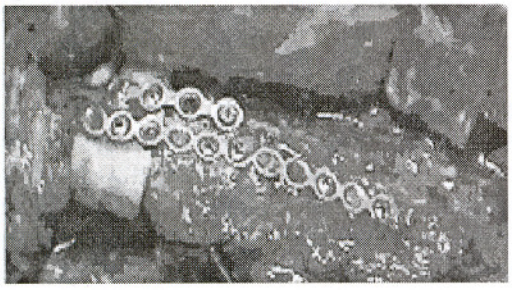
maintain pre-operative occlusion. The fibula with the condyle was then inserted into the glenoid fossa. (Figure 5) No retention suture was placed nor periosteum draped over the condyle since the articular disk was left intact. The lateral pterygoid

FIGURE 5
Condyle with fibula replaced into glenoid fossa



muscle was not re-attached to the condyle. The other end of the fibula was then plated to the native mandible. (Figure 6) Microvascular anastomosis of peroneal artery and vein to recipient vessels in the neck were done. Intermaxillary-mandibular fixation

FIGURE 6
Fibula plated to native mandible

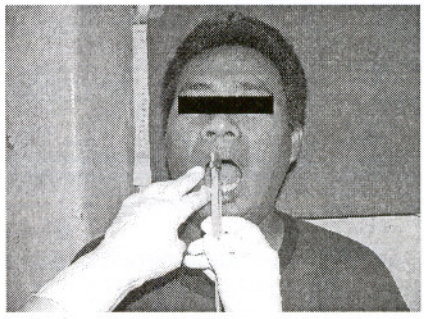


was removed after rigid fixation of the fibular free flap to the mandible. The reconstructed mandible was opened and closed to verify stability of occlusion, rigid fixation and condylar position in the glenoid fossa. A nasogastric tube was used for feeding until all mucosal incisions were healed. Patients were not referred to rehabilitation medicine for oral rehabilitation.

All 5 patients included in the study were evaluated on follow-up based on the following parameters to assess functional outcome:

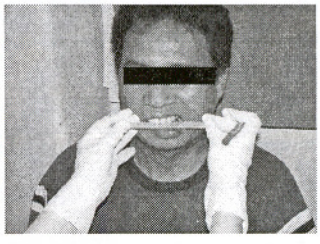
1. *Inter-incisal distance* – measured using a Vernier caliper from the incisal edges of the right maxillary and mandibular central incisor at the midline. If the midlines were not coincident, the distance was measured between the mid-incisal edges of the most centrally located right central incisor and its corresponding tooth on the opposing arch. If the patient is edentulous, the distance was measured from the edge of the alveolar ridges. Ten mm was subtracted from the measured distance to correct for the loss of the central incisor of one jaw.[6] All measurements were taken 3 times and the average was noted. (Figure 7)

FIGURE 7
Measurement of interincisal distance using a Vernier caliper



2. *Lateral excursion* – measured using a Vernier caliper. The patient was asked to bite and a line corresponding to the midline between the upper incisors were drawn on the labial surface of the opposite lower incisor. It is the largest horizontal movement of the patient's lower jaw as the patient moves the jaw from centric occlusion to maximum voluntary left or right laterotrusion while maintaining contact between maxillary and mandibular teeth[7] (Figure 8)
   - *Right lateral excursion* – distance from midline as the patient is asked to move his lower jaw towards his right shoulder
   - *Left lateral excursion* – distance from the midline as the patient is asked to move his lower jaw towards his left shoulder

FIGURE 8
Measurement of left lateral excursion



3. *Maximum protrusion* – the distance between the edge of the upper central incisor and the edge of the lower central incisor as the patient was asked to move his lower jaw as forward as possible
4. Type of diet[8]
   a. Normal diet

b. Minced food
c. Fluids
d. Tube feeding

5. Speech[8]

Factor	A. By Family	B. By the Doctor
Clearly understood	5 points	5 points
Occasionally misunderstood	4 points	4 points
Understood only when subject is known	3 points	3 points
Occasionally understood	2 points	2 points
Never understood	1 point	1 point

Scoring for A and B	Intelligibility
8 to 10 points	Excellent intelligible speech
5 to 7 points	Moderately intelligible speech
4 points and less	Poorly intelligible speech

6. Occlusion – maintenance of proper occlusion noted by a dentist
7. Mandibular Contour – by the patient[9]
   a. good
   b. fair
   c. bad
8. Presence or absence of recurrence of tumor

RESULTS

Five patients who underwent mandibular resection with reconstruction using fibular free flap with condylar autograft were evaluated. The patients' age, sex, diagnosis and operation done are listed in Table 1.

TABLE 1
Patients' Demographics

Name	Age/Sex	Diagnosis	Operation
J.R.	23/M	Ameloblastoma, Right	Segmental mandibulectomy (RBSh*) with fibular osseous free flap reconstruction (1/9/04)
A.C.	26/F	Ameloblastoma, Left	Segmental mandibulectomy (RBSh*) with fibular osseous free flap reconstruction(11/7/03)
M.B.*	39/F	Mucoepidermoid carcinoma T4N0M0, floor of mouth, Stage IV	Tracheostomy, Wide excision with segmental mandibulectomy (RBSB,L,FOM^{A},C^{M},C^{LL} total*), Right with fibular osteocutaneous free flap - deltopectoral flap reconstruction (8-16-02) Soft tissue defect: 5 x 8 cm
R.Z.	32/M	Ameloblastoma, Left	Segmental mandibulectomy (RBSh*) with fibular osseous free flap reconstruction (8/20/02)
T.A.	9/F	Ameloblastoma, Left	Segmental mandibulectomy (RB*) with fibular osseous free flap recon (6/5/01)

*Classification of mandibular and soft tissue defects by Urken (1991) [10]
R – ramus B – body Sh – hemisymphysis S-symphysis L – labial mucosa
FOM^{A} – floor of mouth anterior C^{M} – cutaneous defect, mentum
C^{LL} total – cutaneous defect, lower lip, total

* Patient underwent radiation therapy

Average length of operation was 11 hrs 57 minutes and average length of hospital stay was 17 days. Nasogastric tube was removed at an average of 12 days post-operation. All flaps survived. No patient experienced post-operative displacement of the condyle out of the glenoid fossa.

The post-operative assessment of function was at 8 months to 39 months (average of 22 months).(Table 2)The inter-incisal distance was noted to be 31 mm with standard deviation of ± 12.5 mm. Maximum protrusion was 1.4 ± 0.9 mm. For those with right hemimandibulectomy (n=2), the right lateral excursion was 2.3 ± 3.3 mm and left lateral excursion was 1.66 ±2.35 mm. For those with left hemimandibulectomy (n=3), the right lateral excursion was 8.17 ±2.25mm and left lateral excursion was 3 ± 2.65 mm.

TABLE 2
Mandibular movements measurements (mm) of patients N = 5

Name of Patient	Interincisal Distance	Lateral Excursion		Maximum Protrusion	Laterality of Defect
		Right	Left		
J.R.	28	4.67	3.33	1	Right
A.C.	24	6	0	2	Left
M.B.	16	0	0	0	Right
R.Z.	40	10.5	5	2	Left
T.A.	47	8	4	2	Left

Four patients were able to tolerate normal diet. Maxillary-mandibular jaw relations were restored to normal in these patients as assessed by a dentist. The same 4 patients had excellent intelligible speech. Mandibular contour was judged by these 4 patients to be good although they noted slight asymmetry of the soft tissue defect. (Figure 9 & 10) There was no evidence of recurrence in all 5 patients.

FIGURE 9
Patient R.Z. pre-operation (A) and 25 months post-operation with good facial symmetry(B)

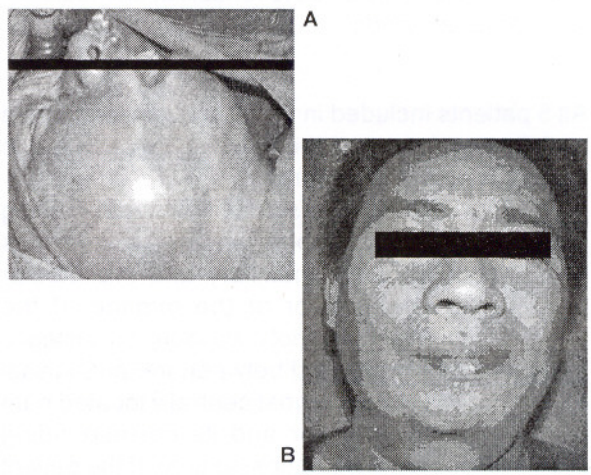
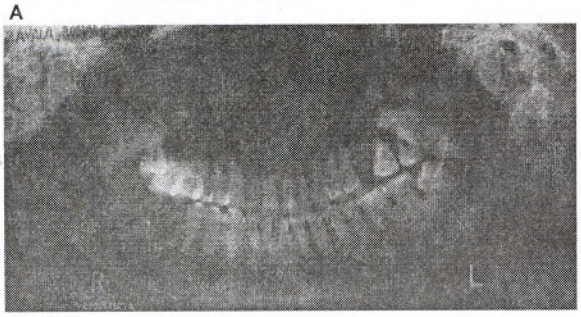
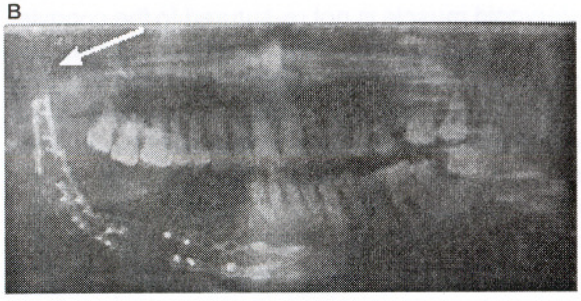


FIGURE 10
Panorex of R.Z. pre-operation (A) and 16 months post-operation showing good bony continuity and condylar head (white arrow) in the glenoid fossa (B)

A

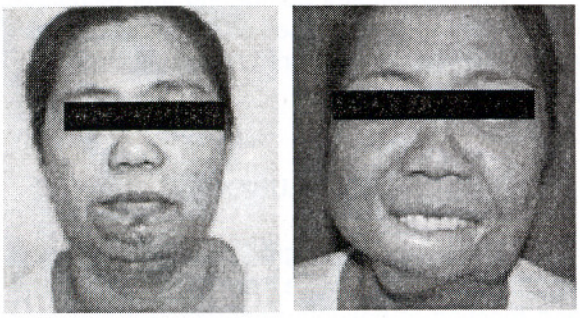


B



One patient (M.B) with a continuous defect of the floor of the mouth, lower lip, mandible and mentum from excision of mucoepidermoid carcinoma underwent reconstruction using an osteocutaneous fibular free flap. The lip defect was reconstructed with a rotation-advancement flap, but dehiscence necessitated a secondary Deltopectoral flap. Patient underwent post-operative radiotherapy. The patient assessed her mandibular contour after 25 months as fair due to bulging soft tissue and incisional scars. Post-operative panorex showed good bony contour with union of the osteotomized fibula to the native mandible with only 1 remaining 2nd mandibular molar on the left side, the patient can only tolerate a soft diet and only had moderately intelligible speech. (Figure 11) The functional outcome in this patient may have been affected by the concomitant large soft tissue reconstruction.

FIGURE 11
Patient M.B. pre-operation (right) and 25 months post-operation (left)



DISCUSSION

The merits of the fibular free flap for mandibular reconstruction have been extensively documented in literature. [8,10,11,12,13] However, reconstruction of the temporomandibular joint (TMJ) still poses some difficulties. The TMJ is a unique diarthrodial joint. The TMJ, by definition, is the articulation between the condyhead of the mandible and the articular fossa and eminence of the temporal bone.[14] The condylar head of the mandible is separated from the glenoid fossa by a cartilaginous articular disc.[3] The condyle has a modified barrel shape and is perpendicular to the ascending ramus of the mandible with its long axis 10-30Ú posterior to the frontal plane.[15]

There are many options available in reconstructing the temporomandibular joint. Alloplastic joints are said to allow a closer reproduction of the normal anatomy of the joint (with restoration of the vertical dimension), avoidance of donor site morbidity, reduction in operating time and reduction in the chance of recurrent ankylosis.[16] But some report prosthesis extrusion, migration, plate exposure, erosion through the skull base and glenoid fossa resorption.[17,18] Titanium prosthesis may be used in instances where the patient cannot withstand prolonged general anesthesia, peripheral vascular disease limits the success of a free flap and/or technical expertise is unavailable.[19]

Autogenous bone grafts have also been used to reconstruct the TMJ. Costochondral grafts are the most widely accepted technique because of biologic compatibility, workability, functional adaptability and minimal additional detriment to the patient.[16] Others say that costochondral grafts have the disadvantage of additional donor site, poor tissue quality and difficulty in sculpting the graft.[20] Cartilaginous overgrowths have also been noted.[21]

Carlson stated that leaving behind at least 1 cm of condyle is needed to be able to secure the bony reconstruction to the remaining condyle. Less than 1cm of condyle would not assist bony reconstruction of the mandible nor would this small volume of bone favorably affect mandibular function.[22] In our study, all patients had at least a minimum of 1 cm of condyle re-attached to the fibular free flap.

Nahabeedian advocated in-situ plating of the fibular free flap to the condyle. This is to preserve TMJ function, increase accuracy of bony reconstruction and to preserve the blood supply to the condyle.[2] Hidalgo, on the other hand, would resect the condyle and re-implant it as a non-vascularized graft. This is for easier rigid fixation to the condyle especially in cases wherein only a small portion of the condyle is left. He places a suture on the edge of the capsule and tightened

around the condyle to keep the condyle in place. Patients are kept in intermaxillary-mandibular fixation for 10 to 14 days to prevent post-operative dislocation of the condyle.[3] Wax recommended fibular contouring with transposition directly into the glenoid fossa since replacing the condyle into the joint resulted in displacement of the condyle out of the fossa.[5] (Table 3)

TABLE 3
Comparison of reconstructive options for TMJ Reconstruction

Author	Method of reconstruction of TMJ	Suture around capsule	IMMF post-operation
Nahabeedian, 2001[2] N = 2	Condyle plated in-situ	None	1 week
Hidalgo, 1994[3] N = 14	Condyle removed then plated to fibula	Yes	7 to 10 days
Wax, 2000[5] N = 17	Fibula contoured as neo-condyle	Yes	None
Our study N=5	Condyle removed then plated to fibula	*None*	*None*

In our study, the condyle was removed along with the specimen for easier inspection for possible tumor involvement. It also afforded easier placement of miniplates for rigid fixation. Since in all cases rigid fixation was achieved, maxillary-mandibular fixation was not needed. The maintenance of the mandibular height, angulation of the ramus and presence of soft tissue around the condyle contributed to the prevention of possible dislocation from the glenoid fossa. The use of the condylar head with its unique shape and good fit into the glenoid fossa was supposed to maintain the range of TMJ and mandibular function as assessed by the interincisal distance, lateral excursion and maximal protrusion.

Our patients had interincisal distance of 31mm (±12.5mm) which allows for adequate intake of food per os Four of the five patients had normal diet and excellent intelligible speech. Normal values for interincisal distance are varied ranging from 35-75mm for women and 40-59mm for men. There was variability in interincisal distance between the sexes, among people of different ages, different body sizes and among individual subjects.[23,24] All patients did not undergo post-operative mouth opening rehabilitation which could have helped in improving the mouth opening of the patients. Interincisal distance of patients in other studies was comparable with our results. (Table 4)

TABLE 4
Comparison of Average Interincisal distance (mm) by different authors

Author	Number of Patients	Interincisal Distance
Nahabeedian, 2001[2]	2	40
Hidalgo, 1994[3]	14	37
Wax, 2000[5]	17	34
Our study	**5**	**31**

For those with right hemimandibulectomy (n=2), the right lateral excursion was 2.34mm (±3.3) and left lateral excursion was 1.66± (2.35) mm. For those with left hemimandibulectomy (n=3), the right lateral excursion was 8.17m (±2.25) and left lateral excursion was 3 mm (±2.65). This can be explained by the fact that the lateral pterygoid muscle was not re-attached to the condyle. The lateral pterygoid is responsible for lateral and protrusive movements of the mandible. When 1 muscle acts alone, the head of the mandible on that side is drawn forward allowing the chin to slide forward to the opposite side.[25] Thus, the jaw would deviate towards the reconstructed side if the lateral pterygoid muscle is not re-sutured to the condyle. This was seen in our patients with reconstruction of the right hemi-mandible although there was only 1 patient in this group of patients who had lateral excursion values. But for patients with reconstruction of the left hemi-mandible, the mandible was noted to be drifting to the right. This could be explained by the fact that the resection involved not only the condylar area. The ramus and body was also involved in the resection thus disrupting the muscle attachments and ligaments to these areas of the mandible. This could lead to fibrosis thus limiting movement of the mandible.[3] Collins advocated re-attachment of the lateral pterygoid muscle to the condylar neck to restore normal lateral excursion and protrusive movements.[25]

Four of the 5 patients had good mandibular contour and mandibular-maxillary relation was restored to normal as assessed by a dentist. Thus, with proper orientation of the condyle within the glenoid fossa, patients are restored to their pre-morbid functional status in terms of aesthetics and occlusion.

One patient (M.B.) with osseous and large soft tissue reconstruction involving the lip, mentum and floor of mouth had limited mandibular movements possibly due to soft tissue fibrosis, which may have been further aggravated by radiotherapy. A similar case was note by Hidalgo.[3] Oral incontinence and presence of only 1 tooth further prevented a return to normal diet.

Further studies comparing this technique with fibular contouring based on functional outcome and studies on condylar graft revascularization are recommended.

CONCLUSION

The condylar autograft in fibular free flaps is an effective way to restore mandibular movements and function in patients undergoing mandibular

reconstruction for conditions sparing at least 1cm of normal condyle.

BIBLIOGRAPHY

1. Hidalgo DA and Pusic AL. Free Flap Mandibular Reconstruction: A 10-year Follow-up Study. Plastic and Reconstructive Surgery.110(2):438-449,2002.

2. Nahabedian MY, Tufaro A and Manson PN. Improved Mandibular Function after Hemimandibulectomy, Condylar Head Preservation and Vascularized Fibular Reconstruction. Annals of Plastic Surgery. 46 (5) : 506-510.2001.

3. Hidalgo DA. Condyle Transplantation in Free Flap Mandible Reconstruction. Plastic and Reconstructive Surgery. 1994. Vol 93 (4) : 770-781.

4. Cordeiro PG, Disa JJ, Hidalgo DA and Hu QY. Reconstruction of the Mandible with Osseous Free Flaps: A 10-Year Experience with 150 Consecutive Patients. Plastic and Reconstructive Surgery. 104 (5): 1314-1320. 1999.

5. Wax MK, Winslow CP, Hansen J et al. A Retrospective Analysis of Temporomandibular Joint Reconstruction with Free Fibula Microvascular Flap. Laryngoscope. 110 (June): 977-981.2000.

6. Wagner,JD, Coleman,JJ, Weisberger, et al. Predictive Factors of Functional Recovery after Free Tissue Transfer Oromandibular Reconstruction. American Journal of Surgery. 1998;176(5):430-435.

7. Hatch JP, Van Sickels JE, Rugh JD et al. Mandibular range of motion after bilateral sagittal ramus split osteotomy with wire osteosynthesis or rigid fixation. ral Surgery Oral Medicine Oral Pathology. 2001.Vol 91 (3) : 274-280.

8. Kimata Y, Sakuraba M, Hishinuma S et al. Analysis of the Relationships between the Shape of the Reconstructed Tongue and Post-operative Functions after Subtotal or Total Glossectomy. Laryngoscope. 2003; Vol 113 (May) : 905- 909.

9. Takushima A, Harii K, Asato H et al. Mandibular Reconstruction using Microvascular Free Flaps : A Statistical Analysis of 178 Cases. Plastic and Reconstructive Surgery, 2001, 108(6).1555-163.

10. Urken ML, Weinberg H, Vickery C, Buchbinder D, Lawson W, Biller HF. Oromandibular reconstruction using microvascular composite free flaps : report of 71 cases and a new classification scheme for bony, soft tissue and Neurologic defects. Archives of Otolaryngology-Head and Neck Surgery. 1991. Vol 117 : 733-744.

11. Disa JJ, Pusic AL, Hidalgo DH, Cordeiro PG. Simplifying Microvascular Head and Neck Reconstruction : A Rational Approach to Donor Site Selection. Annals of Plastic Surgery. 2001. Vol 47(4) : 385-389.

12. Blackwell KE. Unsurpassed Reliability of Free Flaps for Head and Neck Reconstruction. Archives of Otolaryngology Head and Neck Surgery. 1999. Vol 125 (March) : 295-299.

13. Urken ML, Buchbinder D, Constantino PD, Sinha U, Okay D, Lawson W and Biller HF. Oromandibular Reconstruction using Microvascular Composite Flaps . Archives of Otolaryngology-Head and Neck Surgery. 1998. Vol 124 (Jan) : 46-55.

14. Stuteville OH and Lanfranchi RP. Surgical Reconstruction of the Temporomandibular Joint.American Journal of Surgery.1955.Vol 90 :940-950.

15. Hayt MW, Abraham JJ,Blair J. Magnetic Resonance Imaging of the Temporomandibular Joint.Topics in Magnetic Resonance Imaging.2000. Vol 11(2) :138-146

16. Saeed NR, Hensher R, McLeod NM and Kent JN. Reconstruction of the Temporomandibular Joint autogenous compared with alloplastic. British Journal of Oral Maxillofacial Surgery. 2002.Vol 40: 296-299.

17. Patel A, Maisel R. Condylar prosthesis in head and neck cancer reconstruction. Archives of Otorhinolaryngology-Head and Neck Surgery.2001. Vol 127:842-846.

18. Wolford LM. Temporomandibular joint devices: treatment factors and outcomes. Oral Surgery Oral Medicine Oral Pathology Oral Radiology Endodontics. 1997. Vol 83 (Jan) : 143-149.

19. Daniel E and Brown JD. Minimizing complications in the use of titanium condylar head reconstruction prosthesis. Otolaryngology-Head and Neck Surgery.2004.Vol 130: 344-350.

20. Weng Y, Cao Y, Silva CA et al. Tissue engineered composites of bone and cartilage for mandibular condylar reconstruction. Journal of Oromaxillofacial Surgery. 2001. Vol 59 : 185-190.

21. Peltomaki T, Quevedo LA, Jeldes G et al. Histology of surgically removed overgrown osteochondral rib grafts. Journal of Cranio-Maxillofacial Surgery. 2002. Vol 30 : 355-360.

22. Carlson ER. Disarticulation resection of the mandible :a prospective review of 16 cases. Journal of Oromaxillofacial Surgery. 2002. Vol 60 : 176-181.

23. Zawawi KH, Al-Badawi EL, Lobo-Lobo S et al. An index for the measurement of normal maximal mouth opening. Journal of Cancer Dental Association. 2003. Vol 69(11) : 737-741.

24. Fukui T, Tsuruta M, Murata K et al. Correlation between facial morphology, mouth opening ability and condylar movement during opening-closing jaw movements in female adults with normal occlusion. European Journal of Orthodontics. 2002. Vol 24 : 327-336.

25. Collins CP, Wilson KJ and Collins PC. Lateral pterygoid myotomy with re-attachment to the condylar neck :an adjunct to restore function after total joint reconstruction. Oral Surgery Oral Medicine Oral Pathology Oral Radiology Endodontics. 2003. Vol 95 : 672-673

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos 1-2 39-43 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

THE RHOMBOTRAPEZIUS MYOCUTANEOUS FLAP: SURGICAL INNOVATION FOR CLOSURE OF WIDE AND DEEP TEMPORO-FACIAL DEFECTS*

DANILO R. LEGITA, MD**
ARMANDO M. CHIONG JR., MD, FPSO-HNS***
NATHANIEL W. YANG, MD, FPSO-HNS***

ABSTRACT

OBJECTIVE: To present two cases in which an improved rhombotrapezius flap design was utilized maximally to cover a wide and deep surgical defect after extirpation of a malignant tumor in the temporo-facial area.
SETTING: Tertiary Hospital.
PATIENTS AND METHODOLOGY: Two cases of malignancy involving the temporo-facial area of the head are presented. Surgical design for the reconstruction of this defect using rhombotrapezius flap is presented.
RESULTS AND DISCUSSION: Large and deep temporo-facial defects are adequately closed by rhombotrapezius flap with adequate tissue coverage. Surgical design proved to be acceptable with good flap take and overall cosmetic result.
CONCLUSION: Rhombotrapezius flap can be used to cover a large deep defect and can provide more than adequate tissue coverage and bulk to any temporo-facial defects.

INTRODUCTION

A number of reconstructive surgical techniques have been developed to cover the wide variety of head and neck tumors that, through time and experience, have become more resectable. Examples of flaps used to cover large and debilitating facial defects are the myocutaneous pectoralis major, trapezius, and latissimus dorsi flaps. Also included are the osteomyocutaneous flaps implementing the scapula, sternum, fibula, rib, and iliac crest bones for surgeries involving a mandibulectomy.

The study presents the utilization of a rhombotrapezius myocutaneous flap to provide the bulk needed for greatest coverage of very large facial defects, while providing the patient with an enhanced cosmetic result. Surgical design was made to maximize the flap to be used. Comprehensive review of local journal databases revealed no documentation of this design by any local plasic or reconstructive surgeon.

Related Anatomy

A flat, triangulated muscle, the trapezius envelops the back of the neck and the shoulder area. Its function is in the rotation of the scapula, and without it, one cannot fully abduct the upper extremity Its origin is from the medial third of the superior nuchal line of the occipital bone, the external occipital protuberance, the ligamentum nuchae, the spine of the seventh cervical vertebra, the spines of all of the thoracic vertebrae, and the corresponding supraspinous ligament. From its origin at the inferior ligamentum nuchae and the spinous processes of C7 and T5, the rhomboid minor muscle inserts at the root of the scapular spine. It is located superiorly in relation to the greater rhomboid muscle, which in turn first appears at the spines of the T2 to T5 vertebrae, and their corresponding supraspinous ligament. The greater rhomboid muscle is oriented inferolaterally and inserts itself at the medial border of the scapula sandwiched between the triangular surface at the root of the scapular spine above and the inferior angle of the scapula below. The rhomboid muscles act together to abduct the scapula by drawing it medially towards the direction of the vertebral column. Both lend support to the scapula by elevating it, especially in instances when there is

*2nd Place, PSO-HNS Poster Session on Surgical Innovation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, University of the Philippines-Philippine General Hospital
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, University of the Philippines-Philippine General Hospital

weight placed on the shoulder. The lower division of the greater rhomboid muscle swivels the scapula around to depress its lateral angle, thereby accomplishing the abduction of the upper extremity.

As to blood supply, the transverse cervical artery branches from the thyrocervical trunk in 80% of cases, and terminates at the anterior border of the levator scapulae. It is divided into superficial and deep branches. In around 20% of cases, the superficial branch of the transverse cervical artery is found to originate separately, from the subclavian artery. Superiorly, this superficial branch courses over the levator scapulae, and then goes on to pass along the deep side of the trapezius. At the level of the deep fascia of the trapezius, it separates into ascending and descending branches. The descending branch supplies blood to the lower trapezius muscle and is found to descend along the underside of the mid- to lower portions of the trapezius and ends deep in the rhomboid muscle. A branch of the second or third part of the subclavian, the dorsal scapular artery, courses along the deep surface of the rhomboid muscles on its way to the scapula. Here, the dorsal scapular artery anastomoses with branches of the suprascapular and subscapular arteries to supply blood to the scapula. The spinal accessory nerve and direct branches of the ventral rami innervate the trapezius muscle. In the case of the rhomboids, the dorsal scapular nerve, a branch of the brachial plexus mainly derived from the 5th cervical nerve, provides the sole innervation. The nerve courses inferiorly and deep to the levator scapulae and enters the rhomboid muscles along the medial scapular border.

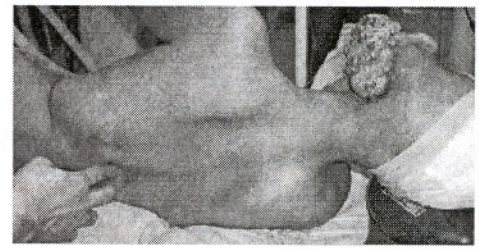
PATIENTS

Case No. 1

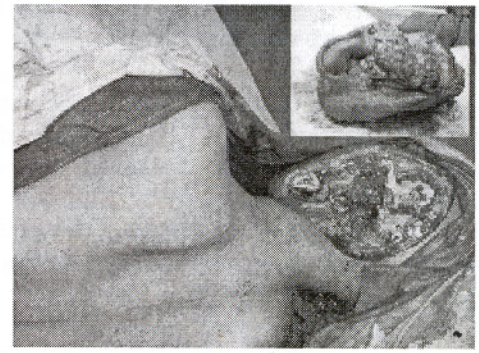
N.H. is 46/F who 5 years ago was diagnosed to have adenoid cystic CA of the left parotid. She had undergone a wide excision, neck dissection with reconstruction under general anesthesia and radiotherapy for 25 days at a tertiary hospital. After only a year, there was a recurrence of the left parotid tumor with the same characteristics as the previous one. The patient however did not seek consult at this time. Five months prior to admission, rapid growth of the mass with associated skin changes and purulent left ear discharge finally prompted consult. On CT scan, the mass was seen to invade the left temporal bone. The plan was to do a Temporal Bone Resection with Trapezius Flap Reconstruction/GA. Patient was subsequently admitted and underwent wide excision.

Illustrations CASE 1

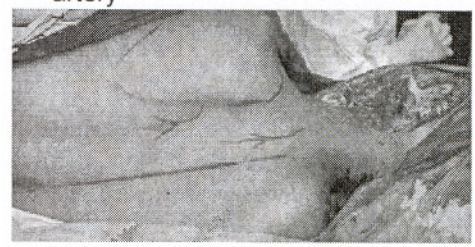
A. Patient intraoperatively in a lateral decubitus position



B. After the wide excision and temporal bone resection

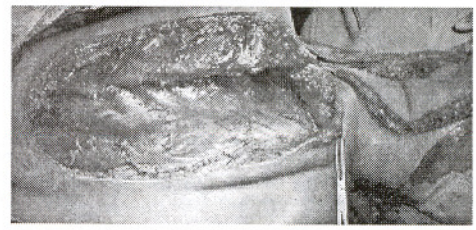


C. Marks showing the area of the dorsal scapular artery and transverse cervical artery

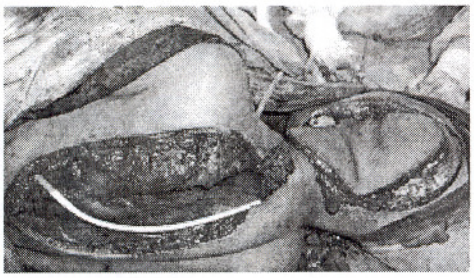


D. The size of the cutaneous island flap proposed

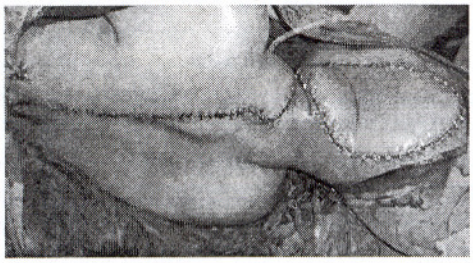
E. After harvesting the flap, showing the defect of the donor site



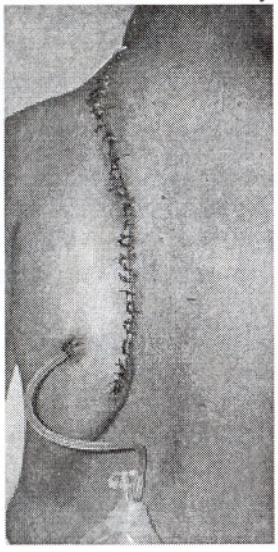
F. Adequate tissue coverage of the defect



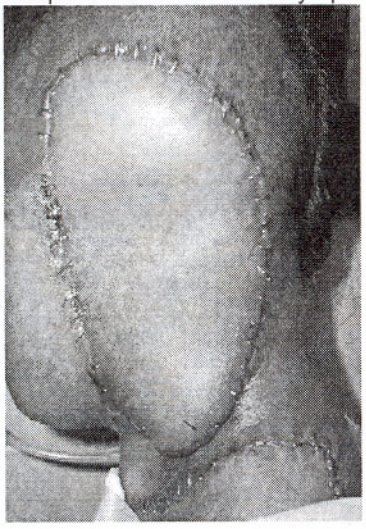
G. Primary closure of the donor and recipient sites



H. The donor site at seven days post-op



I. Recipient site at seven days post-op

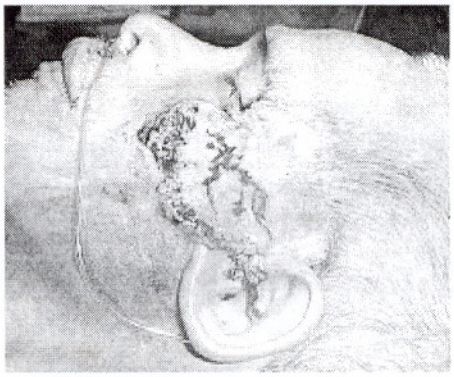


Case No. 2

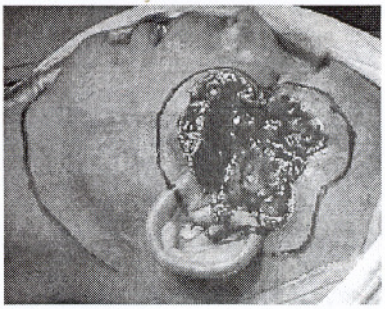
65/M, vagrant brought by nuns with a malar mass; biopsy done showed Basal Cell Carcinoma of the left Malar area with extension to the Left Temporal area. The plan for this patient was wide excision with shaving of the lateral and anterior wall of the maxilla with reconstruction using the rhombotrapezius flap for soft tissue coverage.

Illustrations CASE 2

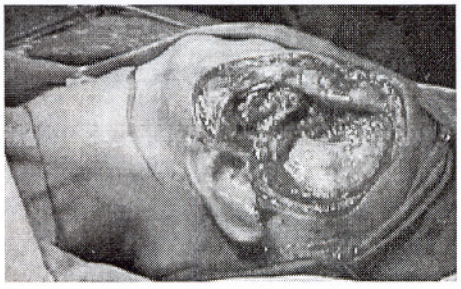
J. Patient intraoperatively showing the mass



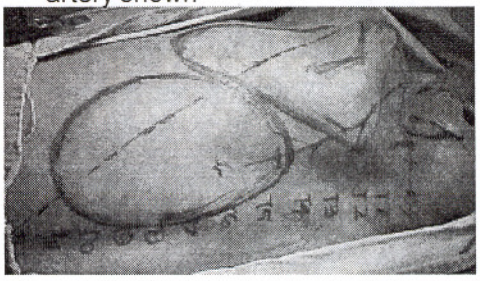
K. Margin for excision



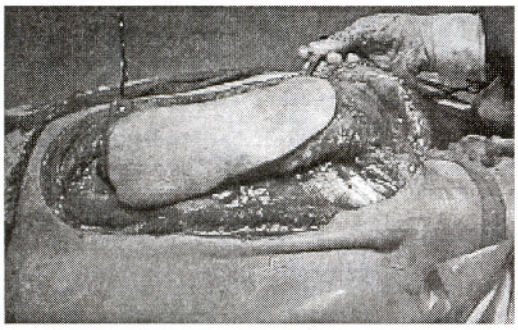
L. Defect after the excision



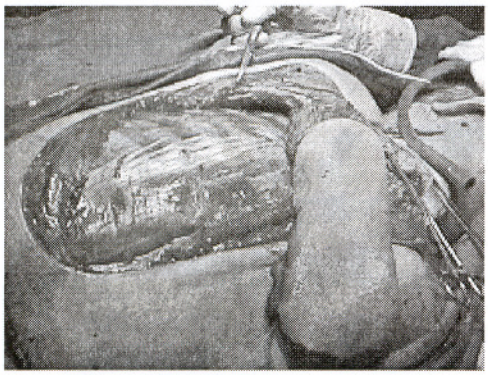
M. The size of the cutaneous island flap proposed, marking for transverse cervical artery shown



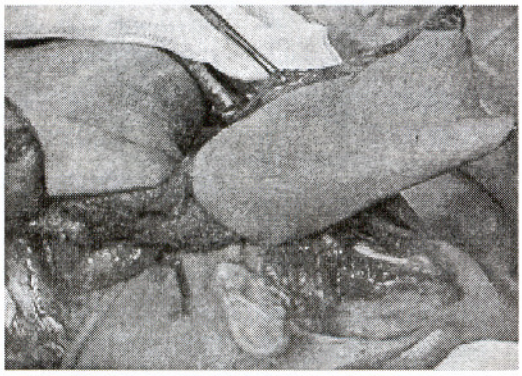
N. After harvesting the flap, showing the defect of the donor site



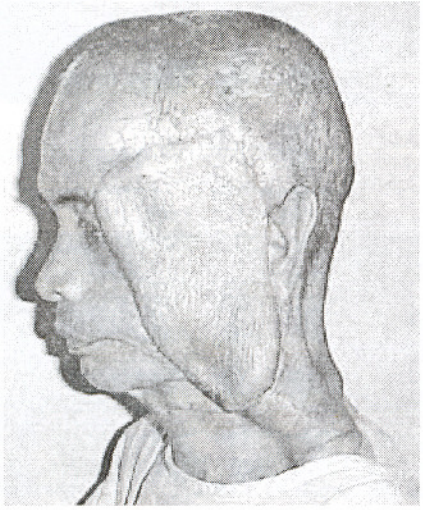
O. Donor site defect



P. Lifting of the flap



Q. Patient postoperatively



RESULTS AND DISCUSSION

Surgical Technique

These two patients were positioned in lateral decubitus for optimal access to the tumor and ipsilateral shoulder blade and back area. The defect created after excision in the first case left a 16 x 14 cm defect. A similar defect was obtained on the second case, reduced by approximately 25-30 percent in diameter with mobilization. The patient's free arm and shoulder were extended anteriorly to "enlarge" the skin over the scapula, and the surgical defect of the head and neck marked and matched with skin between medial edge of scapula and spine. The lower margin was marked 4-5 cm from lower point of scapula (beyond this, the flap was assumed to have a random blood supply). A big area of cutaneous flap was designed (See figure). A skin incision was made around the island flap. The flap was elevated inferiorly and laterally, deep to the rhomboid muscles to protect dorsal scapular artery. The flap was transposed to the head and neck defect and the donor site closed primarily. Separate surgical drains were placed in the neck and back. There was good graft take on both patients, with no significant complications.

The rhombotrapezius flap was first described by Baek, (1980) and subsequently adapted by Krespi, (1988). The table compares the modifications of Krespi with the present study.

Comparing to Other Author

Features	Krespi 1988	Present Design 2004
Trapezius muscle utilized	Inferior fibers	Mostly inferior fibers with part of superior fibers
Blood Supply	Descending branch of transverse cervical artery and dorsal scapular artery	Descending branch of transverse cervical artery and dorsal scapular artery
Location of Cutaneous Island	Overlying the inferior fibers of the trapezius muscle near medial border of scapular blade	Overlying almost both the superior and inferior fibers
Bony Component Utilized	Medial border of shoulder blade	None
Effect on Shoulder function	Marked dysfunction, winging of the scapula due to loss of supportive musculature of scapula	winging of the scapula due to loss of supportive musculature of scapula
Other Structures included	Rhomboid Muscle	Rhomboid minor and major muscles
Arc of Rotation	Wide	Wide
Tissue bulk	Adequate	Adequate
Sacrifice of CN XI	No	No

Advantages and Disadvantages

The advantages of a rhombotrapezius myocutaneous flap in these cases were many. Firstly, in the case of the female patient in case 1, the anterior chest was left undisturbed, thereby preserving the breasts of the woman. In her case, a deformity in her back was definitely more acceptable than an anterior chest wall deformity, because as a donor site it is also easily hidden from view. The flap was described as thin, long, pedicled, and hairless (it can be used alone or with an accompanying bone graft). The graft was also easy to elevate, coming from a non-irradiated donor site. There was added length and a greater arc of rotation, as well as greater bulk coming from the rhomboid musculature. The skin of the back provided a better color match, and in men sometimes has less hair than the chest area. Blood supply, particularly the dorsal scapular artery is more protected as you lift the flap. Finally, primary closure of donor site was possible. Similar advantage is noted with the second case.

The disadvantages of the rhombotrapezius myocutaneous flap were few as compared to the advantages. First, at the operating room, the patient will have to assume an awkward surgical position. Greater tension in the donor suture line can cause delayed healing, but this is preventable with the use of retention sutures.

CONCLUSION

Rhombotrapezius flap can be used to cover a large deep temporo-facial defect and can provide more than adequate tissue coverage and bulk that is acceptable cosmetically.

BIBLIOGRAPHY

1. Krespi, YP.,Oppenheimer, R.W.Fianzer, J.M.The Rhombotrapezius Myocutaneous and Osteomyocutaneous Flaps. Arch Otolaryngol Head Neck Surg, Vol. 114, July 1988.
2. Netterville J, Panje W, Maves M. The Trapezius Myocutaneous Flap: Dependability and Limitations. Archives of Otolaryngology and Head and Neck Surgery. 113: 271-281, 1987.
3. Shapiro M. Use of Trapezius Myocutaneous Flaps in the Reconstruction of Head and Neck Defects. Archives of Otolaryngology. 107: 333-336, 1981.
4. Tan K, Tan B. Extended Lower Trapezius Island Myocutaneous Flap: A Fasciomyocutaneous Flap Based on the Dorsal Scapular Artery. Plastic and Reconstructive Surgery. 105: 1758-63, 2000.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 44-46 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

SUTURE LIGATION TECHNIQUE IN HEMANGIOMA OF THE HEAD AND NECK*

BEL MANUEL G. MAGALLANES, M.D.**
RODOLFO P. NONATO, M.D., FPSOHNS, FPCS***
JOSE L. MONTILLA, III, M.D., FPSOHNS, FPCS***

ABSTRACT

Intra-operative bleeding is what most surgeons want to avoid in any surgery. Excessive blood loss and compromise of vital structures are possible morbidities when this happens. This paper presents a method that will minimize intra-operative bleeding during excision of hemangiomas. "Suture ligation technique" is the application of simple interrupted overlapping sutures using silk 2.0 with an atraumatic needle around the hemangiomas prior to the skin incision. Although a number of cases have been done three were documented. It was observed that the technique provides a less bloody and clearer operative fields hence resulting in a faster and less stressful operation with lesser complications.

INTRODUCTION

Hemangiomas are among the most common congenital abnormalities of which sixty percent are located in the head and neck areas. At present, there is no uniformly accepted treatment with various modalities of therapy being dependent upon the age of the patient, the site and size of the lesion, and the hemodynamic flow of the hemangioma. It is also important to note that congenital hemangiomas typically regress while adult-onset lesions do not. The treatment options include: observation, steroids, embolization, cryotherapy, sclerotherapy, antifibrinolytic agents, radiation therapy, laser photocoagulation, surgery with or without preoperative embolization, or any combination of the above.

In surgical removal of hemangiomas, a bloody operative field should be avoided so as to identify and preserve vital structures like the facial nerve in lesions over the facial region. This paper presents a simple but effective innovative option, the "suture ligation technique", that can be useful in minimizing intra-operative bleeding, thus, resulting in shorter operating time and lesser morbidity.

TECHNIQUE

1. Intubation of patient
2. Patient under general anesthesia
3. Proper surgical positioning of patient
4. Asepsis / antisepsis technique
5. Outlining / Drawing of area to be ligated
6. Application of "suture ligation technique" around the hemangioma by doing simple interrupted overlapping sutures using silk 2.0 with an atraumtic needle (Figures A-2, B-2, C-2). In doing overlapping suture, the bite is full thickness; if it is on the top of the bone the thickness is up to the bone and in the buccal area the full thickness includes the skin up to the mucosa. Caution is observed so as not to apply "suture ligation technique" around the carotid artery and internal jugular vein.
7. Infiltration with lidocaine + 1:100,000 epinephrine along the incision line
8. Skin incision over the planned incision site
9. Elevation of skin flap
10. Excision of hemangioma (Figures A-3, B-4, C-4)
11. Release of suture ligatures, slowly, one at a time and hemostasis of bleeders
12. Suturing of tissues layer by layer
13. External dressing
14. Extubation of patient

*3rd Place, PSO-HNS Poster Session on Surgical Innovation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, WVC-CLMMRH
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, WVC-CLMMRH

CASE SERIES

This paper presents three documented cases of hemangiomas where "suture ligation technique" was applied during surgery.

Case I.

A case of a 7-year-old male (Figures A 1-5) with a 3-year history of parotid hemangioma who underwent parotidectomy shows that the application of "suture ligation technique" around the parotid tumor made the surgery less stressful with the facial nerve branches identified and preserved. In addition, intra-operative bleeding was within allowable limits and therefore no blood transfusion was performed.

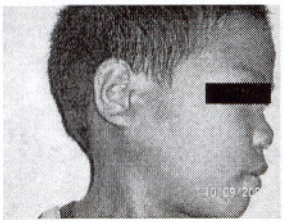


FIGURE A-1

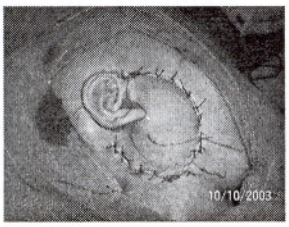


FIGURE A-2

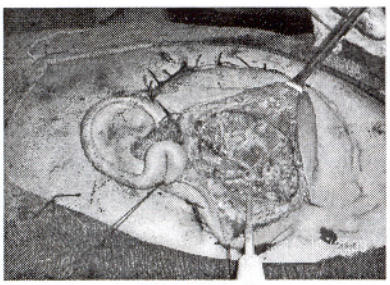


FIGURE A-3

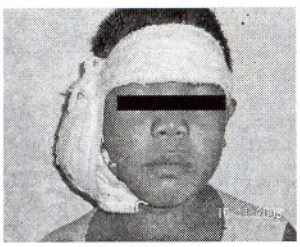


FIGURE A-4

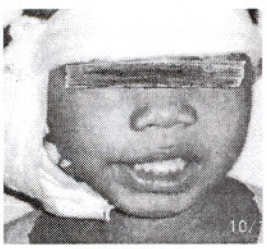


FIGURE A-5

Case II.

A case of a 2-year-old male (Figures B 1-4) with a one year history of hemangioma at the medial canthal area underwent surgical removal using the technique. The operation proceeded uneventfully without any need for blood transufusion.

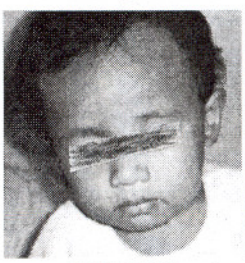


FIGURE B-1

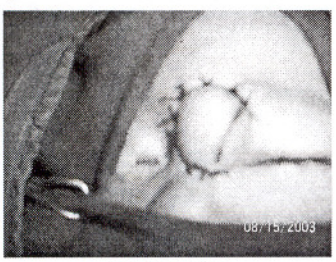


FIGURE B-2

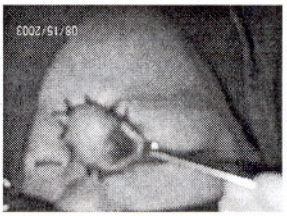


FIGURE B-3

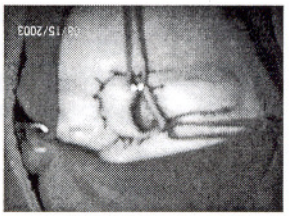


FIGURE B-4

Case III.

A case of a 17-year-old female (Figures C 1-4) with a 6-year history of hemangioma at the infraorbital area which was excised completely with ease using the "suture ligation technique". The operating time was shortened since the operative field was less bloody and clearer.

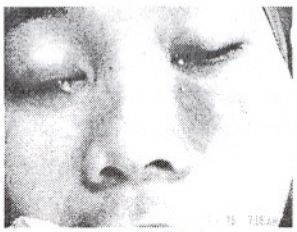


FIGURE C-1

FIGURE C-2

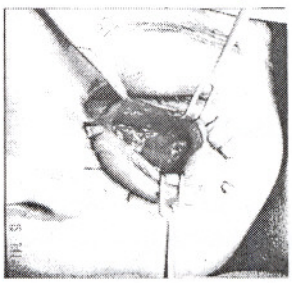


FIGURE C-3

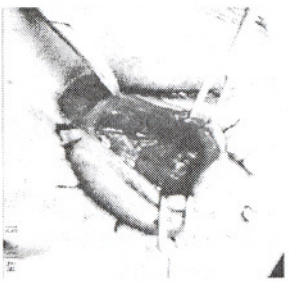


FIGURE C-4

DISCUSSION

In the treatment of hemangiomas, surgical excision appears to be the most effective treatment, often resulting in complete cure. Surgery is reserved for small lesions that fail to regress or larger lesions that either compromised function or cause severe cosmetic deformity. Observation is encouraged in uncomplicated cases considering the likelihood of natural regression.

In any surgery, intra-operative bleeding is always a consideration, more so in operations involving hemangiomas. Hence procedures like embolization, laser and other pre-operative coagulators are utilized to minimize problems with bleeding. These pre-operative preparations are important in situations wherein vital structures have to be identified and preserved like the facial nerve and its branches in the removal of hemangiomas in the parotid area.

In our setting, the use of "suture ligation technique" during excision of hemangiomas in the facial areas has been very useful in minimizing intra-operative bleeding and avoiding iatrogenic injuries to the delicate structures. There are some reservations regarding possible injury to the facial nerve during the application of "suture ligation technique", as well as the viability of the skin flap. However, the technique is considered a lesser evil compared to doing the surgery in the parotid area without a full visualization of the facial nerve and its branches because of a bloody operative field. It was also observed that neither suture marks nor skin flap necrosis due to the application of "suture ligation technique", presented as post-operative problems.

"Suture ligation technique" that is presented in this paper is a simple peri-operative procedure that can help minimize intra-operative bleeding during the excision of hemangiomas. Based on these experiences, patients with hemangiomas underwent successful surgeries as a result of the application of the "suture ligation technique". The operations were less stressful and faster with less bloody and clearer operative fields such that blood transfusion was minimized or even unnecessary.

CONCLUSION

Although there are other conservative modalities in the treatment of hemangiomas, such as steroids, embolization, cryotherapy, sclerotherapy, antifibrinolytic agents, radiation therapy, laser photocoagulation, however, the ultimate management is still surgery if conservative management fails or the lesion compromises function. In this regard, the "suture ligation technique" presented in this paper can be used as a useful peri-operative procedure that is simple and can make the surgery more efficient, resulting in shorter, less bloody operation with clearer operative field and lesser post-operative morbidity.

BIBLIOGRAPHY

1. Blei F, Isakoff M, Deb G. The response of parotid hemangiomas to the use of systemic interferon alfa-2a or corticosteroids. Arch Otolaryngol Head Neck Surg 1997;123:8.

2. Califano J, Eisele DW: Benign Salivary Gland Neoplasms. In Rice DH, Eiselle DW (ed.): The Otolaryngologic Clinics of North America, W.B. Saunders Company, 1999; 32:861-73.

3. DeLacure MD:Carotid Body Tumors, Vascular Anomalies, Melanoma, and Cyst. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, p 615.

4. DiBartolomeo JR. Response of vascular lesions of the head and neck to argon laser radiation. *Otolaryngol Head Neck Surg* 1983;91:203-6.

5. Fredrickson JM. Radiation-induced carcinoma in a hemangioma. *Otolaryngol Head Neck Surg* 1979;87:584-6.

6. Logan TC, Carrasco VN, Lee KJ: Facial Nerve Paralysis. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, pp 191-215.

7. McCaffrey TV, Cortese DA. Neodymium:Yag laser treatment of subglottic hemangioma. *Otolaryngol Head Neck Surg* 1986;94:382-4.

8. Olsen KD: Parotid Deep Lateral Lobectomy. In Bailey BJ (ed): Atlas of Head & Neck Surgery – Otolaryngology, 1st ed. Philadelphia -New York, Lippincott – Raven, 1996, pp 4-5.

9. Olsen KD: Parotid Superficial Lobectomy. In Bailey BJ (ed): Atlas of Head & Neck Surgery – Otolaryngology, 1st ed. Philadelphia -New York, Lippincott – Raven, 1996, pp 2-3.

10. Rebeiz E, April MM, Bohigian BK, Shapshay SM. Nd-YAG laser treatment of venous malformations of the head and neck: an update. *Otolaryngol Head Neck Surg* 1991;105:655-61.

11. Robertson SJ, Wiegand DA, Schaitkin BM. Life-threatening hemangioma arising from the parotid gland. *Otolaryngol Head Neck Surg* 1991;6:858-62.

12. Shemen LJ: Salivary Glands: Benign and Malignant Disease. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, pp 505-533.

13. Subglottic hemangiomas in infants: treatment with CO2 laser. *Laryngoscope* 1984; 94:638-41.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 44-46 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

SUTURE LIGATION TECHNIQUE IN HEMANGIOMA OF THE HEAD AND NECK*

BEL MANUEL G. MAGALLANES, M.D.**
RODOLFO P. NONATO, M.D., FPSOHNS, FPCS***
JOSE L. MONTILLA, III, M.D., FPSOHNS, FPCS***

ABSTRACT

Intra-operative bleeding is what most surgeons want to avoid in any surgery. Excessive blood loss and compromise of vital structures are possible morbidities when this happens. This paper presents a method that will minimize intra-operative bleeding during excision of hemangiomas. "Suture ligation technique" is the application of simple interrupted overlapping sutures using silk 2.0 with an atraumatic needle around the hemangiomas prior to the skin incision. Although a number of cases have been done three were documented. It was observed that the technique provides a less bloody and clearer operative fields hence resulting in a faster and less stressful operation with lesser complications.

INTRODUCTION

Hemangiomas are among the most common congenital abnormalities of which sixty percent are located in the head and neck areas. At present, there is no uniformly accepted treatment with various modalities of therapy being dependent upon the age of the patient, the site and size of the lesion, and the hemodynamic flow of the hemangioma. It is also important to note that congenital hemangiomas typically regress while adult-onset lesions do not. The treatment options include: observation, steroids, embolization, cryotherapy, sclerotherapy, antifibrinolytic agents, radiation therapy, laser photocoagulation, surgery with or without preoperative embolization, or any combination of the above.

In surgical removal of hemangiomas, a bloody operative field should be avoided so as to identify and preserve vital structures like the facial nerve in lesions over the facial region. This paper presents a simple but effective innovative option, the "suture ligation technique", that can be useful in minimizing intra-operative bleeding, thus, resulting in shorter operating time and lesser morbidity.

TECHNIQUE

1. Intubation of patient
2. Patient under general anesthesia
3. Proper surgical positioning of patient
4. Asepsis / antisepsis technique
5. Outlining / Drawing of area to be ligated
6. Application of "suture ligation technique" around the hemangioma by doing simple interrupted overlapping sutures using silk 2.0 with an atraumtic needle (Figures A-2, B-2, C-2). In doing overlapping suture, the bite is full thickness; if it is on the top of the bone the thickness is up to the bone and in the buccal area the full thickness includes the skin up to the mucosa. Caution is observed so as not to apply "suture ligation technique" around the carotid artery and internal jugular vein.
7. Infiltration with lidocaine + 1:100,000 epinephrine along the incision line
8. Skin incision over the planned incision site
9. Elevation of skin flap
10. Excision of hemangioma (Figures A-3, B-4, C-4)
11. Release of suture ligatures, slowly, one at a time and hemostasis of bleeders
12. Suturing of tissues layer by layer
13. External dressing
14. Extubation of patient

*3rd Place, PSO-HNS Poster Session on Surgical Innovation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, WVC-CLMMRH
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, WVC-CLMMRH

CASE SERIES

This paper presents three documented cases of hemangiomas where "suture ligation technique" was applied during surgery.

Case I.

A case of a 7-year-old male (Figures A 1-5) with a 3-year history of parotid hemangioma who underwent parotidectomy shows that the application of "suture ligation technique" around the parotid tumor made the surgery less stressful with the facial nerve branches identified and preserved. In addition, intra-operative bleeding was within allowable limits and therefore no blood transfusion was performed.

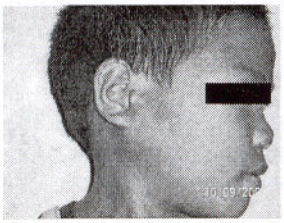


FIGURE A-1

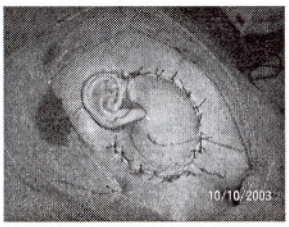


FIGURE A-2

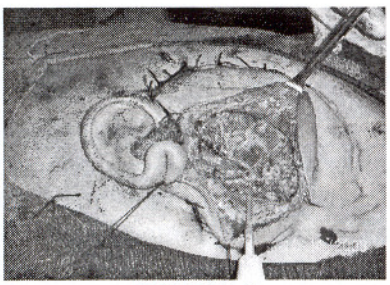


FIGURE A-3

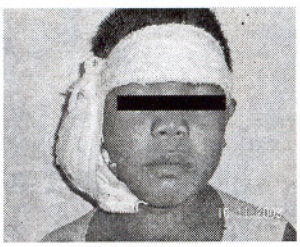


FIGURE A-4

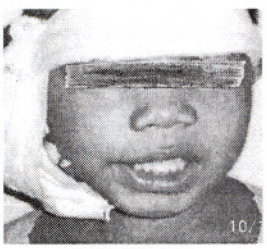


FIGURE A-5

Case II.

A case of a 2-year-old male (Figures B 1-4) with a one year history of hemangioma at the medial canthal area underwent surgical removal using the technique. The operation proceeded uneventfully without any need for blood transufusion.

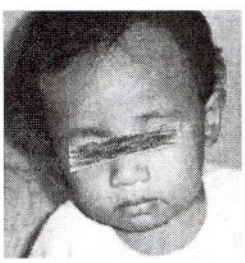


FIGURE B-1

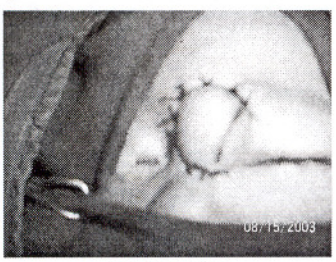


FIGURE B-2

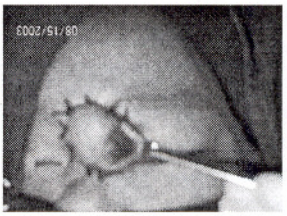


FIGURE B-3

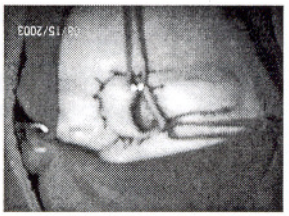


FIGURE B-4

Case III.

A case of a 17-year-old female (Figures C 1-4) with a 6-year history of hemangioma at the infraorbital area which was excised completely with ease using the "suture ligation technique". The operating time was shortened since the operative field was less bloody and clearer.

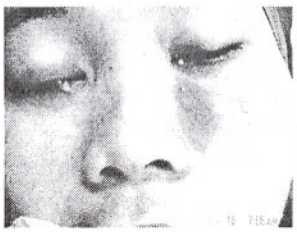


FIGURE C-1

FIGURE C-2

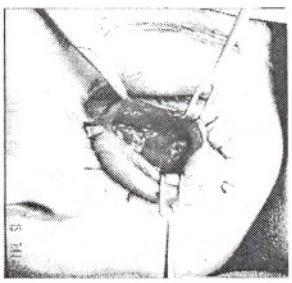


FIGURE C-3

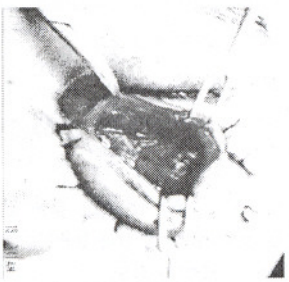


FIGURE C-4

DISCUSSION

In the treatment of hemangiomas, surgical excision appears to be the most effective treatment, often resulting in complete cure. Surgery is reserved for small lesions that fail to regress or larger lesions that either compromised function or cause severe cosmetic deformity. Observation is encouraged in uncomplicated cases considering the likelihood of natural regression.

In any surgery, intra-operative bleeding is always a consideration, more so in operations involving hemangiomas. Hence procedures like embolization, laser and other pre-operative coagulators are utilized to minimize problems with bleeding. These pre-operative preparations are important in situations wherein vital structures have to be identified and preserved like the facial nerve and its branches in the removal of hemangiomas in the parotid area.

In our setting, the use of "suture ligation technique" during excision of hemangiomas in the facial areas has been very useful in minimizing intra-operative bleeding and avoiding iatrogenic injuries to the delicate structures. There are some reservations regarding possible injury to the facial nerve during the application of "suture ligation technique", as well as the viability of the skin flap. However, the technique is considered a lesser evil compared to doing the surgery in the parotid area without a full visualization of the facial nerve and its branches because of a bloody operative field. It was also observed that neither suture marks nor skin flap necrosis due to the application of "suture ligation technique", presented as post-operative problems.

"Suture ligation technique" that is presented in this paper is a simple peri-operative procedure that can help minimize intra-operative bleeding during the excision of hemangiomas. Based on these experiences, patients with hemangiomas underwent successful surgeries as a result of the application of the "suture ligation technique". The operations were less stressful and faster with less bloody and clearer operative fields such that blood transfusion was minimized or even unnecessary.

CONCLUSION

Although there are other conservative modalities in the treatment of hemangiomas, such as steroids, embolization, cryotherapy, sclerotherapy, antifibrinolytic agents, radiation therapy, laser photocoagulation, however, the ultimate management is still surgery if conservative management fails or the lesion compromises function. In this regard, the "suture ligation technique" presented in this paper can be used as a useful peri-operative procedure that is simple and can make the surgery more efficient, resulting in shorter, less bloody operation with clearer operative field and lesser post-operative morbidity.

BIBLIOGRAPHY

1. Blei F, Isakoff M, Deb G. The response of parotid hemangiomas to the use of systemic interferon alfa-2a or corticosteroids. Arch Otolaryngol Head Neck Surg 1997;123:8.

2. Califano J, Eisele DW: Benign Salivary Gland Neoplasms. In Rice DH, Eiselle DW (ed.): The Otolaryngologic Clinics of North America, W.B. Saunders Company, 1999; 32:861-73.

3. DeLacure MD:Carotid Body Tumors, Vascular Anomalies, Melanoma, and Cyst. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, p 615.

4. DiBartolomeo JR. Response of vascular lesions of the head and neck to argon laser radiation. *Otolaryngol Head Neck Surg* 1983;91:203-6.

5. Fredrickson JM. Radiation-induced carcinoma in a hemangioma. *Otolaryngol Head Neck Surg* 1979;87:584-6.

6. Logan TC, Carrasco VN, Lee KJ: Facial Nerve Paralysis. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, pp 191-215.

7. McCaffrey TV, Cortese DA. Neodymium:Yag laser treatment of subglottic hemangioma. *Otolaryngol Head Neck Surg* 1986;94:382-4.

8. Olsen KD: Parotid Deep Lateral Lobectomy. In Bailey BJ (ed): Atlas of Head & Neck Surgery – Otolaryngology, 1st ed. Philadelphia -New York, Lippincott – Raven, 1996, pp 4-5.

9. Olsen KD: Parotid Superficial Lobectomy. In Bailey BJ (ed): Atlas of Head & Neck Surgery – Otolaryngology, 1st ed. Philadelphia -New York, Lippincott – Raven, 1996, pp 2-3.

10. Rebeiz E, April MM, Bohigian BK, Shapshay SM. Nd-YAG laser treatment of venous malformations of the head and neck: an update. *Otolaryngol Head Neck Surg* 1991;105:655-61.

11. Robertson SJ, Wiegand DA, Schaitkin BM. Life-threatening hemangioma arising from the parotid gland. *Otolaryngol Head Neck Surg* 1991;6:858-62.

12. Shemen LJ: Salivary Glands: Benign and Malignant Disease. In Lee KJ (ed): Essential Otolaryngology, 6th ed. Norwalk, CT, Appleton & Lange, 1995, pp 505-533.

13. Subglottic hemangiomas in infants: treatment with CO2 laser. *Laryngoscope* 1984; 94:638-41.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 47-51 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

NEW TECHNIQUE OF OCCLUSAL SPLINT FABRICATION USING DENTAL MODELING COMPOUND*

DWIGHT ALEJO,M D**
SAMANTHA S. CASTANEDA, MD, FPSO-HNS***
JOSELITO F. DAVID, MD, FPSO-HNS***

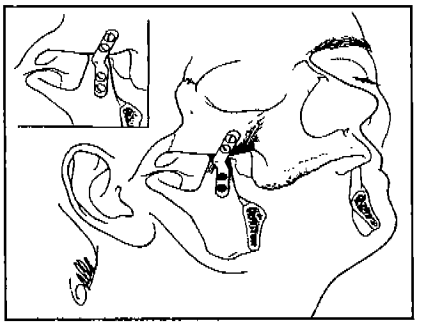
INTRODUCTION: The restoration of function after surgery with mandibular reconstruction is of utmost importance. Mastication and deglutition are compromised if pre-operative dental occlusion is not re-established. For this purpose, occlusal splints are fabricated pre-operatively. Various methods of occlusal splint fabrication are at hand.
DESIGN: Surgical Instrumentation
SETTING: Tertiary Academic Hospital
OBJECTIVE: This paper presents a simple, quick and inexpensive way of fabricating an occlusal splint with the use of dental modeling compound.
MATERIALS AND METHODS: The dental modeling compound is used pre-operatively to make an occlusal appliance. Occlusal splint fabricated with this method was used in 6 patients who underwent segmental mandibular resection with reconstruction for various pathologies. Post-operatively, patients were assessed in terms of occlusion, type of diet and pain on mastication.
RESULTS: Out of the 6 patients, only 5 patients were available for evaluation. One patient suffered a myocardial infarction 3 days post-operation and subsequently died. The five patients had good mandibular-maxillary relation post-surgery. They were able to tolerate regular diet with no pain on mastication.
CONCLUSION: In conclusion, we have discussed a simple, quick and cost-effective way of fabricating an occlusal splint for use in mandibular reconstruction.

INTRODUCTION

Reconstructive techniques to restore function and cosmesis are performed for oromandibular defects after tumor extirpation, osteoradionecrosis, trauma or infection. The main goals of oromandibular reconstruction are to restore oral sphincter competence, pre-operative facial appearance, dental occlusal relationship to allow mastication and deglutition and normal speech. These pose a continuing challenge for the reconstructive surgeon.

Several problems result when mandibular reconstruction is not considered after ablative surgery. Mastication and deglutition are severely affected which may result to a poor quality of life.[1] The maintenance of pre-operative occlusion in a patient with partial or complete dentition is important to avoid post-operative complications such as occlusal disharmony, temporomandibular joint dysfunction and painful mastication. Many methods to stabilize and align resected mandibular segments have been reported in the literature. Li advocates placement of a bone plate from the mandible to the zygoma.[2] This technique is utilized for patients who are edentulous and with large tumors that deform the lateral aspect of the mandible. (Figure 1)

FIGURE 1
Mandibular stabilization using miniplates from the mandible to the zygoma by Li et al, 1996



Steinberg advocates use of a mandibular fixation device using a stabilization bar which does not interfere with excision of the tumor.[4] When the lateral border of the mandible is not involved, others would contour the reconstruction plate to the lateral

*1st Place, PSO-HNS Poster Session on Surgical Instrumentation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, East Avenue Medical Center
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, East Avenue Medical Center

aspect of the intact mandible. Holes are drilled and the plates are removed to allow surgical access for tumor resection. The reconstruction plate with the bone grafts attached to the inner surface are then re-applied using the same holes.[3] But as stated, this technique can only be used when the mandible is not deformed by the tumor.

Intermaxillary-mandibular fixation, if the patient is dentate, is the most straight forward and simple method but it does not hold the mandible stable in all three planes of space.[4] The use of occlusal splints adds stability to the intermaxillary-mandibular fixation in all planes. Occlusal splints are fabricated pre-operatively. This is then used intra-operatively prior to insetting of the bone flap to ensure that proper occlusion is maintained.

There are many methods of fabrication of occlusal splints. This is usually fabricated by a dental technologist or a prosthodontist. First step is getting a maxillary and mandibular impression of the patient pre-operatively. These impressions are then set in dental stone to get the positive impression. (Fig. 2) The impressions are then mounted on an articulator and set into the occlusion of the patient. (Fig. 3) These first few steps would take around 1-2 hrs depending on how fast the material hardens.

FIGURE 2
Maxillary impression set into dental stone (R) and mandibular impression (L)

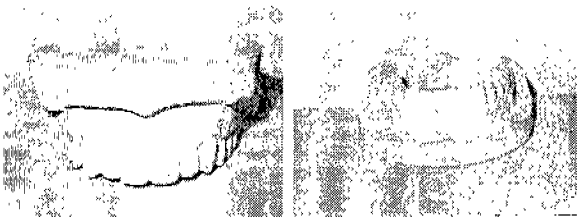
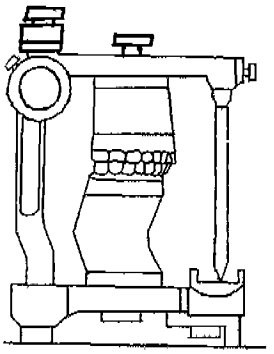


FIGURE 3
Maxillary-mandibular relation is set using an articulator and face-bow registration
Adapted from Mathog,1992[5]



The next steps are where the variability comes in. There are different techniques and materials used for fabrication of the occlusal splint. Some use autopolymerizing acrylic resin and apply it on the cast in a sprinkle-on technique.[6,7].

Some would roll the acrylic resin into dough.[8] There are other techniques using different materials with their inherent advantages and disadvantages. Basically, the techniques and materials used are different because they want to increase accuracy of fit and durability of the splint especially in cases where the splint is to be used for a long time such as in bruxism.[9]

In cases wherein long term durability is not required, such as in maintaining pre-operative occlusion in mandibular reconstruction, an alternative technique and material in making an occlusal splint can be used. A technique of fabricating the occlusal splint that only takes a few minutes without need for any specialized equipment and only basic knowledge of dental anatomy would be a valuable tool in mandibular reconstruction.

GENERAL OBJECTIVES

The purpose of this paper is to present a simple, quick and cost-effective way of fabricating an occlusal splint for use during mandibular reconstruction.

Specific Objectives

1. To present a novel way of fabricating an occlusal splint using a different material
2. To show its effectiveness by maintenance of pre-operative occlusion in 6 patients who underwent mandibular reconstruction

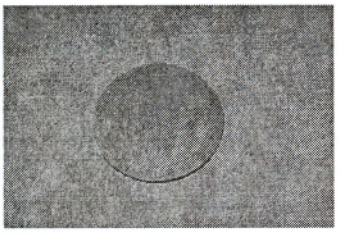
SIGNIFICANCE OF THE STUDY

This occlusal splint can be used for maintenance of pre-operative occlusion of patients undergoing mandibular reconstruction. This simplified and cost-effective way of fabricating an occlusal splint can be done by anyone requiring a splint for mandibular reconstruction.

MATERIALS AND METHODS

The material used for this splint is a reversible thermoplastic material called dental modeling compound. This could be bought at any dental supply store for P56 per piece. (Fig 4) One piece has a diameter of 7 cm. Only a third of this material will be used.

FIGURE 4
Dental modeling compound



The dental compound is immersed in hot water to soften it. It is rolled into a thin, tubular form. (Fig 5) This hardens in 1-2 minutes depending on the temperature of the water it is immersed in. As soon as the tubular form is made, the patient is asked to bite the material. The material is patted to conform to the buccal facets of the maxillary and mandibular dentition. (Fig 6) It is important to make sure that when the patient bites that he is in centric relation. When the material has hardened, the splint is then removed. To check if a proper occlusal splint has been made, the splint is re-applied and the patient is asked to close his mouth. If the bite does not cause any discomfort to the patient then it is a good splint. (Fig 7) If the bite is wrong, then the same dental compound can just be immersed in hot water again and the same steps followed. This technique takes only 5 minutes to fabricate a splint without use of any equipment.

FIGURE 5
Impression compound is rolled into a tubular form after immersed in hot water

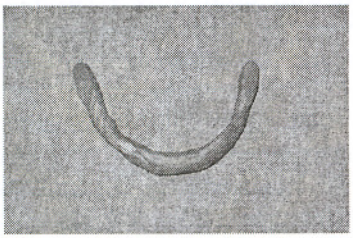


FIGURE 6
Tubular form is placed on the mandibular teeth and molded onto it (right) then patient bites (left)

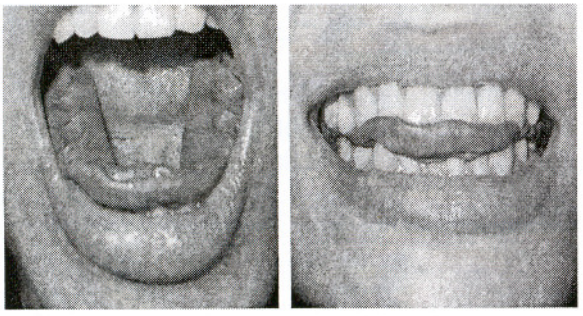
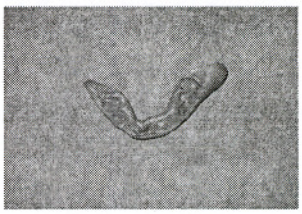
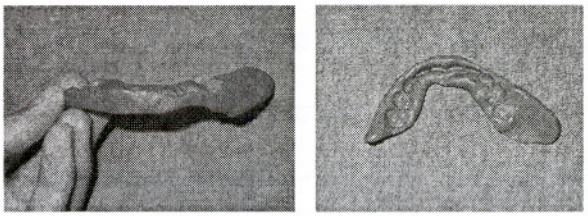


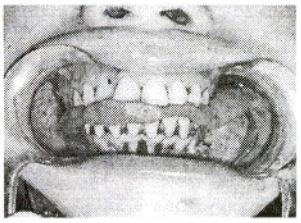
FIGURE 7
Occlusal splint maxillary side (R), buccal side (middle) and mandibular side (L)

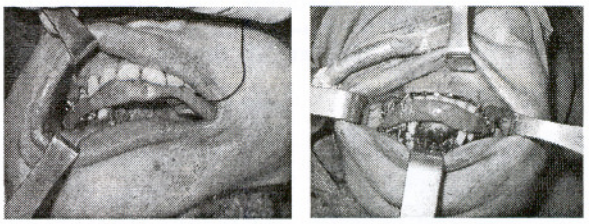




This splint can then be used to maintain the pre-operative occlusion of patients for mandibular reconstruction. (Figure 8)

FIGURE 8
Occlusal splint used in patients for mandibular reconstruction





To determine its effectiveness, the occlusal splint using this technique and material were tested on 6 consecutive patients who underwent segmental resection for various pathologies. (Table 1) The patients were all partially edentulous pre-operatively. No patient was edentulous. Mandibular defects were classified according to Urken's classification of oromandibular defects.[6] All patients had nasogastric tube feeding post-operation to allow mucosal incisions to heal. Patients were then evaluated post-operatively regarding type of diet, occlusion and pain on mastication.

RESULTS

Out of the 6 patients, only 5 patients were available for evaluation. One patient (S.M) suffered a myocardial infarction 3 days post-operation and

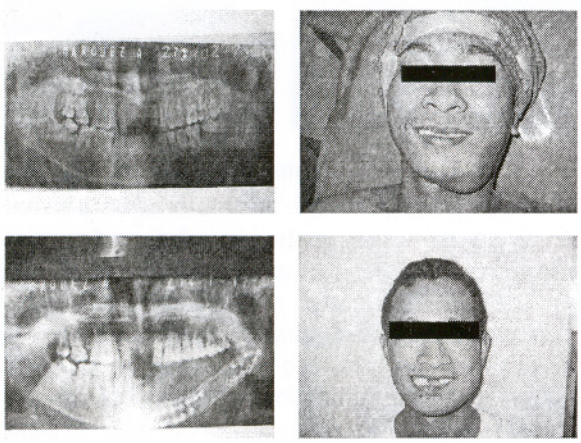
subsequently died. The five patients had good mandibular-maxillary relation post-operation. They were able to tolerate regular diet with no pain on mastication. (Figure 9)

TABLE 1
Patients who underwent mandibular reconstruction with use of the occlusal splint

Name	Age/Sex	Diagnosis	OR done
J.A.	10/M	Fibromatosis of the mandible	Segmental mandibulectomy (BS*) with fibular free flap reconstruction (8-27-04)
I.S.	21/F	Ameloblastoma, Left	Segmental mandibulectomy (BS*) with fibular osseous free flap reconstruction (5-18-04)
A.M	27/M	Ameloblastoma, Left	Segmental mandibulectomy (BSh*) with fibular osseous free flap reconstruction (4/27/04)
A.L.	17/M	Recurrent Neurofibroma s/p excision with inferior mandibulectomy (2003)	Excision with segmental mandibulectomy (BSB*C^m) with fibular osteocutaneous free flap reconstruction (3/19/04) Soft tissue size : 3 x 6 cm
S.M.	63/M	Gingival CA with neck metastasis, bilateral T4N2cMo St IVa	Wide excision, segmental mandibulectomy (BSB*FOM^{ant}) with selective neck dissection, bilateral with fibular osteocutaneous free flap reconstruction (3/12/04) Soft tissue size : 5 x 5 cm
J.R.	23/M	Ameloblastoma, Right	Segmental mandibulectomy (RBSh*) with fibular osseous free flap reconstruction (1/9/04)

*Urken, 1991[10] B- body R- ramus Sh – hemisymphysis S – symphysis
C^m - cutaneous defect, mentum FOM^{ant} – floor of mouth, anterior

FIGURE 9
Patient's (A.M) bite pre-operation (above) and 3 months post-mandibular reconstruction (below)



DISCUSSION

Occlusal splints are passive orthodontic appliances that are used to maintain the status quo within the dentition.[11] Various uses of these occlusal appliances have been described in literature. It can be used in patients with condylar fractures wherein closed reduction and immobilization with intermaxillary fixation is the treatment option.[5] Occlusal splints have been advocated to reduce the harmful consequences of bruxism such as wearing out of tooth facets, cusp or restoration fractures and tooth mobility.[12] The primary aims in fabrication of occlusal splints for bruxism are to minimize distortion, reduce mechanical stress to the teeth and provide a precise fit.[8] Most commonly used material for splints is autopolymerizing hard acrylic resin either in a dough technique or a sprinkle-on technique because of the durability of the acrylic resin and minimized wastage to ensure accurate fit of the splint.[6,7,8]

Occlusal splints are also used to maintain pre-operative occlusion in mandibular reconstruction. For this purpose, the splints are used only once and only during the time of surgery thus durability of the splint is not necessary. Accuracy of fit is the most important factor. The use of the dental impression compound can precisely reproduce the pre-operative occlusion of the patient because it is conformed to the patient's bite prior to the operation. It retains its shape unless re-heated. This was seen in the 5 patients wherein this technique and material were used to fabricate an occlusal splint which was utilized during mandibular reconstruction. The 5 patients had good maxillary-mandibular relation with regular diet. The patients did not complain of pain on mastication.

In comparison to the conventional technique of fabricating a splint which would cost around P150 and would require more knowledge of dental techniques and equipment, this method can be easily done at the bedside without need of any equipment and cost only P19. The dental impression compound can be re-heated if proper occlusion was not reproduced thus mistakes are not costly. This occlusal splint can then be fabricated by a reconstructive surgeon when a prosthodontist or prosthetist is not available.

The limitation of this splint and the reason for its short term use is that the material gets brittle with time. The material loses water from the time of its immersion in hot water. Thus it is advised to fabricate the splint, at most, a day before the operation.

CONCLUSION

In conclusion, we have discussed a simple and cost-effective way of fabricating an occlusal splint for use in mandibular reconstruction.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 52-54 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

THE NASAL SPECULITE*

RONY S. DELOS SANTOS, MD**
JOSE A. MALANYAON JR., MD, FPSO-HNS***
ELIAS T. REALA, MD**
RIO ABRENICA, MD**
KONRAD O. AGUILA, MD**

ABSTRACT

OBJECTIVE: To design a cost effective, handy, easy to fabricate, ergonomic nasal speculum with a built-in light source.
DESIGN: Instrumentation
SETTING: Tertiary Government Hospital
MATERIALS AND METHODS: Two 3cc syringes were mounted on each side of a nasal speculum to serve as battery cases for the two 1.5 volts battery. A laryngoscope bulb, connected to a metallic plate, made from the two long arms of a paper fastener, was then suspended from the speculum screw, with the bulb positioned in between the speculum blades. An electric wire connected the batteries and the metallic plate. The upper negative pole wire was connected to a ballpen spring and was glued near the fulcrum. The device illuminates automatically with opening of the speculum blades.
RESULTS: Nasal speculite provided comparable visualization of the nasal cavity as that with a nasal speculum with head mirror and light source. The illumination was adequate and there was no more need for light focusing. There were no complaints of discomfort from the subjects.
CONCLUSION: The Nasal speculite is a cost effective, handy, easy to fabricate ergonomic instrument that can be used by the ENT specialist at his/her own convenience, obviating the need for head mirrors and light source, in the examination of the nasal cavities.

INTRODUCTION

There is little doubt that the nose and the sinuses are the most diseased organs in the human body, and patients who suffer from these areas occupy a considerable portion of the physician's time.[1] As the practice of rhinology evolved, it has been established that in an ideal setting, there is no adequate substitute for a proper head mirror and light source when examining the nasal cavities.

In instances however, where a light source and a head mirror are not readily available, like in bedside examinations or consultations done outside the clinic setting, variations of the nasal speculum that do not need these and modification of other ENT instruments designed for anterior rhinoscopy, were introduced. Reister has a model diagnostic unit known as Reister 2050[2], which includes an illuminated nasal speculum attached to the otoscope head as light source. The Karl Storz illuminated nasal speculum[3], on the other hand, provides direct visualization of the nasal cavity through a fiber optic light source and carrier. There is no doubt these two units have excellent diagnostic capabilities. However, the former requires a separate instrument to provide illumination making it a heavier instrument and ergonomically unsound. The latter also has to be connected to a light source that should be carried at all times making it inconvenient. Furthermore, these two instruments are expensive. Mishra in 2001 introduced a modified otoscope for diagnostic nasal endoscopy[4]. This, however, is not yet commercially fabricated.

At this time, therefore, there is still no cost effective and handy instrument that resolved the problem of intricate instrumentation for anterior rhinoscopy.

*2nd Place, PSO-HNS Poster Session on Surgical Instrumentation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Jose R. Reyes Memorial Medical Center
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, Jose R. Reyes Memorial Medical Center

BIBLIOGRAPHY

1. Curtis DA, Plesh O, Miller AJ et al. A comparison of masticatory function in patients with or without reconstruction. Head and Neck. 1997. Vol 19 (July) : 287-296.
2. Li KK, Cheney ML, Teknos TN. The importance of mandibular position in microvascular reconstruction. Laryngoscope. 1996. Vol 106 (7) : 903-907.
3. Hidalgo DA and Pusic AL. Free-Flap Mandibular Reconstruction : A 10-Year Follow-Up Study. Plastic and Reconstructive Surgery. 2002. Vol 110 (2) : 438-449.
4. Steinberg MJ and Collins SL. A Simple Fixation Device to Preserve Anatomic Position during Reconstruction of Mandibular Defects. Laryngoscope. 1998. Vol 108 (3) : 448-451.
5. Mathog RH. Atlas of Craniofacial Trauma.WB Saunders Company, 1992.
6. Kass CA and Tregaskes JN. Occlusal splint fabrication. The Journal of Prosthetic Dentistry.1978; Vol 41:460463.
7. Von Krammer RK. Constructing occlusal splints. The Journal of Prosthetic Dentistry. 1979; Vol 41:105-108.
8. Grupe HE and Gromek HJ. Bruxism splint :technique using quick-cure acrylic. Journal of Periodontology. 1959;Vol 30 : 156-157.
9. Bohnenkamp DM. Dimensional stability of occlusal splints. The Journal of Prosthetic Dentistry. 1998; Vol 75. 262-268
10. Urken ML, Weinberg H, Vickery C, Buchbinder D, Lawson W, Biller HF. Oromandibular reconstruction using microvascular composite free flaps : report of 71 cases and a new classification scheme for bony, soft tissue and neurologic defects. Archives of Otolaryngology-Head and Neck Surgery. 1991. Vol 117 : 733-744.
11. Moyers RE. Handbook of Orthodontics. Year Book Medical Publishers, Inc. 4th edition. 1988.
12. Halachmi M, Gavish A, Gazit E et al. Splints and stress transmission to teeth : an in-vitro experiment. Journal of Dentistry. 2000. Vol 28 : 475-480

OBJECTIVE

To design a cost effective, handy, easy to fabricate, ergonomic nasal speculum with a built-in light source.

FIGURE A: The Nasal Speculite

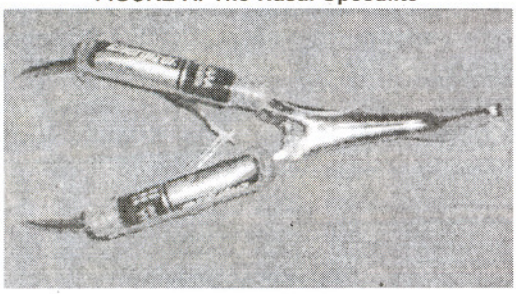
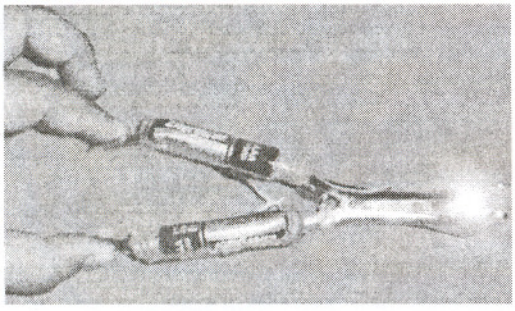


FIGURE B
The Lighted nasal speculum upon opening the speculum blades



MATERIALS AND METHODS

Materials

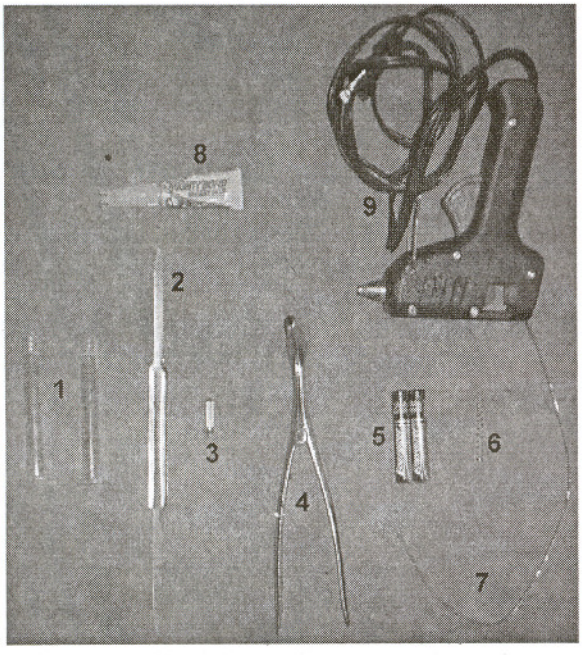


FIGURE C: Materials

1. 2 syringes (3cc)	10.00
2. paper fastener	5.00
3. laryngoscope bulb	300.00
4. nasal speculum	300.00
5. 2 alkaline batteries (1.5 v)	50.00
6. Used ball pen spring	-
7. electrical wire	10.00
8. Adhesive Glue	35.00
9. Glue gun stick	10.00
Total	Php 720.00

Procedure

1. A 4x1cm rectangular cut were made on the two 3 cc syringes and were mounted on each side of a nasal speculum to serve as cases for the two 1.5 volts batteries
2. Electrical wires were placed on each end of the syringes with both positive and negative charges.
3. The two long arms of a paper fastener were cut approximately 4.5cm in length.
4. The two ends of the fastener plates were suspended to the fulcrum screw on top of each other, the free end of the fastener served as the bulb holder and conductor.
5. The positive and negative poles on the lower end were connected together, while the negative pole on the upper end was attached to the outer surface of the plates using a soldering gun.
6. The upper positive end was glued to a ball pen spring which is placed on the inner aspect of the handle just below the fulcrum.
7. The bulb automatically illuminates once the spring touches the opposite side as the blades are opened.

FIGURE D
Circuit Diagram of the Nasal Speculight

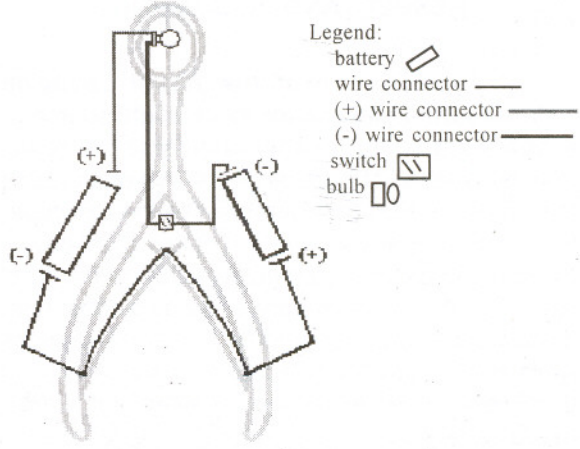


FIGURE E
Anterior rhinoscopy showing clear visualization of the inferior turbinates

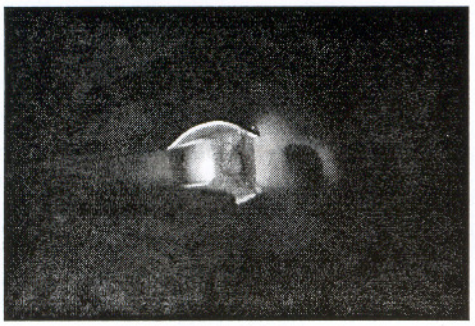


FIGURE F
Suctioning of the nasal cavity

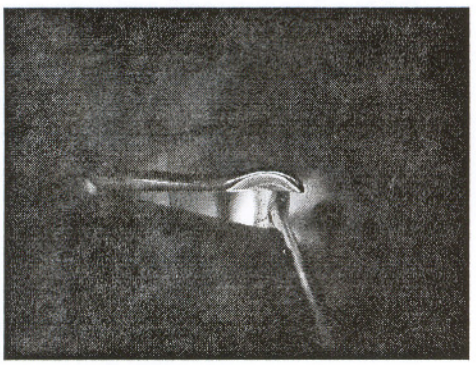


FIGURE G
Picture showing foreign body removal in the nasal cavity

RESULTS AND DISCUSSION

Examination of the nasal cavity in instances where a head mirror or a light source or a headlight is not readily available, is really troublesome to ENT practitioners. We often resort to using other ENT instruments, like the otoscope, to provide proper visualization of the nasal cavity. But sometimes, this too is not available or the aural speculum that we sometimes use as a substitute, does not give us adequate field. Several devices were also introduced to address this problem but they were either expensive or were not readily available as well.

The nasal speculite was used to perform anterior rhinoscopy on patients by residents of a tertiary government hospital. The examiners commented that it provided comparable visualization of the nasal cavity as that with a nasal speculum with head mirror and droplight. The illumination was adequate and there was no more need for frequent light focusing. It is handy and ergonomic. There is no problem also with instrumentation, as in foreign body removal, since the other hand is free. The patients had no complaints of discomfort from the device.

CONCLUSION

The Nasal speculite is a cost effective, handy, easy to fabricate ergonomic instrument that can be used by the ENT specialist at his own convenience, obviating the need of head mirrors and light source, in the examination of the nasal cavities.

RECOMMENDATION

We recommend that ENT practitioners try to fabricate their own nasal speculite so that they can attest personally to its benefits as mentioned.

BIBLIOGRAPHY

1. 1.Leighton G. Siegel, MD. The Head and Neck History and Examination, Boies Fundamentals of Otolaryngology, 6th edition, 1989,pp
2. www.allmedstar.com. Reister 2050 UNI Deluxe 2.5v Diagnostic Set
3. Karl Storz Endoskope Catalogue. Illuminated Nasal speculum with fiberoptic light carrier. N1.
4. Mishra A. Cost-effective diagnostic nasal endoscopy with a modified otoscope. Journal of Laryngology and Otology 2001 Aug; 115(8):648-9

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol 20 Nos 1-2 55-58 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

OTO-DRILL
(A PROTOTYPE SURGICAL DRILL UNIT) *

PAUL JANSEN T. ALCARAZ, MD**
FRANCIS V. ROASA, MD, FPSO-HNS***

ABSTRACT

OBJECTIVE: To design and produce a high quality, inexpensive surgical drill using locally available electronics.
DESIGN: Descriptive (Instrument Design)
SETTING: University based tertiary hospital
MATERIALS AND METHODS: The surgical drill apparatus will use high quality electronics readily available locally which will make it cheaper than the other available units. This prototype unit was designed and tested by the author in collaboration with the Santo Tomas University Hospital Biomedical Engineers. The drill units schematics and specifications where patterned from the RAM Microtorque II drill unit which is produced in the U.S.A.
RESULTS: The prototype is a cost effective alternative to the expensive drill units available in the market. It was given a 24 hour durability test which it passed with no loss of power or drilling efficiency proving that it can be used for major surgeries especially in the field of Otolaryngology and Neurosurgery.
CONCLUSION: The OTODRILL is a cheap alternative and of comparable quality to expensive surgical drills available in the market which can be used in major surgeries in the field of Otolaryngology and other surgical fields.

INTRODUCTION

In the 1960's Frank Cohen, a dentist by profession started using a drill he made himself to remove decayed teeth by polishing it down under local anesthesia.(1) His invention changed not only the field of dentistry, but the field of medicine as well.

The use of the surgical drill in otolaryngologic surgery has revolutionized the way procedures of this sort are done. Surgeries like mastoidectomy and maxillofacial reconstruction now rely heavily on the use of the surgical drills. Ever since Dr. Julius Lempert introduced the use of the dental drill in temporal bone dissection for mastoidectomy, the otolaryngologist became more aware of the intricacies of the anatomy of the ear because of better and safer exposure. In the field of maxillo-facial reconstruction, it has become an irreplaceable tool when it came to drilling for placement of plating systems in fractures and reconstruction. In head and neck reconstructive surgery, it is being used in the placement of osteotomies in bone grafts. The surgical drill in neurosurgery has changed the way of approaching different diseases of the nervous system. With the advent of dental drills, it proved to be an efficient tool mainly because of its portability but is still very costly.

With these technological advances, it is imperative that the modern day Otolaryngologist have access to this technology in order for us to be at par with the world. The problem, especially in our country is that not all hospitals have this drill unit because of its cost which hampers the health services to our fellow Filipinos.

*3rd Place, PSO-HNS Poster Session on Surgical Instrumentation Contest, November 30, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Sto. Tomas University Hospital
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, Sto. Tomas University Hospital

OBJECTIVE

To design and produce a high quality, inexpensive surgical drill using locally available electronics.

MATERIALS

All materials to assemble the prototype where acquired locally. They are made up of high quality circuit board, capacitors and transformers all created in Japan and the United Kingdom. (Table 2 - 3 and figs. 3-5). The casing used is locally produced, made of plastic with the ff. dimensions of 11 x 10 x 7.

External parts include the ff:

1. **Power switch.** (Figure 1): It is located in the upper left from panel of the control box. It turns the control box off and on. Switch should be in off position when not in use.
2. **Speed control dial,** 0 – 35,000 RPM (Figure 1): Located in the upper right of control box. When using this dial in hand mode, turn dial clockwise to increase speed and counterclockwise to reduce speed. Dial should be turned fully counterclockwise to the minimum position when not in use or before turning it off.
3. **Foot or hand toggle switch.** (Figure 1): The lower left switch on the control box can be set to either hand or foot pedal use. When set in the hand position, the speed is completely controlled by the speed dial knob. When set in the foot pedal mode, the speed is controlled by the variable foot pedal.
4. **Hand-piece cord outlet.** (Figure 1): Located in the lower right hand of the control panel. The hand-piece is plugged here.
5. **Variable foot pedal control outlet.** (Figure 2): Located in the back of the drill unit. Variable foot pedal is plugged here.
6. **Power plug socket**. (Figure 2): Also located at the back of the unit. The power cord is plugged here.

FIGURE 1
Front View of the prototype drill

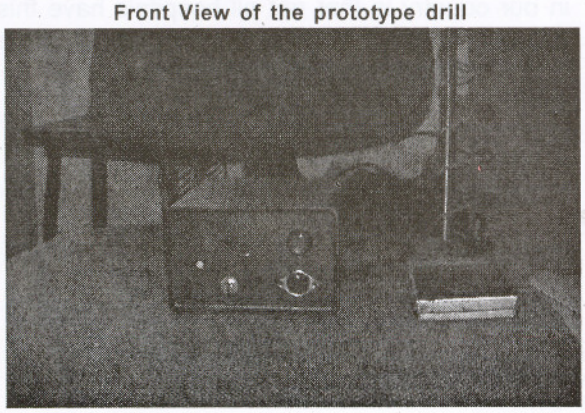


FIGURE 2
Back view of the drill showing the variable foot pedal plug and the fuse

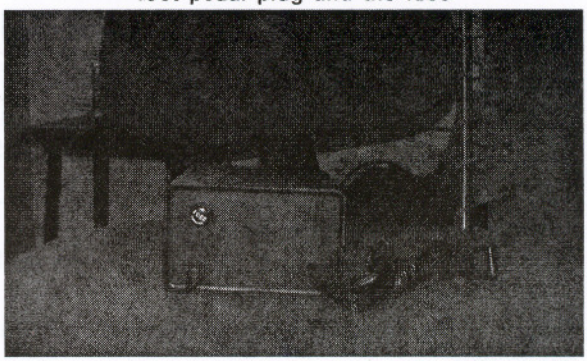


FIGURE 3
Assembled electronic parts of the prototype drill

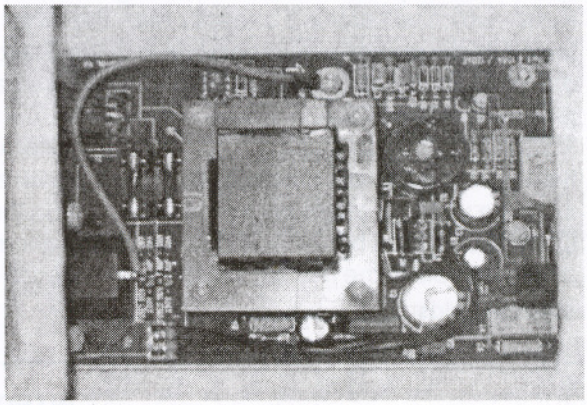


FIGURE 4
The transformer of the prototype drill

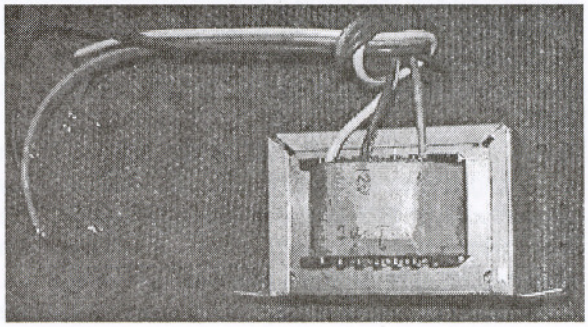
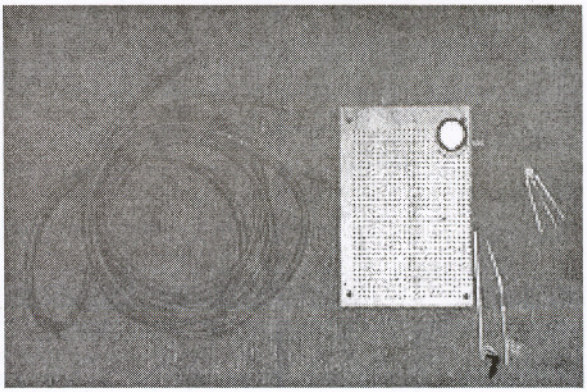


FIGURE 5
The circuit board and the



METHODOLOGY

The drill unit was designed by the author, in cooperation with the Santo Tomas University Hospital Biomedical Engineers. Testing, including the 24 hour endurance test was done. The drill unit was left working at high setting for 24 hours in order to assure that the prototype can withstand long term use without the loss of power. The prototype was then used by the author in a temporal bone dissection exercise to test its drilling efficiency. All materials to assemble the prototype where acquired locally. The drill's schematic diagram and block diagram (Fig 6-7) and the drill unit specifications (Table 2.) was taken from the RAM Microtorque II Dental drill. The drill was assembled by the Biomedical engineers of the Santo Tomas University Hospital. It took about 6 months to perfect it.

RESULTS

The OTODRILL prototype is of comparable quality and performance with very minimal cost when compared to the commercially available surgical drills. It took the author and the biomedical engineers 6 months to perfect The major difference is its extremely low cost to produce which can help the plight of both physicians and patients in this country.

TABLE 1
Otodrill compared to commercially available drills

	OTODRILL	COMERCIALLY AVAILABLE DRILLS
Power source	Any outlet	Depends on voltage of drill
Output current	0-30Vac	0-30 Vac
RPM	0 - 35,000	0 - 35,000
cost	P 1,500	P 20,000 and up
Materials used	Same as RAM Microtorque II drill except for the circuit board (Produced by Sony.)	Same as the prototype except circuit board (produced by RAM corp.)

DISCUSSION

When the surgical drill was introduced in surgery, it revolutionized many fields of specialization especially that of otology and maxillofacial reconstruction. In otology, during the 1930's, overhead light provided illumination and surgery, and temporal bone dissections where performed with a mallet, gouge and curettes (1). In simple mastoidectomy for instance, the antrum was opened with the mallet and gouge and a right angled probe inserted into the area to demonstrate the antrum which many times damaged the incus. In those days of mastoid surgery, it is miraculous that ears with modified or radical procedures healed and remained dry according to Howard P. House (1). It was Dr. Julius Lempert (2,3) who started to perform his revolutionary techniques that brought the surgeries of the ear to the modern era. Dr. Lempert used the headlight and the two power magnifying loop for better illumination and visualization. To remove bone, he replaced the mallet and gouge with dental drills and burrs. The temporal bone is one of the most complicated anatomical areas in the human body. Surgical accessibility of all its structures has vastly increased the number of potential treatments for patients with hearing and balance disorders thanks to the advancement of the use of the dental drill and burr.

Today it is easier for us otolaryngologists to drill down and visualize the temporal bone structures because of better instrumentation which gave rise to lesser morbidity. It is because of this that the author believes that it should be readily available to the otolaryngologist. One way is to make a high quality product using high quality electronics locally available at a remarkably lesser cost. Thus the OTODRILL was born.

CONCLUSION

The OTODRILL is a very inexpensive surgical drill unit which uses high quality electronics readily available in our country and will help lower the cost of acquiring a surgical drill for the Otolaryngologist or hospital which can lower the cost for patients in seeking medical help.

RECOMMENDATION

It is recommended by the author that the OTODRILL be tested in ENT-Surgical procedures

BIBLIOGRAPHY

1. Nelson m.d., Ralph A.: Temporal Bone Surgical Dissection Manual revised edition: pp 2- 4: House Ear institute 1991.
2. Cummings, Fredricksson et. al.: Otolaryngology and Head and Neck Surgery, Third edition, volume four, chapter 171 p. 3356: Mosby, 1996

3. Myers et. al: Operative Otolaryngology, Head and Neck Surgery: volume II, chapter 110, pp.1286 – 1288: WB Saunders, 1997
4. Bailey et. al.: Head and Neck Surgery – Otolaryngology, Second edition: Volume two, chapter 139, p. 2053: Lippincot – Raven, 1998.

APPENDIX

TABLE 2: Drill unit specifications
Input: 220Vac, 50/60 1.0 AMP
Output: 0 – 30Vdc, 1AMP
Operating speed range: 0 - 35,000 RPM
Fuse: 1 AMP
Weight: 1.50 lbs (.681100 kgs)
Length: 11 x 10 x 7 cm. (110 x 100 x 70 mm.)

TABLE 3
List of materials used

Name of part	Number used
Transformer 220v w/ optional auto-volt capacity	1
Capacitor 2,200 uF	1
Rectifier diode	4
Circuit board	1
Voltage regulator circuit	1
LED diode	1
Din socket	1
On – off switch	1
Togel switch	1
Fuse	1
AC plug	1
Foot pedal	1
Casing	1

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 59-65 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

LARGE NASOPHARYNGEAL TRUE TERATOMA IN A FILIPINO NEWBORN: A CASE REPORT*

MARVIN M. TOLENTINO, MD**
JOSEPH NOEL N. OCONER, MD**
NATIVIDAD A. ALMAZAN-AGUILAR, MD, FPSO-HNS***

ABSTRACT

OBJECTIVES:

1. To present a rare case of a true teratoma of the nasopharynx in a Filipino newborn.
2. To present a rational diagnostic and management approach to the case.

DESIGN: Case report
SETTING: Tertiary Government Hospital
PATIENT: One female newborn
RESULTS: A newborn presented with a congenital large naso-oropharyngeal mass. She did not present with signs of airway obstruction. The oral mass was found to be attached to the nasopharynx. The initial consideration was a teratoma. The patient also manifested with an incomplete cleft palate and dermoid cyst on the left eye. Contrast CT scan confirmed the attachment of the mass to the left nasopharyngeal wall. The mass was subsequently resected and delivered transorally. The final histopathology showed teratoma. Otorhinolaryngologic management of this case encompassed the following priorities: (1) ensuring vital & vegetative function (airway & feeding), (2) examination of the newborn for concomitant congenital anomalies, (3) resection of the mass after accurate delineation of its extent and dimensions and (4) planning for future repair of the palatal defect.
CONCLUSION: True teratomas of the nasopharynx are rare lesions (originating from the 3 embryonic germ cell layers). Airway management is the first priority of the otorhinolaryngologist in these cases because of potential to cause upper airway obstruction.

INTRODUCTION

Teratomas are tumors composed of tissues from all three embryonic germ layers (ectoderm, mesoderm and endoderm). These tumors may arise from any part of the body – usually as midline structures. Tupper and Lack cited the head and neck region as the 3rd most common location for teratomas, accounting for 5.5% of all cases [following teratomas of sacrococcygeal region (40%) and the ovaries (37%)]. (1) Head and neck teratomas reportedly occur in 1 of 40,000 births. The cervical, orbital and temporal areas are commonly involved in this region. (2) The nasopharynx a mucosa-lined space behind the nasal cavity bordered by the skull base (superior) and the soft palate (inferior)] forms part of the upper respiratory tract in normal nasal breathers. Nasopharyngeal teratomas are therefore exceptional because of the potential to occlude the upper airway. Expeditious evaluation and management of the airway at the time of birth is the single greatest challenge for the otorhinolaryngologist in these cases.

This case report is an account of our recent clinical experience in the care and management of a Filipino baby born with a large naso-oropharyngeal teratoma.

The objectives of this study are the following:

1. To present a rare case of naso-oropharyngeal teratoma in a Filipino newborn, and;
2. To present a rational diagnostic and management approach to the case.

*1st Place, PSO-HNS Intersting Case Report Contest, April 24, 2004, Bacolod Convention Plaza Hotel, Bacolod City
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, East Avenue Medical Center
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, East Avenue Medical Center

CASE REPORT

A newborn female was seen by the ENT-HNS service of a tertiary government hospital for evaluation of oral mass.

Baby G.T. was born term (38-39 weeks by LMP) to a 39 year old (gravida 8, para 7) via normal spontaneous delivery at home assisted by a midwife. A bulky oral mass was noted at the time of birth. The baby had a weak and muffled cry. She did not exhibit signs of respiratory distress or cyanosis. Noisy or labored breathing was not noted. Baby GT was rushed to the emergency room for further evaluation and management.

Maternal history was negative for illnesses like URTI, UTI or vaginal infections. Mother denied any exposure to radiation or intake of prohibited drugs during the pregnancy. She did not have a single prenatal check up.

Family history was negative for congenital anomalies, asthma, pulmonary tuberculosis, diabetes mellitus or hypertension.

Physical examination of the new born revealed a well developed female neonate, not in respiratory distress and with following vital signs CR: 130's/min, RR: 40's/min, T:36.9. She was 38-40 wks on Ballard's maturity scoring (appropriate for gestational age). Baby GT had a weak and muffled cry. No cyanosis or stridor was appreciated by the examiner.

On examination of the oral cavity a lobulated mass about 6x6x5cm was noted protruding from the oral cavity. The patient could not close her mouth. A U-shaped soft tissue defect on the left side of the secondary palate was appreciated. The pedicle of the mass was found to be interposed at the hemipalatal defect. (Fig. 1) The mass was dark-colored and had crusting surface. It did not transilluminate. On palpation the mass was noted to be firm, doughy and non-compressible. The Furstenberg test (enlargement of the mass on compression of the IJV) was negative. The stalk of the mass was palpably traced to be attached to the left nasopharynx. Transoral nasopharyngoscopy using 4mm 70 degrees Karl storz sinuscope confirmed the left nasopharyngeal attachment of the pedunculated mass. The mass did not bleed on palpation nor was it tender. It did not elicit distress on palpation. The examination of the nasal cavity disclosed patent nostrils with good airflow

The examination of the ears and neck were both unremarkable.

The examination of the eyes showed a white fleshy nodule on the limbal area (corneoscleral junction) of the left eye (Fig. 2).

The rest of the physical findings were unremarkable.

The impression of ENT service was

FIGURE 1
Baby GT: Preoperative photographs

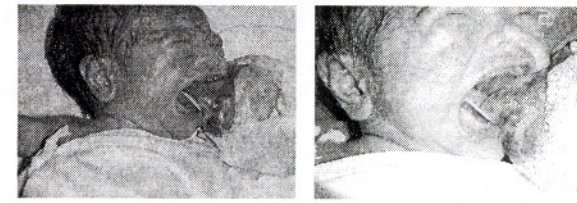
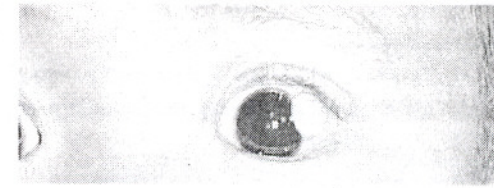


FIGURE 2
Limbal dermoid



congenital naso-oropharyngeal mass with extraoral extension (t/c teratoma); cleft palate incomplete bilateral; limbal mass, left. In the absence of conspicuous signs of upper airway obstruction (stridor, cyanosis, etc.), the initial plan of the service consisted of insertion of an orogastric tube to facilitate feeding and requesting for a contrast CT scan of the oral cavity to include the nasopharynx and cranium to ascertain the extent of the mass.

Baby GT was referred to Pediatric service for co-management. Routine newborn care (Vitamin K, Fucithalmic eye ointment application, etc.) was rendered. Intravenous Ampicillin and Gentamycin were started.

Patient was likewise referred to Ophthalmology service for evaluation of the left eye. The impression of the service was limbal dermoid, OS. The condition did not warrant emergent management at the time of admission.

CT scan was done on the 7th hospital day (Day 7 of life). Plain and contrast studies of the cranium, nasopharynx and oral cavity demonstrated a heterogeneously enhancing soft tissue mass extending outside, of the mouth with fat and bone densities within, measuring 6 x 6.5 x 5 centimeters. (Fig. 3A) The mass was noted to have a pedicle which originated from the left lateral nasopharyngeal wall and the ipsilateral soft palate. There was no abnormal density changes in the brain parenchyma. (Fig. 3B) Posterior fossa structures were unremarkable. Visualized calvarium and paranasal sinuses were intact. A nasopharyngeal teratoma was considered. (Appendix 1)

The surgical plan of the service was excision of the naso-oropharyngeal mass (with extraoral extension) via transoral approach under GA. Patient underwent surgery on the 12th HD after clearance by Pediatrics.

The pharynx was examined upon induction of general anesthesia (via orotracheal route). The surgeons utilized Foley catheters to retract the

FIGURE 3A
Contrast CT scan:
at the level of the nasopharynx

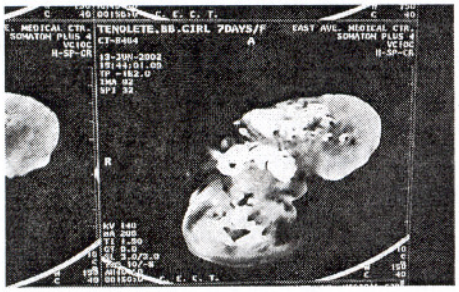
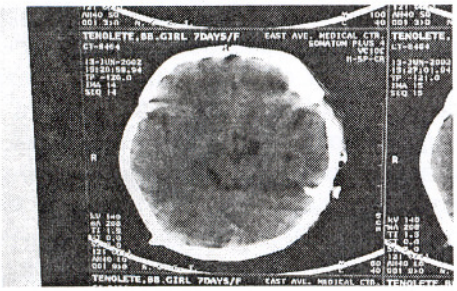
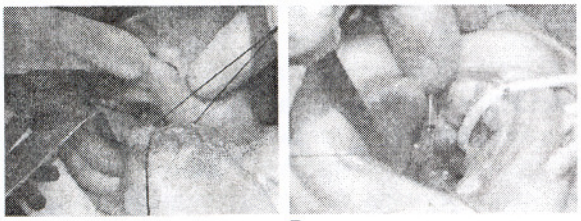


FIGURE 3B
Contrast CT scan: cranium

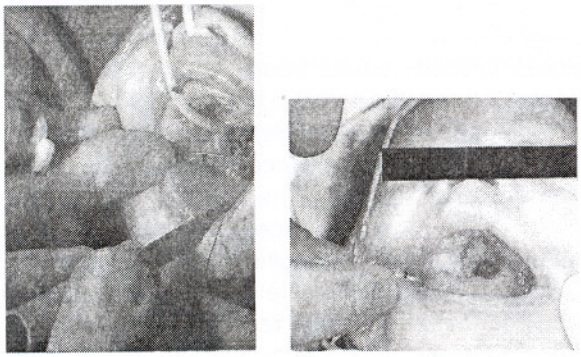


palate and 4mm 70 degrees Karl Storz sinuscope to aid visualization of the nasopharynx. The pedunculated mass was noted to be attached to the left side of the nasopharynx. A U-shaped cleft defect of the secondary palate was likewise appreciated. The pedicle about 0.5 cm in diameter was then ligated. The mass was thereafter delivered through the oral cavity. (Fig. 4A, B, C, and D) Duration of the surgery was 1 hr and 5 mins. Blood loss was less than 30 cc.

FIGURE 4 A-D
Intraoperative photographs



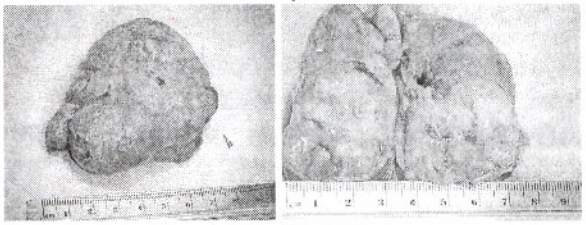
A B



C D

The specimen was sent to the laboratory for histopathologic examination. Grossly the specimen measured 6cmx6cmx5cm and weighed 80 grams. The mass had a brownish tan nodular outer surface with fibrinopurulent material. (Fig 5A) Cut sections revealed a fleshy, whitish solid surface with several gritty areas. (Fig 5B) Microscopically, tissue derivatives from the three embryonic germ layers were noted: 1. keratinizing squamous epithelium,

FIGURE 5A-B
Gross specimen

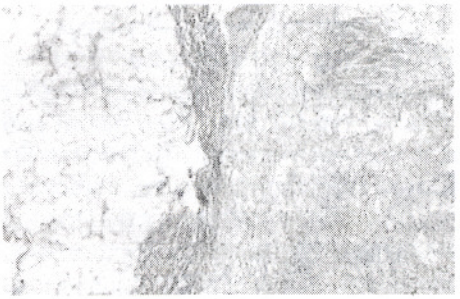


A B

serous glands (ectoderm); 2. lobules of mature adipose tissue, smooth muscle cells and cartilage (mesoderm); and 3. respiratory epithelium (endoderm). (Fig. 6) (Appendix 2)

Postoperatively, IV antibiotics were continued. Oral hygiene measures and wound care consisting of NSS oral swabs were initiated. Good

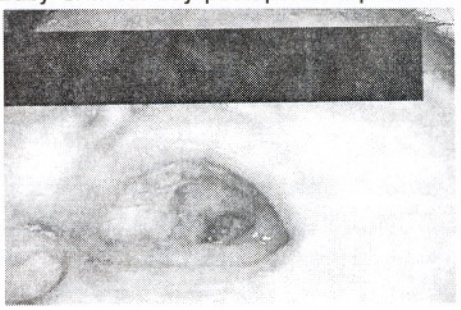
FIGURE 6
Baby G.T.



healing was noted in the next few days. (Fig. 7) Feeding was initiated on the fifth post-operative day. Patient was discharged 7 days after the surgery.

Unfortunately Baby GT's parents failed to bring back the patient for follow-up consultations at the outpatient department.

FIGURE 7
Baby G.T.: 6th day postoperative photo



DISCUSSION

True teratomas are lesions containing tissue originating from the 3 embryologic germ cell layers (ectoderm, mesoderm, and endoderm). The term teratoma is often used to describe any of four types of tumor that constitute tissue foreign to the area in which it is located. These include dermoids(hairy polyps), teratoid, true teratomas, and epignathi. (3) In 1992, Tharrington and Bussen proposed a histologic classification for the congenital tumors. (4)

1. Dermoids are neoplasm composed of only of ectodermal and mesodermal elements.
2. Teratoids contain ectodermal, mesodermal, and endodermal elements. These elements are however not well differentiated and lack clear organization.
3. True teratomas contain tissue derivatives from 3 germ layers. Cell layers demonstrate more organization.
4. Epignathi are the least frequent but most striking of teratomas in that well-formed organs and limbs may be found occurring in abnormal locations. (e.g. an arm coming out of the oral cavity)

Our young patient presented with a pedunculated naso-oropharyngeal mass which was later histopathologically verified to be a true teratoma.

A true teratoma of the nasopharynx is a rare entity. While it is agreed that all four types of teratoma have a collective occurrence 1:4000 births, the confusing classification cited earlier makes it difficult to sort out the exact incidence of the true teratomas of the nasopharynx internationally. [3]

Locally, Astorga et al reported the case of a full term female infant presenting with an oro-antral (encroachment of the oral cavity and maxillary antrum) teratoma. The infant also manifested typical features of Goldenhar syndrome (underdevelopment of the orbit, mandible, external ear and facial muscles, hemivertebrate of the vertical column) and other multiple congenital anomalies such as cleft palate, micrognathia thymicuplasia, congenital heart disease and corpus callosum agenesis.[5] The case of Baby GT may very well be the first documented report of congenital nasopharyngeal teratoma – with extraoral extension at that!

Occurrence of teratomas in the head and neck regions has an equal incidence in both sexes in comparison to similar tumors in other body regions [6]. Cuppitt et al have linked maternal polyhydramnios, preterm birth and the occurrence of other congenital abnormalities with nasopharyngeal teratoma. Maternal polyhydramnios cannot be verified in this case in the absence of maternal prenatal consultation. Baby GT was a term newborn who manifested with 2 other congenital anomalies: 1) a defect on the secondary palate; 2) a dermoid on the limbus of the left eye.

The palatal defect is thought to be secondary to the naso-oropharyngeal mass which hindered normal fusion of the palatal shelves (normally completed at 3 months age of gestation). [7]

Dermoids are hamartomas (benign overgrowths) of fibrous fatty tissue covered by epithelium that usually occur at the limbus (corneoscleral junction) of the eye, usually inferotemporal. Hair follicles, sweat and sebaceous glands may be present in these lesions. These lesions have a characteristic appearance and are associated with Goldenhar syndrome. [8] Baby GT did not have manifestations of this syndrome.

Tewfik et. al. cited three theories to explain the occurrence of teratomas 1.totipotent cells escaping embryologic organization and undergoing unrestrained growth, 2. pathogenic germ cell development; and 3. the twin inclusion theory (teratomas as a different embryo growing inside the body of its twin).[9] The first postulate holds most plausibly for true teratomas of the nasopharynx. [3]

The neonate born with a nasopharyngeal teratoma usually presents with severe respiratory distress (e.g. noisy/labored breathing, cyanosis) necessitating orotracheal intubation or tracheostomy.[9] Baby GT did not exhibit signs and symptoms of upper airway obstruction. The authors attribute this fortuitous circumstance to 3 related factors: 1. obligate nasal respiration among neonates, managed to offset potential respiratory embarrassment from the bulky oral mass; 2. thin pedicle measuring 0.5 cm and 3. the palatal defect.

A bulky mass would naturally give rise to feeding difficulty. This problem was addressed by the facile insertion of an orogastric tube in our patient.

Pertinent differential diagnoses teratoma presenting as a congenital nasopharyngeal mass in a neonate are the following: 1. encephaloceles 2. gliomas 3. Rathke's pouch cyst and craniopharyngoma, 4. hemangioma, 5 Tornwaldt's cyst, 6. chondroma, and 7. rhabdomyosarcoma.

An encephalocele is the most important diagnosis to rule out in Baby GT's case. An encephalocele results from herniation of cranial contents through a defect in the skull. It may include meninges only (meningocele), or it may involve brain and meninges (meningoencephalocele).[6] In 1990, Curlan et al reported the case of a neonate presenting with an oral encephalocele. [10] Serious injury (CSF leak, meningitis, seizure) can result from failure to differentiate this CNS abnormality from a nasopharyngeal teratoma. Clinically an encephalocele tends to be smooth, bluish, soft,

compressible masses that transilluminate. These masses enlarge with crying and upon compression of the internal jugular vein [(+) Furstenberg sign]. All of these findings were absent in our patient's nasopharyngeal teratoma.

A glioma is thought to be an encephalocele that has lost its intracranial connection, although 15% remain attached to the central nervous system via a fibrous stalk. [6] Like most teratomas, a glioma would be firm and non-compressible. The Furstenberg's sign would be absent and the mass will not transilluminate.

Rathke's pouch cyst and craniopharyngiomas are possible differentials for nasopharyngeal mass in a newborn because they may erupt through the sella turcica and may present at any age. [1]

Hemangiomas are the most frequently occurring head and neck tumors in children. They are thought to arise from vasoformative tissues and are classified as capillary, cavernous, or mixed. [6] A careless wedge biopsy of the mass could lead to exsanguinating hemorrhage.

Less important differential consideration include: Tornwaldt's cyst, chordoma, and sarcomas.

Tornwaldt's cyst is a benign developmental lesion within the midline nasopharynx. The cyst forms from the obstruction of the pharyngeal bursa (embryonic communication between the nasopharynx roof ant the notochord). [11] Tornwaldt's cyst can be potentially complicated by infection leading to abscess formation.

Chordomas are rare, slow growing, low grade malignancies that similarly originate from remnants of the primitive notochord. Thirty-five per cent (35%) originate from the roof of the nasopharynx). [6]

A soft tissue malignancy such as embryonal or botryoid rhabdomyosarcoma is common in infants and young children. Next to the orbit, the nasopharynx is the most commonly affected head and neck site. [11]

Rybak et al have cited lipomas, lymphomas, lymphangiomas, neurofibromas as additional differential diagnoses. [3]

Histopathology definitively differentiates teratomas from the other pathologic entities. Teratomas classically have a wall composed of stratified squamous epithelium with underlying sebaceous glands, hair shaft, and other skin adnexal structures. Structures from other germ layers can be identified, such as cartilages, bone, thyroid tissue, and other organoid formation. [12]

Transoral fine needle aspiration biopsy has been utilized on the cytologic diagnosis of nasopharyngeal teratoma. [13] FNAB was not done on this case.

In 1999, Sagol et al reported the prenatal detection of nasopharyngeal teratoma in a 34 y/o pregnant woman with elevated maternal serum alpha-fetoprotein (MSAFP), and sonographic findings of a heterogenous semisolid mass filling the oropharynx and nasopharynx. The fetus died in utero. Postmortem histopathologic examination of the mass was confirmatory for nasopharyngeal teratoma. [14] The absence of maternal prenatal consultations in this case precluded any benefits these laboratory tests may harbor.

Prenatal diagnosis of a bulky nasopharyngeal mass in utero is relevant insofar as provisions for airway access may be made for any respiratory emergency that may ensue following delivery. [15]

Otorhinolaryngologic management of this case of a neonate born with a nasopharyngeal teratoma should encompass the following concerns, in order of priority: 1. ensuring the patency of the upper airway, 2. feeding, and 3. screening for other congenital anomalies on physical examination and referring to concerned specialties for co-management, 4. delineation of dimensions and extent of the mass as a prerequisite to 5. tumor removal and 6. cleft palate repair at an appropriate age.

Most nasopharygeal teratomas present with airway obstruction. [3,4,16,17] A nasopharyngeal mass in any patient, both pediatric and adult poses a potential for upper airway obstruction. Ruling out this life threatening emergency is of foremost importance to the otorhinolaryngologist - especially for a young patient who is anatomically more susceptible to respiratory compromise (narrow airways, poor collateral ventilation, less compliant lungs/thorax, less intercostals muscle exertion, horizontal rib position and easily fatigable respiratory muscle). Emergent measures may consist of orotracheal intubation and or tracheostomy. These were not necessary in the case of Baby GT because she did not manifest with signs & symptomatology of airway compromise (stridor, retractions, restlessness, etc.).

Feeding problems are likely to be encountered in a neonate who has impaired swallowing function secondary to the bulky oral mass. An orogastric tube was inserted to deliver nutrition and to prevent aspiration. Milk feedings were subsequently initiated

Congenital anomalies seldom occur in isolation. A thorough physical examination was performed in this case to rule out coexisting problems. A dermoid cyst was noted on the limbus of Baby GT's eye. Ophthalmologic consultation was accordingly made. The patient was likewise referred to Pediatrics for co-management and proper neonatal care.

Only after the establishment of vital/vegetative function, can removal of bulky oral mass be carried out. Delineation of the dimensions and extent of the mass should precede surgery. CT and MRI play

a key role in achieving this goal. Contrast CT scan of the oral cavity, nasopharynx and cranium done in the case of Baby GT succeeded in 1. confirming the nasopharyngeal attachment of the pedicled mass, 2. strengthening the clinical impression of the congenital nasopharyngeal teratoma (with the disclosure of a heterogeneously enhancing soft tissue mass having fat and bony densities within); 3. ruling out intracranial extension of the mass and coexisting congenital neuro-craniopathogy. Anencephaly and hemicrania have been associated with nasopharyngeal teratomas. [2] Surin in 1999 reported the case of a congenital nasopharyngeal teratoma invading the skull base and the right temporal region. [18] Earlier, Aughten et al reported the case of a premature female infant with nasopharyngeal teratoma and Dandy-Walker malformation (hydrocephalus and marked fourth ventricle enlargement secondary to CSF flow obstruction) among other congenital abnormalities (diaphragmatic herniation, congenital heart defect). [19]

The recommended treatment for head and neck teratomas is surgical excision. Baby GT's nasopharyngeal teratoma was excised through the transoral approach aided by endoscopy, The excision was facilitated by the cleft palate. A craniofacial approach would have been necessary had the CT scan revealed intracranial extension. [9] Excision of the mass proved to be both therapeutic(resection of the bulky oral pathology) and diagnostic (histopathologic specimen obtained to confirm clinical impression).

Transoral CO2 laser surgery and microendoscopic removal of the nasopharyngeal teratoma in the premature 36 week old female infant has been reported. [20]

Complete management of Baby GT's case entails repair of the palatal defect to avoid velopharyngeal insufficiency (VPI). VPI pertains to dysfunction of the velopharyngeal (soft palate and posterior pharyngeal wall) apparatus resulting from incomplete closure of the nasal and oral cavities. This condition leads to abnormal quality and articulation patterns. Various methods for cleft palate repair exist (e.g. 2-flap, V-Y push back, Von Langenbeck, and Furlow palatoplasties). [21] Most centers perform palatoplasty at 10-18 months of age, the age at which speech articulation skills begin to develop. [22] Baby GT's parents were counseled on the implication of the palatal defect and future management concerns. As of writing, the patient has not been brought back for any follow up consultations.

CONCLUSION

A female newborn was brought to the ER of a tertiary government hospital for evaluation of a congenital oral mass. She did not present with signs and symptomatology of airway obstruction. The oral mass was found to be attached to the left nasopahrynx. Initial consideration was a teratoma. The patient was also noted to have an incomplete cleft palate and dermoid cyst on the left eye. CT scan confirmed the attachment of the heterogenous mass to the left nasopharyngeal wall. No intracranial extension/pathology was noted. On the 12th hospital day the mass was excised and delivered transorally. The postoperative period was unremarkable. Unfortunately the patient was not brought back for follow up consultations at the out patient department.

Holistic otorhinolaryngologic management of this case of a neonate born with a nasopharyngeal teratoma included ensuring vital vegetative functions (airway and feeding), screening for concomitant congenital pathologies, removal of the mass after radiographic delineation and planning for future palatoplasty to offset velopharyngeal insufficiency as a possible consequence of the palatal defect.

BIBLIOGRAPHY

1. Schwartz, S et al. Principles of surgery, 7th edition. NY: McGraw Hill, 1999.
2. Bailey, B et al. Head and Neck Surgery – Otolaryngology 3rd ed. PA: Lippincott – Williams & Wilkins, 2001.
3. Rybak, LP et al. Obstructing Nasopharyngeal Teratoma in the Neonate. A Report of Two Cases. Archives Otolaryngology Head Neck Surgery. 1991; 117 (12):1411-5.
4. Tharrington, CL, Bossen, EH. Nasopharyngeal Teratomas. Archives Pathology Laboratory Medicine. 1992; 116: 165-167.
5. Astroga RZ et al. Teratoma of the oro-antral cavity in goldenhar syndrome: a case report. Philippine Journal of Otolaryngology Head Neck Surg. 1993; 32-40
6. Cummings, C et al. Otolaryngology Head & Neck Surgery, 3rd ed. USA:Mosby, 1998.
7. Sadler TW. Langman's Medical Embryology. PA: : Lippincott – Williams & Wilkins, 1995.
8. Wright, KB et al. Pediatric Ophthalmology & Strabismus, USA : Mosby, 1997.
9. Tewfik, TL. Congenital Malformations Nose. Emedicine, March 17, 2003.
10. Curlan SE et al. Oral encephalocele in a male newborn. American Journal of Otolaryngology, 1990.
11. Seiden, AM et al: Otolaryngology: the Essentials. NY:Thieme, 2001

12. Cotran, RS, Vkumur, and SL Robbins. Robbins – Pathologic Basis of Diseases. 5th ed. PA: WB Saunders, 1994.
13. Schwartz, MR et al. Fine needle aspiration diagnosis of a nasopharyngeal teratoma. Acta Cytol. 1991 may-Jun; 35(3): 360-4.
14. Sagol S, et al. Prenatal sonographic detection of nasopharyngeal teratoma. Journal Clinical Ultrasound. 1999 Oct; 27(8):469-73.
15. Marras, T, et al. Perinatal management of nasopharyngeal teratoma. Journal of Otolaryngology. 1995 Oct;24(5):310-2.
16. Candan, S et al. Nasopharyngeal teratoma as a respiratory emergency in the neonate. Journal of Otolaryngology. 1991 Oct; 20(5): 349-52.
17. Byard, RW et al . Congenital teratomas of the neck and nasopharynx: a clinical and pathological study of 18 cases. Journal of Pediatric Child Health. 1990 Feb; 26(1): 12-16.
18. Sarin, YK, An unusual congenital nasopharyngeal teratoma. Pediatric Surgery Int. 1999; 15(1): 56-7.
19. Augton, DJ et al. Nasopharyngeal teratoma ('hairy polyp'), Dandy-Walker malformation, diaphragmatic hernia, and other anomalies in a female infant. Journal of Medicine and Genetics. 1990 Dec; 27(12): 788-90.
20. Gunkel, AR, et al. Transoral CO2 laser resection of extensive nasal oropharyngeal teratoma. Laryngorhinootology. 1996 Apr; 75(4): 239-41.
21. Smith, HW. The Atlas of Cleft Lip and Cleft Palate Surgery, NY: Grune and Stratton, 1983.
22. Jafek, BW, et al. ENT secrets. NY: Hanley and Belfus, Inc., 1997.

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 66-70 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

A BLEEDING NECK MASS: AN UNUSUAL CASE OF NEUROFIBROMA*

PEDRO R. PATAO I, MD**

ABSTRACT

OBJECTIVES: 1. To present an unusual case of neurofibroma of the neck that does not meet the criteria for neurofibromatosis. 2. To describe the role of surgery in the treatment and reconstruction of a cosmetically unacceptable, disfiguring lesion. 3. To emphasize the importance of early detection and possibility of malignant transformation in neurofibroma. 4. To present the criteria in the diagnosis of neurofibromatosis.
DESIGN: Case Report
SETTING: Tertiary Hospital
PATIENT: A 36 years old male with a huge bleeding neck mass.
RESULT: Repeated incision biopsy of the lateral neck mass revealed neurofibroma. CT scan of the mass showed that it was superficial to the sternocleidomastoid muscle and was not adherent to the major vessels of the neck. A wide excision of the mass was done and the defect was reconstructed with a pectoralis major flap.
CONCLUSION: A case of neurofibroma that does not meet the criteria for von Recklinghausen's disease is presented. This may represent a distinct form of neurofibromatosis. In this kind of tumor, surgery remains the treatment of choice for resectable lesions. Early detection of the tumor is imperative for its successful treatment.

INTRODUCTION

In a patient presenting with a neck mass, the first consideration is the patient's age. Within each age group, the incidence of a neck mass varies. In pediatric and young adult age group, inflammatory masses predominate. In old adults, the first consideration is a newgrowth. The location of the mass is also important. Developmental or congenital lesions occur in constant locations.

Neurofibromas are tumors derived from Schwann cells, fibroblasts and the supporting cells known as perineural cells. They are benign but may be multiple. It is a slow growing mass which unlike schwannoma is unencapsulated. Tumors are usually asymptomatic and when it is multiple, it is usually associated with von Recklinghausen disease. It can undergo malignant transformation, which can change the outcome of the disease.[11,12,13] Neurofibromatosis is an autosomal dominant inherited syndrome divided into 7 types.[12] Type I or multiple neurofibroma or von Recklinghausen's disease is characterized by acoustic nerve schwannomas, gliomas of the optic nerve, meningioma, pigmented nodules of the iris, and café-au-lait spots. It is associated with a defect of chromosome 17. Neurofibromatis Type II or central neurofibromatosis is characterized by bilateral schwannoma of the acoustic nerve and multiple meningiomas. It is caused by a defect on Chromosome 22. Type III is the mixed type. The Type IV "variant" resemble Type II but have numerous neurofibromas and are at greater risk of developing optic gliomas, neurilemmomas and meningiomas. Type V or segmental (dermatomal) neurofibromatosis from postzygomatic somatic mutation and is not generally heritable. Type VI is characterized by the absence of neurofibromas, only café-au-lait spots, is of late onset and is not yet known if inherited.

Head and neck manifestations of neurofibromatosis are relatively uncommon (14%-37%) and cause grave threats to nearby structures.[11,12,14] Its potential risk for malignant transformation should be kept in mind, hence, the need for early diagnosis is valuable.[12,16] Surgery remains the treatment of choice for resectable tumors.

*2nd Place, PSO-HNS Interesting Case Report Contest, April 24, 2004, Bacolod Convention Plaza Hotel, Bacolod City
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, Ilocos Training and Regional Medical Center

CASE REPORT

This is the case of a 36-year-old, male who sought consult due to a left lateral neck mass.

The present condition started 29 years PTC as a small non-tender mass on the left lateral neck area with no other associated symptom. The mass gradually enlarged in size to about 2 centimeters in its greatest diameter. The patient was then brought for consult and an excision biopsy was done. No histopathologic study was done on the excised tissue.

25 years PTC, a small non-tender mass was again noted on the previous site. The patient was then again brought for consult and excision of the mass was done. No histopath was done on the said tissue again.

At 20 years and 5 years PTC, the mass recurred and was again excised with no histopathologic study done on the mass.

3 years PTC, a small non-tender mass was again noted on the previous site with no other associated symptom. The mass gradually enlarged but this time no consult was done due to financial difficulty until 1 month PTC when the mass had grown to about 10 centimeters in its greatest diameter and was noted to bleed profusely. Consult was then done at this institution.

Upon consultation, a 12 x 10 centimeter fungating, friable, necrotic, foul smelling mass was noted on the left lateral neck area (Figure 1-2)). The mass was bleeding spontaneously. It had a bag of worms feeling upon palpation and had the following borders:

Anteriorly: 1-cm medial to the medial border of the sternocleidomastoid muscles

Posteriorly: 2 cm from the left paravertebral line

Inferiorly: 2.5-cm superior to the clavicle

Superiorly: up to the earlobe

There were no other significant physical examination findings.

Incision biopsy of the mass was done revealing neurofibroma. A repeat and deeper incision biopsy was done to rule out neurofibrosarcoma and the result still revealed neurofibroma. CT Scan was then requested to determine the extent of the mass. The mass was noted to be superficial to the sternocleidomastoid muscles and was not adherent to any major vessels of the neck.

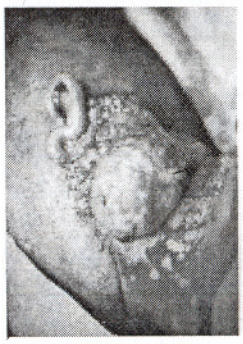


FIGURE 1

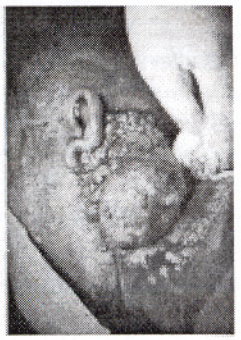


FIGURE 2

OPERATIVE FINDINGS

The mass was multinodular, with the following boundaries: anteriorly: anterior border of the middle third of the sternocleidomastoid; posteriorly: 1 (one) centimeter away from the left parasternal line; superiorly: earlobe; inferiorly: 2 (two) centimeters superior to the middle third of the clavicle. Superficial blood vessels that were supplying the mass had increased in size. The mass was superficial to the sternocleidomastoid muscle and was not adherent to the major vessels of the neck. A wide excision of the mass was done and the superficial portion of the sternocleidomastoid muscle was excised also. (Figure 5) The defect was reconstructed with a pectoralis major flap. (Figure 3-4)

Final histopathologic result revealed Neurofibroma. (Appendix C)

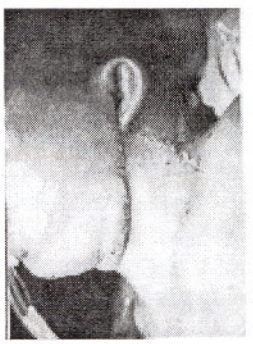


FIGURE 3

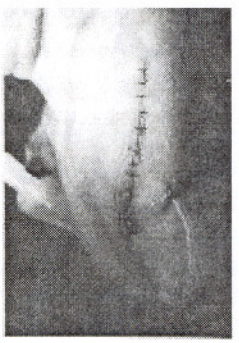


FIGURE 4

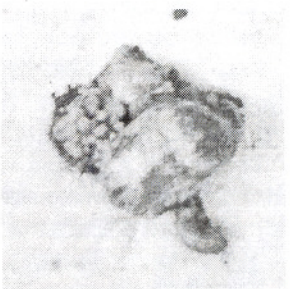


FIGURE 5

CASE DISCUSSION

In the initial evaluation of a neck mass, consideration should be given to the patient's age group. For within each group, the relative incidence of congenital, inflammatory and neoplastic diseases differs. Pediatric and young adult groups

generally exhibit inflammatory lesions more frequently than congenital ones, with neoplastic masses relatively low. On the other hand, adult neck masses are commonly neoplastic rather than inflammatory or congenital. Equally noteworthy is the neck region from which the mass would emanate. A basic understanding of the neck geography is always a superior tool of head and neck physicians in tracking down the real culprit.

Early determination of the nature of the mass is therefore necessary so that definitive management can be readily instituted. However, in the eager search of the diagnosis, the physician must always work within the limits of logical approach and principles that have served as the pillars of evaluating and managing neck masses throughout the years. Otolaryngologists, who are the ultimate caregivers in neck diseases, must always be guided by the fairly well established guidelines in the pursuit of diagnosis and eventually treatment, even in the most perplexing circumstances. The whole process, time consuming as it maybe, even frustrating sometimes, will not only satisfy the physician's dilemma but also will likewise afford a honest-to-goodness treatment of the patient's illness.

The patient presented is an adult who came in with a bleeding fungating friable mass on the left lateral neck area. The history of the illness will yield raw materials to build the case, the physical findings are the prima facie evidences and the ancillary procedures might fix some kinks. Generally, a neck mass especially in an adult should always be considered malignant unless proven otherwise. It is a great disservice to the patient if the mass is excised for diagnostic purposes unless all other measures are exhausted to prove otherwise.

Neurofibroma located on the neck with no other associated symptom is rare. A head and neck manifestation of neurofibromatosis only accounts for 14%-37%.[2,11] Minimal literature is available about the presence of a solitary neurofibroma that is not part of neurofibromatosis.

Neurofibroma is a benign, slow growing nerve sheath tumor, which unlike schwannoma is not encapsulated. Its nerve fibers are incorporated and traverse the mass. Tumors are usually asymptomatic and may be multiple when seen with von Recklinghausen's disease. They may grow to large sizes. The factors that influence the growth of neurofibromas are not well understood.[3,8] One theory is that patients with neurofibroma have a reduced amount of neurofibrin, a protein that is thought to help control the activity of Ras, which regulates cell growth. When associated with von Recklinghausen's disease, 4.6%-16% have shown sarcomatous transformation. [11] Neurofibroma can also be classified as localized, diffuse and plexiform. Localized neurofibroma is the most common type in which the lesion is located in the dermis, subcutaneous and deep soft tissue as well. Diffused neurofibroma is an uncommon type wherein the tumor extends beyond the confines of perineum. Plexiform neurofibroma consists of nerve sheath cells and nerve fibers initially within the perineurium of large nerves. Lesions are deeply seated and involve major nerve trunks. Plexiform neurofibromas involve single or multiple nerves. Solitary nerve plexiform neurofibromas are considerably more common and only 2 cases have been found to occur within the neck region as reported by Batsakis and Phynonen et al.

Our patient presented with a multinodular mass with no other associated symptom. He was diagnosed as a case of neurofibroma and not neurofibromatosis. The National Neurofibromatosis Foundation laid out 7 criteria for the diagnosis of Neurofibromatosis. The diagnostic criteria are met in an individual who has 2 or more of the following features:[5,6,7]

1. six or more café-au-lait macules over 5 millimeter in greatest diameter in pre-pubertal and over 15 millimeter in post pubertal individuals
2. two or more neurofibromas of any type or one plexiform neurofibroma
3. freckling in the axillary, inguinal regions
4. optic glioma
5. one or more Lisch nodules (iris hamartomas)
6. distinctive osseous lesions such as sphenoid dysplasia or thinning of the long bone cortex with or without pseudoarthrosis
7. a first-degree relative (parent, sibling, or offspring) with Neurofibromatosis by the above criteria.

The patient only presented with the lateral neck mass and there was no other associated symptom. Likewise, the patient had no relative who had the same condition. The patient was then diagnosed as a case of neurofibroma.

Schwannoma can be a differential diagnosis. It can also present as lateral neck mass but unlike neurofibroma, the individual axons do not traverse the lesion and it is cystic. Pain is prominent but neurological defects are unusual. Cystic degeneration, focal thrombosis and necrosis are prominent. Histologically, it can be ruled out with the presence of Antoni type A and B tissues. Malignant change seldom occurs in this lesion.[1,11]

The tendency of neurofibromas to become malignant is generally recognized, but the incidence of such transformation is not well documented. Hosoi and Brashfield et al calculated

the incidence of such change at about 13% and 29% of all cases of von Recklinghausen's disease respectively. Sarcomatous degeneration of neurofibromas occur between 5.5% and 16% of cases especially in deeply situated lesions, thus, giving a poorer prognosis. Prognosis of peripheral nerve plexiform neurofibroma is still uncertain due to limited reported cases in the literature to date.

Management of benign peripheral nerve sheath tumors in general is mainly surgical, which gives an excellent prognosis. Defects after excision can be managed with reconstructive techniques. In our case, a pectoralis major flap was used to reconstruct the defect. Cutler and Gross and Das Gupta et al noted that benign forms of peripheral nerve tumors can easily be separated from their nerve trunks which can and must be left intact. A nerve graft should be considered when an important nerve is involved in a benign tumor, which cannot be enucleated. Kavanaugh and Panje, recommends enbloc resection with cable grafting when nerve fibers are tenuous and interspersed within the tumor. Neurofibromas are radioresistant. Chemotherapy as well as immunotherapy remains to be palliative modes of treatment. Clinical trials are ongoing to understand why neurofibromas grow and how we might retard their growth. One of the more promising approaches, sponsored by the National Cancer Institute, examines whether an experimental drug called r115777, a farnesyl-transferase inhibitor, might interfere with the function of Ras and other proteins. The Mayo Clinic is studying whether another pharmaceutical product, pirfenidone, a collagen synthesis inhibitor, might arrest the growth or reduce the size of neurofibromas.

Counseling is also an important aspect in the management of neurofibroma. [3] Some people with neurofibroma become lonely and withdrawn because they feel different from others. Many parents of children with neurofibroma, or for that matter, neurofibromatosis, feel shock, anger, sadness, confusion and anxiety. Family and genetic counseling can provide support, answer questions and help the patient plan for the future.

The five-year survival rate for malignant neurofibroma ranges from 40%-60%. Hematogenous extension to the bones and lungs was noted in 33% of patients. Treatment of choice for malignant neurofibroma is wide excision with radiotherapy.

CONCLUSION

To our knowledge, there has been no locally reported case of neurofibroma of the neck that is not part of von Recklinghausen's disease, much more of a case of a bleeding neurofibroma. Most reported cases dealt with neurofibroma which were part of von Recklinghausen's disease. Even in neurofibromatosis, the incidence of head and neck manifestation is as low as 14% but in some studies, it is reported to be as high as 37%. Neurofibromatosis is often diagnosed in childhood due to the presence of cutaneous or intracranial tumors, CAL spots and Lisch nodules. We report a case of an adult patient with an isolated neurofibroma who does not meet the clinical criteria for neurofibromatosis. This might suggest that an isolated neurofibroma may comprise a distinct type of neurofibromatosis.[2]

The treatment of choice is still surgery for resectable tumors and this gives a favorable diagnosis. Incomplete excision is known to produce recurrence. Most patients seek consult due to disfigurement that causes social withdrawal. And for this reason, family and genetic counseling is very important in the management of neurofibroma.

The early detection of the tumor is imperative for the surgical intervention to be favorable. Close monitoring is needed because the incidence of tumor recurrence and the ability of this tumor to undergo malignant transformation. Transformation to a malignant tumor will require wide excision followed by radiotherapy.

BIBLIOGRAPHY

1. Cummings et al. Otolaryngology-Head and Neck Surgery. 3rd ed., Mosby
2. Mac Colin M., Blakley P., Louis D., Mankin H. and Short M.P. : A Clinical Study of Patients with Isolated Multiple Neurofibromas
3. Pontin, Jason. From the Editor: Acumen Journal of Life Vol.1, No.1
4. Bello SP and Reyes VJO: Neurofibroma, A Case Report
5. National Neurofibromatosis Foundation
6. National Institute of Neurological Disorders And Stroke: Neurofibromatosis info
7. Neurofibromatosis, Incorporated
8. AAOS Online Service Fact Sheet: Neurofibroma
9. American Academy of Orthopedic Surgeons
10. Bailey BJ. Ed Head and Neck Surgery Otolaryngology J.B. Lippincot 1993
11. Manaois T., Multiple Plexiform neurofibroma of the Neck: A Case Report. ITRMC Proceedings 1998

12. Luna G., Gonzales J.R., Chiong Jr. A.; Head and Neck Manifestations of Neurofibromatosis Type 1: A Case Series Report: The Philippine Journal of Otolaryngology Head and Neck Surgery Vol.17 No.3-4, 2002
13. Matsui I, Tanimura M, Kobayashi N, Sawada T, Nagahara N, Akatsuka. Neurofibromatosis Type 1 and cancer, Cancer, 1993; 72; 746-754
14. Muecke M. Amedee RG. Head and Neck Manifestations of Neurofibromatosis, Journal of Louisiana State Medical Society 1994 May; 146; 183-186
15. Gutmann, David, et al. The Diagnostic Evaluation And Multidisciplinary Management of Neurofibromatosis I and Neurofibromatosis II. JAMA. 1997 July, 278; 51-57

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos 1-2 71-79 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

IN THE FACE OF A COMPROMISED AIRWAY*

ANNE ELIZABETH JAVELLANA, MD**
JOEL ROMUALDEZ, MD, FPSO-HNS***
NORBERTO V. MARTINEZ, MD, FPSO-HNS***
ALLAN CARPELA, MD**

ABSTRACT

OBJECTIVES: This case report aims to (1) Present the differential diagnosis of chronic cough without neglecting uncommon causes (2) Increase awareness of diagnostic challenges that may arise in the face of a compromised airway (3) Elucidate the therapeutic complexity of airway management;
(4) Emphasize the value of a multi-disciplinary team approach in such cases; Illustrate the vital role otolaryngologists play in the diagnosis and management of airway problems
DESIGN: Case Report
SETTING: Tertiary Care Hospital in Quezon City, Philippines
PATIENTS: One Patient
RESULTS: This is the case of an eleven-year old male that presented with chronic cough that was refractory to conventional empiric medical therapy. As his symptoms progressed, further evaluation revealed a mass that was obstructing a large portion of the airway. Timely and methodical investigation and intervention proved to be life-saving.
CONCLUSION: A working knowledge of the differential diagnoses of chronic cough is crucial in the diagnosis and management of the compromised airway. A high index of suspicion, systematic and thorough investigation and a multi-disciplinary approach are vital components of the treatment plan. Bronchoscopy in the hands of a skilled practitioner is still a diagnostic and therapeutic mainstay.

INTRODUCTION

It is said that in purgatory, one is given just enough air to breathe. In the case presented, the patient must have felt closer to hell.

This is the account of an eleven-year old boy that presented with a rather mundane complaint of chronic cough but escalated into a life-threatening chain of events.

Cough is a protective reflex that clears the airway of excessive secretion and foreign bodies. It is a response brought about by the stimulation of irritant receptors in the upper and lower airways, diaphragm and certain viscera. As such, extrapulmonary causes must also be considered in patients presenting with cough. Chronic cough is arbitrarily defined as cough of more than three weeks duration.[12] This is commonly due to infection, reactive airway disease, foreign body aspiration, sinusitis, laryngopharyngeal reflux, and psychogenic or habit cough.[14] At times, children may cough even without any pathological basis. In a study by Munyard and Bush, healthy children cough from none to 34 times a day (mean 11.3). [16] However, nocturnal or prolonged coughing is unusual. Risk factors associated with chronic cough include environmental pollution, the presence of a smoker in the family and parental bronchitis or wheezing. When confronted with a patient with chronic cough, inquiring about its precipitating factors, quality, severity, other related symptoms and the time of day or season of the year will give the clinician clues to the possible etiology of the cough.

This case report endeavors to discuss the important causes of chronic cough in school-aged children, while taking into consideration more infrequent etiologies. This combination of a common symptom caused by an unusual disease entity unfolding under extraordinary circumstances makes this a fascinating case. The otolaryngologist must take into account exceptional causes of ordinary patient complaints, which may prove to be harbingers of more life-threatening conditions.

This paper also envisions increasing awareness of the diagnostic challenges with which one may be faced, and to demonstrate the therapeutic complexity that is part and parcel of

*3rd Place, PSO-HNS Interesting Case Report Contest, April 24, 2004, Bacolod Convention Plaza Hotel, Bacolod City
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, St. Luke's Medical Center
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, St. Luke's Medical Center

airway management. The otolaryngologist should be mindful that any procedure performed in this critical area might cause further compromise. Without adequate groundwork, surgical procedures of the airway may lead to more serious and disastrous complications. This case presents a diagnostic dilemma complicated with a race against time to save a child's life. It underlines the value of prompt and appropriate judgment in choosing diagnostic alternatives.

This paper also aims to emphasize the value of a multi-disciplinary team approach in the diagnosis and management of airway problems, and illustrate the vital role otolaryngologists play in cases such as this. The importance of each member of the medical team can never be underestimated.

CASE REPORT

An eleven year-old Filipino male from Guam presented with a chief complaint of chronic cough.

The patient had a two-month history of an unproductive cough associated with an intermittent, low to moderate grade fever. No specific temporal pattern was isolated and no precipitating, aggravating or alleviating factors were identified. A primary care physician had initially seen him in consultation and treated him for upper respiratory tract infection, but empiric treatment with amoxicillin and ibuprofen failed to resolve symptoms. On the contrary, the next few weeks saw him develop easy fatigability, diminished physical activity, anorexia and weight loss. In light of these, a therapeutic trial of azithromycin, albuterol, and a short course of prednisone were administered, but these provided only minimal relief, if at all.

Symptoms progressed even further. His harsh and dry cough increasing in frequency and severity, although he was not frankly dyspneic. Follow up consultation showed him to be tachypneic with decreased breath sounds in the left mid- and lower-lung field, but even the breath sounds were eventually lost. He was then admitted into a local hospital for further evaluation and management. An infectious etiology was still the primary consideration, as evidenced by his blood picture that revealed leukocytosis with neutrophilic predominance. On the other hand, his chest x-ray showed complete opacification of the left hemithorax, volume loss and an ipsilateral shift of the mediastinal structures (Fig. 1). Computed tomography of the chest confirmed complete atelectasis of the left lung (Fig. 2). These gave the impression that the left mainstem bronchus was obstructed. Whether the obstruction was intrinsic

FIGURE 1
Chest Radiograph taken prior to admission showing complete opacification of the left hemithorax,

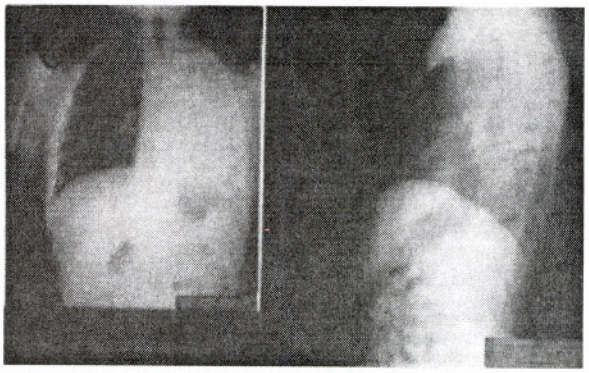
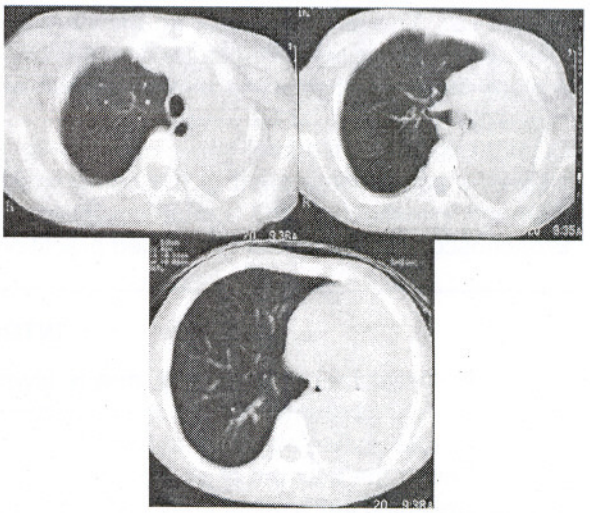


FIGURE 2
Chest CT taken prior to admission



or extrinsic had yet to be determined. A more thorough work-up was advised, and for this purpose, he was transferred to our institution.

On admission, he was observed to be mildly tachypneic with a persistent but dry cough. There was asymmetrical chest expansion with left-sided chest lag, dull percussion and no breath sounds on the left lung field. In contrast, the right side had good airflow, a resonant percussion and no adventitious sounds. Oxygen saturation remained at 99-100% and arterial blood gases studies revealed normal acid-base balance and adequate oxygenation at room air. His blood picture showed some decrease in the levels of leukocytes and platelets. A repeat chest x-ray showed left-sided atelectasis and consolidative pneumonia.

At this point, the working impression of the main service (Pediatric Pulmonology) was atelectasis, rule out mucus plug versus tuberculosis. The bronchoalveolar lavage culture yielded *Acinetobacter wolfii*, but smears for acid-fast bacilli and *Mycobacterium* cultures were

negative. Purified Protein Derivative (PPD) was also negative. Conservative medical management was attempted with levofloxacin (based on sensitivity studies) 8 mg/kg/day, salbutamol and oral methylprednisolone, as well as respiratory therapy (postural drainage, incentive spirometry, intermittent positive pressure breathing). However, five days of this approach failed to make a significant difference in patient status.

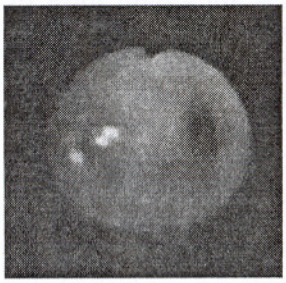


FIGURE 4
First flexible bronchoscopy

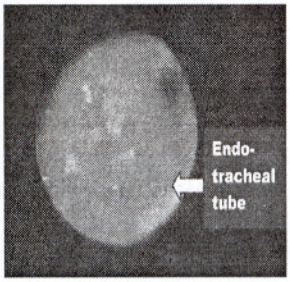


FIGURE 4A
Endoscopically-guided preferential intubation of the right mainstem bronchus

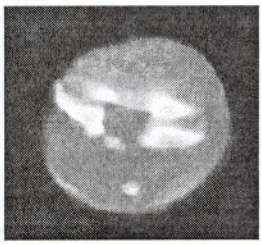


FIGURE 4B
Rigid Bronchoscopy through tracheostomy site with biopsy

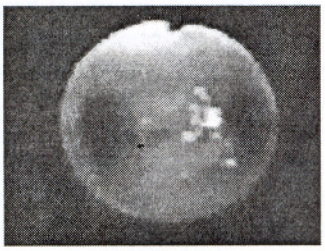


FIGURE 4C
Flexible bronchoscopy post-chemotherapy showing regression of the carinal mass. The carina is still widened. Take off of the right and left mainstem bronchi cearly visualized. The left main bronchus is patent with visualization of the left upper, lower lobes & lingual. Right mainstem bronchi is also patent with visualization of all the lobes.

A flexible bronchoscopy was consequently performed by the main service (Fig. 4). It surprisingly revealed a glistening, cherry red, pedunculated mass at the carina, completely obstructing the left mainstem bronchus and approximately 60% of the right. Tissue samples were taken from the mass. The patient was then referred to an otolaryngologist for further evaluation and management. Surgical intervention was delayed in anticipation of a potential histopathologic diagnosis and the possibility of definitive management.

All the specialty services involved sat down and mapped out all the possible diagnostic options for the patient. They decided to perform a high resolution CT scanning as the next step while awaiting biopsy results. However, while the imaging was being performed, the patient's condition deteriorated even further. He began to experience episodes of dyspnea and chest pain. Crackles and wheezes were heard on auscultation with episodes of desaturation. He became acidotic with uncorrected hypoxemia, developed left-sided pneumothorax with resultant pneumomediastinum and subcutaneous emphysema, all with rapidly increasing severity. All of these pointed to escalating obstruction from an apparently enlarging carinal mass.

As a result of all these, the patient had to undergo emergency intubation at the CT scan suite. The patient was then wheeled into the operating room for repositioning of endobronchial tube guided by a flexible endoscopy. A closed tube thoracotomy was also performed. A pectoral blowhole was created to allow egress of air. Endoscopy showed that the mass had grown even larger. The left bronchus remained completely obstructed, while the right was now about 85% blocked. In an effort to provide a secure airway, the right mainstem bronchus was preferentially intubated with a size 5.0 endotracheal tube. This placed the tip of the tube at the level of T5, while only the adapter remained outside the oral cavity—the tube was too short. He was mechanically ventilated and moved to an intensive care unit but self-extubated on the same day.

To compound matters, the tissue samples taken during the first flexible endoscopic examination turned out to show only chronic inflammation. Better specimens would need to be obtained. High resolution CT scan of the chest confirmed the physical findings, revealing a suspicious nodular density in the carina with an irregular, soft tissue structure in the adjacent subcarinal region. The left bronchus was obliterated, the left lung atelectatic (Fig. 3).

In the light of these developments, a tissue diagnosis became imperative, with the intention of instituting proper & definitive management. The patient was referred to an interventional radiologist to explore the possibility of a CT-guided percutaneous needle biopsy. Regrettably, the anatomic location of the mass precluded this, as the needle would have to traverse important structures of the mediastinum before finally reaching the tracheobronchial region. The thoracic

and cardiovascular surgery service was again called upon, but doing an open thoracotomy would have been too radical for a mere biopsy. The risk of a larger degree of morbidity was not an attractive one, particularly in a patient whose health condition was steadily declining. There was no better option at that point but for the Otolaryngology service to perform a rigid bronchoscopy including a repeat biopsy. The diagnostic plan was to maximize the amount and depth of tissue sampling such that an adequate specimen was ensured, but it needed to be executed in the most expeditious means possible, without precipitating devastating complications like bleeding into the airway, edema and mediastinal violation severely compromising the airway.

When some degree of improvement in the patient's physical status has been achieved, coupled with partial regression of the pneumothorax and subcutaneous emphysema, he underwent rigid bronchoscopy via the tracheostoma under general anesthesia. The mounting problem at this point was how to secure the airway while doing the carinal mass biopsy. This was answered by placing a cuffed endobronchial tube on the right main bronchus to prevent blood aspiration. Knowing the precarious state of the airway, additional airway support was badly needed. With this in mind, a tracheostomy was performed using a pediatric Shiley size 3.5. Knowing full well that the tracheostomy tube would not be able to bypass the obstruction, the right mainstem bronchus was preferentially intubated using a size 3.0 endotracheal tube that also exited at the tracheostomy site.

The mass was now discovered to be occluding more than 90% of the carina and had focal areas of necrosis. Frozen section studies of the carinal mass were made. These were found to be consistent with a small round cell tumor, but no specific tissue diagnosis could be made at that time. Although suspicions of malignancy had been confirmed, the tissue diagnosis needed to be accurate and exact so as to initiate definitive therapy. Immunohistochemical stains had to be done. Meanwhile, the patient was maintained on high dose steroids, methylprednisolone 60 mg intravenously every 6 hours, in order to prevent post-biopsy airway edema. This was initially effective. The patient was weaned from the ventilator and hooked to a T-piece.

After a brief two-day reprieve, the patient developed chest pain yet again, and the subcutaneous emphysema and pneumothorax worsened once more. The closed tube thoracostomy (CTT) bubbled on coughing, so it was intermittently placed on negative pressure. This bought the pathologists two more days. In due course, he suffered bouts of dyspnea and desaturation, with oxygen levels as low as 50%. The endobronchial tube that was supposed to secure the airway was unable to manage the amount of secretions produced. A tenacious mucus plug formed in its lumen. Oxygen levels dropped even further. Both the tracheostomy and endobronchial tube were pulled out and emergent endotracheal re-intubation was performed using a size 6.0. This proved to be life saving, but only for the moment. The once-appealing idea of preferential intubation was scrapped due to the presence of an air leak and the possibility of mucus plug formation. Since the patient was sustained on an endotracheal tube, it was decided that it would be better to replace it with a larger tracheostomy tube with an inner cannula that would allow frequent cleaning. With great difficulty, an adult Shiley size 4.0 tracheostomy tube took the endotracheal tube's place, and hung high above the obstruction. It was all that could be done to force air through the tiny hole left in his air passages. It was secured with one ordinary tracheostomy tie, and several hundred fervent prayers.

It was then decided that the patient desperately needed more aggressive intervention if he were to stay alive. The perils of complex anesthetic management, bleeding, mediastinal violation, and a host of others needed to be dealt with if any more catastrophes were to be prevented. He was thus scheduled for rigid bronchoscopy with debulking of the offending mass at 7 o'clock the very next morning.

At 6 o'clock, just as he was being placed onto the gurney that would wheel him off to the operating room, the telephone rang. It was the pathologist. Surgical specimen studies showed infiltration of tissue with small round cells with minimal cytoplasm, round to ovoid nuclei, occasional small indistinct nucleoli, and occasional mitotic figures. Immunohistochemical staining for cytokeratin, chromogranin, and synaptophysin were all negative, but LCA (leukocyte common antigen) stained positive (Fig 5). The final histopathologic diagnosis was signed out as Lymphoblastic Lymphoma. The idea of the surgical procedure was gladly abandoned in favor of emergent chemotherapy. Everyone breathed a little easier, and very soon after, so did this 11 year-old boy.

The patient underwent a one-week course of emergent chemotherapy with vincristine, doxorubicin, L-asparaginase, tropisetron & methotrexate. This was followed by four weeks of induction chemotherapy, then five courses of consolidation chemotherapy. There was a marked improvement of signs and symptoms as early as 2

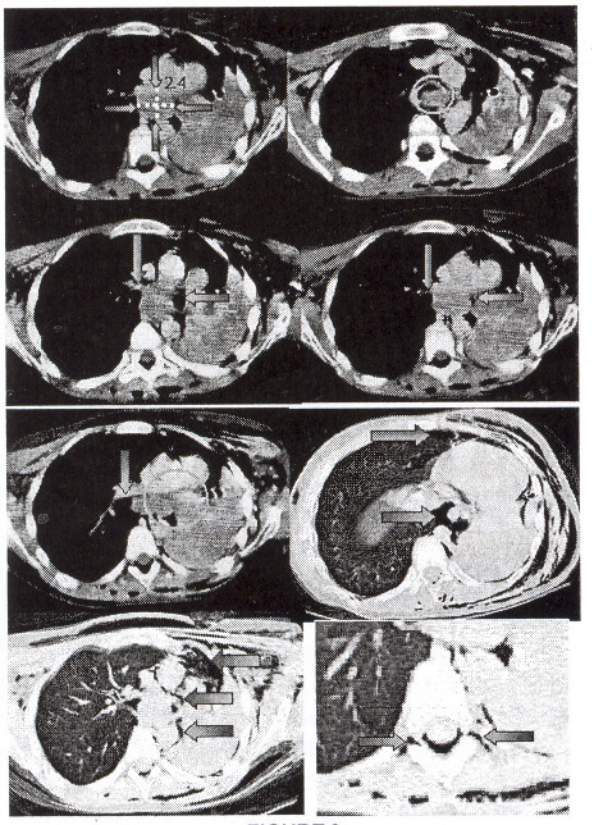


FIGURE 3

High Resolution CT Scan of the Chest

a. Minimal pleural thickening &/or effusion on the left
b. Irregular soft tissue density structure in the subcarinal region measuring approximately 2.7 x 2.4 cm. No evidence of calcification. The adjacent carina shows suspicious nodular density for which involvement cannot be ruled-out. Bronchoscopy is recommended for further evaluation. Findings may represent space occupying lesion/enlarged lymph node. There is obliteration of the bronchus going to the left lower lobe and area of the lingual. There is atelectasis of the left lower lobe and lingual. The mediastinum is shifted to the left.
c. There is pneumothorax measuring approximately 2-3% bilaterally. There is also pneumomediastinum and subcutaneous emphysema. Minimal air might be present in the spinal canal.
d. No discrete pulmonary nodule.
e. No signs of bone destruction.

to 4 days after the induction chemotherapy. This did not mean that the patient, nor the team were home free. It was yet undetermined if the mass was primarily intraluminal or extraluminal. There was still a possibility that, once the tumor shrank, a large defect may be left in the carina, giving the airway problem a new, but nonetheless dangerous, spin. A Montgomery T-stent was prepared for airway management, should the need arise.

On the 12th day, day 5 post-chemotherapy and within 5 days after initiation of induction chemotherapy, flexible endoscopy was repeated

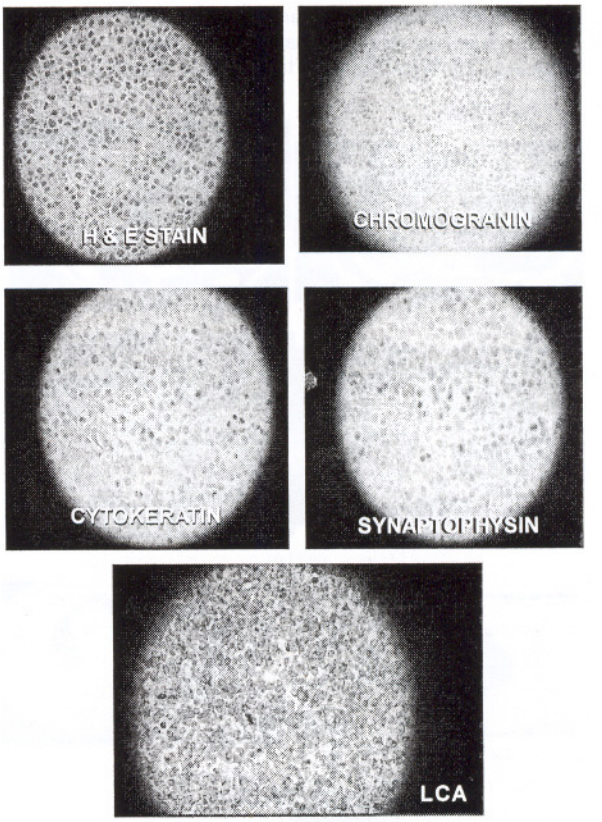


FIGURE 5
Immunostaining

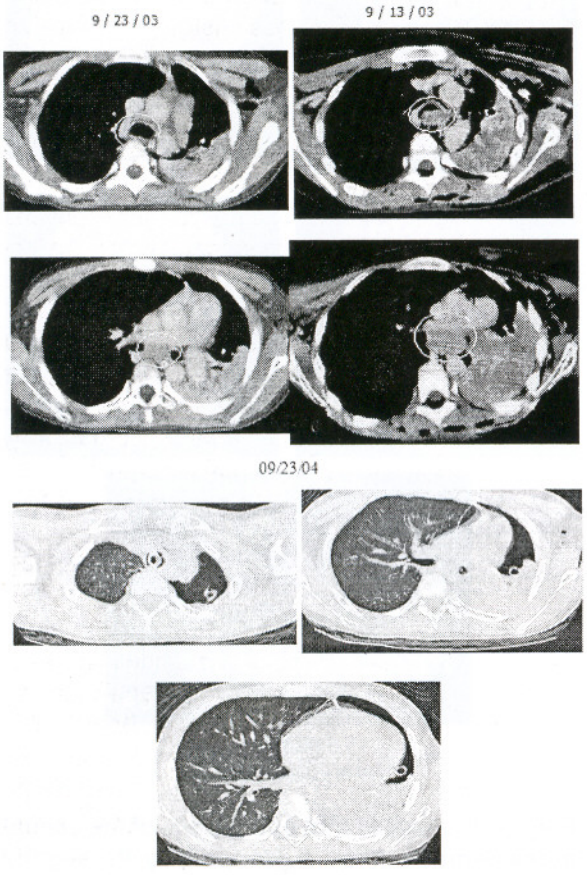
(Fig 5). It revealed that only a trace of the carinal mass remained, as evidenced by its slightly widened appearance. The take-off to both mainstem bronchi was observed to be patent, as well as the smaller-caliber passages. No defect was seen in the carinal wall. The patient was finally decannulated.

The carinal and mediastinal masses were closely monitored with flexible bronchoscopy and high-resolution CT scan (Fig. 6), to the point that no discrete mass lesion was identified. Metastatic work-up all proved to be negative. This included bone marrow aspiration biopsy, CT scan of the whole abdomen, bone scintigraphy, and Lactate Dehydrogenase (LDH) levels. The case was signed out as Lymphoblastic Lymphoma, Stage III (St. Jude's Classification). On his 78th hospital day, he was finally sent home asymptomatic with complete remission of the disease.

FIGURE 6
Post Chemotherapy CT Scan

Follow-up study no longer shows the nodular soft tissue density in the region of the carina. There is regression of the soft tissue fullness in the subcarinal region . There is significant decrease in amount of the pneumothorax on the left side. Atelectatic lung with inhomogeniety particularly in the posterior aspect is still observed, showing slight decrease in size. There is regression of the pneumothorax on the right side. Marked decrease in amount of subcutaneous emphysema and pneumomediastinum as well

as the air in the spinal canal are noted. Mediastinal shift to the left is still observed. Tracheostomy and nasogastric tubes are now noted. Rest of the findings remain stationary



DISCUSSION

Cough is one of the most common problems for which a patient seeks care. A survey done by the US Department of Health and Human Services showed that Americans spend more than a billion dollars in procuring cough remedies. [19] Cough is commonly a temporary problem but in some instances, this may be an indication of a serious underlying problem just like in this case. Its initial treatment is often empiric, involving trials of bronchodilators, antihistamines, decongestants & mucolytics, either in combination or as monotherapy. Failure of therapeutic trial would entail sequential diagnostic testing, including chest radiograph, purified protein derivative test for tuberculosis, computed tomography, provocative testing or esophagograms. This approach, more often than not, elucidates the diagnosis and allows physician to institute effective treatment. [12] Then again, it may take months before an accurate diagnosis is made, and in this particular case, may give rise to dire situations.

At the outset of the clinical problem, with the impression of an upper respiratory tract infection, the patient was given the usual antibiotics and antipyretic. However, at a point when the patient's cough turned chronic inspite of adequate medical management, his physician needed to consider other causes of his symptoms. The more common cause would still have been infectious, but atypical organisms may have been involved. Tuberculosis was also ruled out by negative Mycobacterial culture and a negative PPD. Another differential diagnosis would be a reactive airway disease, such as asthma & its cough variant but clinical trials of bronchodilators and steroids did not improve the condition of the patient. Atelectasis may be caused by obstruction from various lung pathologies. Plugs of tenacious mucus could have given this picture, although the patient's cough had never been productive. An aspirated foreign body was also a consideration, but it would have to be non-metallic—lest it would show up on radiologic images. Enlarged mediastinal lymphadenopathies extrinsically compressing the airway could also have been a likely cause. However, based on bronchoscopy and high-resolution CT scanning, an intrinsic airway mass was present in the carina.

Desai et al explained that symptoms from tracheal obstruction are not generally manifested until at least 50% of the lumen is compromised; consequently, a delay in the diagnosis of tracheal tumors is expected. Cough was the initial symptom in 33% percent of cases, with wheezing and stridor being the most common presentations. [7] This, combined with the fact that primary tumors of the trachea are uncommon, much less malignant, might push this differential to the back of the clinician's mind, in favor of more plausible diagnoses.

Atelectasis is the incomplete expansion or diminished volume affecting all or part of a lung. Sat [18] mentions that the obstructive atelectasis is the most common type, and this results from reabsorption of gas from the alveoli when communication between the alveoli and the trachea is obstructed. Causes of obstructive atelectasis include foreign body, tumor, and mucous plugging. It was this entity that signaled the need for a more in depth evaluation of the patient's condition and the detection of his primary pathology airway obstruction. From this problem all others followed. The impaired muco-ciliary clearance and ineffective cough produced by the obstruction and atelectasis predisposed to secondary bacterial infection, explaining the fever and neutrophilia. This was initially offset by hyperinflation of the right lung, but it was only a matter of time before it was prevailed over. It was unclear whether all the desperate efforts of forcing air into the patient's obstructed lungs were beneficial or detrimental. On the one hand, his oxygen saturation levels were improved by positive pressure ventilation. On the

other, the mass and atelectatic lung caused a ball-valve obstruction and forced air into the pleural cavity, mediastinum and subcutaneous spaces. What little air which managed to penetrate the mass would become trapped, and forced out through other channels, leading to pneumothorax, pneumomediastinum and massive subcutaneous emphysema. The rate at which this progressed was alarming. There was also compression of vital structures and vasovagal reactions which precipitate episodes of bradycardia and hypotension. In due course, the patient would have decompensated, had it not been for timely intervention.

Primary tracheal neoplasms are extremely rare lesions. Stewart reports an incidence of about 0.1 per 100,000 population.[20] In children, less than 10% are benign[10, 6] More than 80% of primary tracheal malignancies are either squamous cell carcinoma or adenoid cystic carcinoma. Primary lymphomas of the trachea are even more unusual as evidenced by the scarcity of literature. It is theorized to originate from mucosa-associated lymphoid tissue.[6]

In contrast, secondary tracheal tumors are, by definition, malignant and involve the trachea either by direct extension or by hematogenous metastasis. There is a particular type of lymphoma that is worthy of note; namely, lymphoblastic lymphoma. This condition predominantly affects males (2:1) and those younger than 20 yrs of age. However, adults with this disease have been described. Although it constitutes less than 5% of all non-Hodgkins lymphoma, approximately 40% of cases of childhood lymphoma fall into this category. A very characteristic clinical feature is the presence of a prominent mediastinal mass in 50-70% of patients at the time of diagnosis, suggesting a thymic origin. The disease is rapidly progressive, and early dissemination to the bone marrow and thence to blood and meninges leads to the evolution of a picture resembling T-cell Acute Lymphocytic Leukemia (ALL). Until recently, the prognosis was grim, but recent attempts to treat this tumor aggressively by utilizing protocols effective in ALL have produced encouraging results.

In retrospect, a primary mediastinal lymphoma that directly extended into the trachea would be a more plausible explanation for the patient's afflictions, but several features obscured the diagnosis. First, these tumors usually compress the airway or other vital structures rather than erode into them. The airway was not extrinsically compressed, nor was there any sign of superior vena cava syndrome. Additionally, the mass appeared to be primarily tracheal and even possessed a number of benign features. It was smooth, glistening, pedunculated and had well-defined margins. It was not broad-based and fungating. Second, peripheral lymph nodes are frequently seen in children with mediastinal lymphoma and are the ones customarily biopsied before the mediastinal mass, but no other lymphadenopathies were evident. The high dose steroids may also have aided to alleviate the obstruction caused by the lymphoid mass. [4]

Bronchoscopy is the first step for the evaluation and diagnosis of malignant neoplasms of the airway. It provides the surgeon with the exact location, nature, and extent of the tumor thereby affording evaluation of tumor resectability and planning for possible therapeutic alternatives. It can also be used to get tissue samples for accurate histopathologic diagnosis. Moreover, it provides temporary stabilization of the obstructed airway. For unresectable tumors, therapeutic bronchoscopy with laser surgery, photodynamic therapy, cryotherapy, or endobronchial brachytherapy may provide palliation[21]. Flexible bronchoscopy has the potential of precipitating airway obstruction especially when significant airway narrowing is present. Rigid bronchoscopy provides the best ability to maintain airway control as ventilation can be maintained through the instrument. Both flexible and rigid bronchoscopy can be used for biopsy, but larger tissue samples can be afforded by the rigid bronchoscope as in this case. Rigid bronchoscopy can also minimize intraluminal bleed. The rigid bronchoscope acted as a stent, which applied pressure to the bleeding endoluminal tumor. Through the rigid bronchoscope, large-bore suction tubes were used to suction bleeding areas, necrotic debris, blood clots, and excessive secretions in the airway.

With the benefit of hindsight, many lessons may be gleaned from this case. The anatomic location of the mass in itself made it a problematic case. First, it was difficult to bypass for airway palliation; second, it predisposed to mediastinal violation; and third, even minimal manipulation may result in bleeding or edema that converts a critical airway narrowing to potential life-threatening obstruction.[21] Physicians treating cases that seem straightforward must always make allowances for uncommon etiologies. A working knowledge of these is critical in making life-saving saving decisions and instituting timely management.

CONCLUSIONS

From the outset, this paper endeavored to provide a working knowledge of differential diagnoses of chronic cough. This has proven to be crucial in the diagnosis and management of complicated cases, primarily those that involve the

compromised airway. The timely diagnosis of tracheal masses depends upon maintaining a high index of suspicion and conducting an efficient workup, including definitive evaluation by bronchoscopy. The importance of a multidisciplinary approach cannot be overemphasized. There may be a need for prompt intervention that requires special areas of expertise. It is for situations such as this that many years are spent training. It is for situations such as this that the otolaryngologist is called upon—and his duty is to answer.

BIBLIOGRAPHY

1. Bailey, BJ et al. editors (2001). Head & Neck Surgery—Otolaryngology (3rd Ed., Vol. 1). Pennsylvania: Lippincott Williams & Wilkins.
2. Bluestone et al. editors (2003). Pediatric Otolaryngology (4th Ed., Vol. 2). Pennsylvania: Saunders.
3. Buck, ML et al. editors (Dec 1998). Ciprofloxacin use in children: a review of recent literature. Pediatric Pharmacotherapy (Vol. 4, No. 12) Virginia.
4. Cottrill C. Steroids for Hodgkin's Disease and Non-Hodgkin's Lymphoma Patients. www.lymphoma.org.uk.
5. Cummings, CW et al. editors (1998). Otolaryngology—Head & Neck Surgery (3rd Ed., Vols. 3 &5). Missouri: Mosby—Year Book, Inc.
6. Desai DP, Holinger LD, Gonzalez-Crussi F. Tracheal neoplasms in children. Ann Otol Rhinol Laryngol. 1998 Sep; 107(9 Pt 1): 790-6.
7. Fernbach DJ, Vietti TJ editors (1991). Clinical Pediatric Oncology: 4th edition. Missouri: Mosby—Year Book, Inc.
8. Guha A, Mostafa SM, Kendall JB. The Montgomery T-tube: anaesthetic problems and solutions. British Journal of Anaesthesia, 2001, Vol. 87, No. 5 787-790.
9. Gilbert JG, Mazzarella LA, Feit LJ. Primary tracheal tumors in the infant and adult. AMA Arch Otolaryngol. 1953 Jul; 58(1): 1-9.
10. Kumar P, Bush AP, Ladas GP, Goldstraw P. Tracheobronchial obstruction in children: experience with endoscopic airway stenting. Ann Thoracic Surg 2003 May; 75 (5): p1579-86.
11. Lawler, WR. An Office approach to the diagnosis of chronic cough. Am Fam Physician. 1998 Dec.
12. McClay, JE. Laryngeal and Tracheal Stents. eMedicine.com, Inc (2001).
13. Moses, S. Family Practice Notebook (2000). Minnesota.
14. The Merck Manual of Diagnosis and Therapy (1995-2004). New Jersey: Merck & Co., Inc.
15. Munyard P, Bush A: How much coughing is normal? Arch Dis Child 1996; 74: 531.
16. Philip EB. Chronic cough. Am Fam Physician. 1997 Oct.
17. Sat S, Atelectasis. eMedicine.com, Inc (2004).
18. Schappert SM. National ambulatory medical care survey. 1991: Summary. In: Vital and Health Statistics No. 230. US Department of Health and Human Services, March 29, 1993: 1-20.
19. Stewart MG. Primary Malignant Tracheal Tumors. The Bobby R. Alford Department of Otorhinolaryngology and Communicative Sciences. 1992 Jan.
20. Wood DE. Management of malignant tracheobronchial obstruction. Surg Clin North Am 2002 Jun; 82 (3): p621-42.

APPENDICES

APPENDIX B
St. Jude Staging System

Stage IA single tumor (extranodal) or single anatomic area (nodal), with the exclusion of mediastinum or abdomen

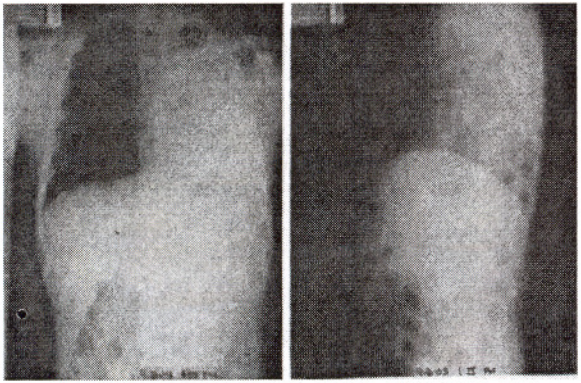
STAGE IIA single tumor (extranodal) with regional node involvementTwo or more nodal areas on the same side of the diaphragmTwo single (extranodal) tumors with or without regional node involvement on the same side of the diaphragmA primary gastrointestinal tract tumor, usually in the ileocecal area, with or without involvement of associated mesenteric nodes only*

STAGE IIITwo single tumors (extranodal) on opposite of the diaphragmTwo or more nodal areas above and below the diaphragm All primary intrathoracic tumors (mediastinal, pleural, thymic)All extensive primary intra-abdominal disease*All paraspinal or epidural tumors, regardless of other tumor site(s)

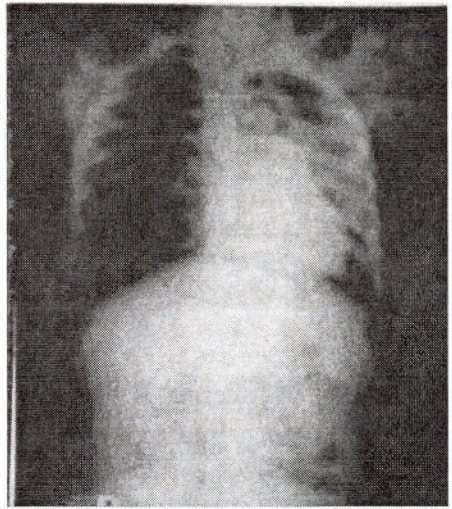
STAGE IVAny of the above with initial CNS and/or bone marrow involvement**

* A distinction is made between apparently localized GI tract lymphoma and more extensive intra-abdominal disease because of their quite different patterns of survival after appropriate therapy. Stage II disease typically is limited to segment of the gut plus or minus the associated mesenteric nodes only, and the primary tumor can be completely removed grossly by segmental excision. State III disese typically exhibits spread to para-aortic and retroperitoneal areas by implants and plaques in mesentery or peritoneum, or by direct infiltration of structures adjacent to the primary tumor. Ascites may be present, and complete resection of all gross tumor is not possible

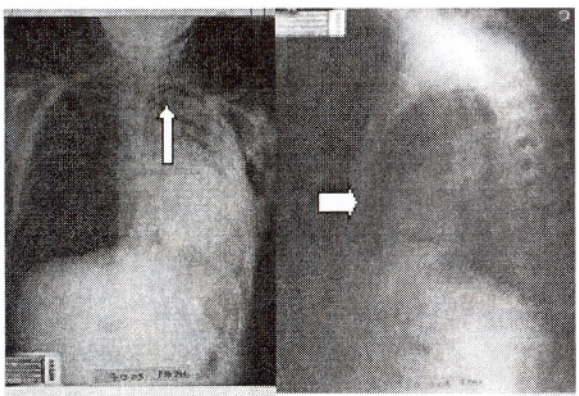
** If the marrow involvement is present initially, the number of abnormal cells must be 25% or less in an otherwise normal marrow aspirate with a normal peripheral blood picture



Chest X-ray on admission shows atelectasis and consolidative pneumonia



After closed tube thoracostomy, there was a decrease in the left-sided pneumothorax and subcutaneous emphysema. Endotracheal tube tip at T3.



Follow up chest roentgengram shows pneumothorax, pneumomediastinum & subcutaneous emphysema

THE PHILIPPINE JOURNAL OF OTOLARYNGOLOGY HEAD AND NECK SURGERY
Vol. 20 Nos.1-2 8-13 © 2005 PHILIPPINE SOCIETY OF OTOLARYNGOLOGY HEAD AND NECK SURGERY

A RANDOMIZED CONTROLLED TRIAL ON THE EFFECTIVENESS OF PROBLEM-BASED LEARNING COMPARED WITH TRADITIONAL DIDACTIC LECTURE ON OTITIS MEDIA AMONG JUNIOR INTERNS IN A TERTIARY TEACHING HOSPITAL*

RODERICK E. YALUNG, MD**
EDWIN R. TATAD, MD, FPSO-HNS***
FLORDELINA E. PIO, MD, FPSO-HNS***

ABSTRACT

RESEARCH QUESTION: Is there a difference in the proportion of students who will achieve a score of ≥ 60% in the posttest on Otitis Media under the Problem-based learning and Traditional didactic lecture?
STUDY DESIGN: Randomized controlled trial
SETTING: Tertiary teaching hospital
SUBJECT: Junior interns rotating at the department of Otolaryngology-Head &Neck Surgery.
METHODOLOGY: All Junior Interns rotating in the Department of Otolaryngology-Head and Neck Surgery in a tertiary teaching hospital from September 2002 to February 2003 were included in the study. They were divided into 2 groups rotating every 15 days with a total of 12 groups enrolled during the study period. The group was randomly allocated by lottery to either traditional didactic lecture or problem-based learning.
RESULTS: There was a statistically significant improvement (p = 0.000) from the pre to the posttest scores of students in both groups. The TDL group had a higher proportion (91%) of interns who achieved a grade of ≥ 60% compared with PBL group (84%) although there was no significant difference between the 2 groups in the proportion of the students who passed the posttest examination.
CONCLUSION: There is insufficient evidence to show that a difference exists between problem-based learning and traditional didactic lecture in the proportion of the students who achieved ≥60% in the posttest on Otitis Media.

INTRODUCTION

The rapid changes and developments in the field of medicine in recent years have created a need towards meaningful learning skills for medical students to keep abreast of these changes. For this reason medical schools saw the need for reforms and innovations in their curricula. While most medical students are still enrolled in the traditional curriculum, Problem-based learning (PBL) as a learning strategy has slowly gained acceptance in several medical schools throughout the world since its introduction at the McMaster University in 1969. Medical schools reporting self-instruction, a surrogate of problem-based learning, as an innovation increased from 79% in 1994-1995 to 94% in 1998-1999. In as much as PBL has gained enthusiasm among its supporters, advocates of the traditional curriculum have raised issues as to its effectiveness in providing basic knowledge and clinical skills.

PBL is an approach of the learning process wherein students tackle problems in small groups, identify what they need to learn and the resources they are going to use to accomplish learning under faculty guidance. It is aimed at enhancing student-centered, interactive and integrated learning through intensive small group tutorials. Several potential advantages for students' learning are used to support the superiority of PBL over the traditional curriculum. Students are maybe more highly motivated; better problem-solvers and self- directed learners; better able to learn and recall information; and better able to integrate basic science knowledge into the solutions of clinical problems.

*2nd Place, PSO-HNS Analytical Research Contest, December 02, 2004, Westin Philippine Plaza Hotel
**Resident, Department of Otorhinolaryngology-Head and Neck Surgery, FEU-NRMF
***Consultant, Department of Otorhinolaryngology-Head and Neck Surgery, FEU-NRMF

Rideout et. al.[1] reported higher levels of satisfaction with the educational experience among nursing students undertaking the PBL program. There are conflicting reports, however. In a review article, Colliver[2] concluded that there is no convincing evidence that PBL improves knowledge base and clinical performance. In a randomized controlled trial reported by Wendelberger et, al.[3], no difference in the examination score was observed between 3rd year clerks on a pediatric rotation instructed using either a PBL or TDL. A controlled trial study of students in Junior Surgery clerkships reported by Schwartz et. al.[4] found no significant difference in the overall medical board examination between students in PBL and TDL. These findings lend credence to the claim of the detractors of PBL that this innovative teaching approach is unlikely to make students learn more. While it is true that there is a need to come up with new teaching concepts, approaches and strategies to cope with the accelerated trend of change in medical education, the various conflicting reports on the outcomes of PBL have raised a great deal of concern among academicians.

OBJECTIVES

General Objective

To compare the effectiveness of problem-based learning (PBL) with the traditional didactic lecture (TDL) on otitis media among Junior Interns rotating at the Department of ENT-HNS from September 2002 to February 2003.

Specific Objectives:

1. To compare the pre and posttests scores of the students in the problem-based learning (PBL) to those in the traditional didactic lecture (TDL).
2. To determine the proportion of students who attain the minimum passing level (MPL) of 60% in PBL and in TDL.
3. To determine if there is a difference in the proportion of students who will achieved a score of $\geq$ 60% in the posttest on Otitis Media between PBL and TDL.

METHODOLOGY

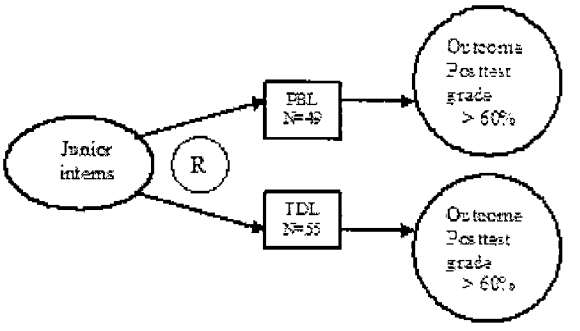
All Junior Interns rotating in the Department of Otolaryngology-Head and Neck Surgery in a tertiary teaching hospital from September 2002 to February 2003 were included in the study. Each batch was divided into 2 groups rotating every 15 days with a total of 12 groups enrolled during the study period. The group was randomly allocated by lottery to either traditional didactic lecture or problem-based learning.

The power of the study was computed instead of the sample size required since sample size was fixed. Based on the z statistics (see Appendix 1 p 17), power = 86%.

The Conceptual Framework

The conceptual framework (see Fig. 1) used in this study to make an inference for two proportions of two independent samples (i.e. PBL and TDL) with the desired outcome of $\geq$ 60% posttest score is as follows:

FIGURE 1
Conceptual Framework



The investigator selected a sample from the population who were subsequently randomized into either TDL or PBL. Outcome was measured and data were analyzed.

Questionnaire

One set of questionnaire was administered prior to and after the intervention based on the course syllabus on Otitis Media that was given on the first day of rotation of the Junior Interns. The one-hour pre-test was administered at the beginning of the rotation to check for baseline knowledge on the topic. The one-hour posttest was given at the end of the rotation to determine acquired knowledge. The test consisted of 25 multiple choice questions on otitis media. Both objective and clinical type of questions were asked with focus on the following topics: Anatomy, Pathophysiology, Physical Examination, Diagnosis, Management and Complications. The set of questions was subjected to a minimum passing level (MPL) determination set at 60 % using the Nedelsky method and transmuted to the minimum passing grade of 75%.

Traditional Didactic Lecture

- A Pretest was given at the beginning of the rotation

- A two-hour lecture on otitis media was given on the 5th day of their rotation by the resident in charge and included the following topics:
  1. Anatomy
  2. Etiology
  3. Pathophysiology
  4. Physical Examination
  5. Diagnosis
  6. Management
  7. Complications
- A posttest was given at the end of the rotation.

Problem-Based Learning

- The same pretest was given at the beginning of the rotation
- A module with 3 theoretical cases on Otitis Media was given on the first day of rotation. The students were given 5 days to study and answer the questions. Subsequently, they were expected to tackle the problems by small group discussion. The resident-in-charge served as the facilitator.
- Steps in PBL will be based on 7 jumps (Fajutagana 2002).
  a.) The first jump: Selection of discussion chairman and secretary, reading the problem, defining and agreeing on the meaning of difficult terms.
  b.) The second jump: Identification of phenomenon or problem, sharing of insights, data analysis.
  c.) The third jump: Brainstorming, discussion using small group.
  d.) The fourth jump: Summarize conclusion.
  e.) The fifth jump: Listing of learning goals.
  f.) The sixth jump: Review of literature, reading of textbooks, interview experts, access electronic information highway, self-directed learning, data gathering.
  g.) The seventh jump: Sharing of output of self-directed learning, identify difficult areas for possible extra session or lecture.
- A posttest was given at the end of the rotation.

Data Analysis

SPSS 10.0 for windows software was used for data encoding and analysis. Data collected was treated using: (1) Descriptive statistics: Proportion, Mean, Range and Standard Deviation; (2) Wilcoxon signed rank test for paired data analysis (population parameter not available to calculate paired t test); and (3) Inferential statistics: Z statistics to test the difference between 2 proportions.

Definition of Terms

1. Problem-based learning (PBL): an approach of the educational learning process in which students tackle problems in small group supervised by a tutor.
2. Traditional didactic lecture (TDL): an approach in which the learning process is more of professor or teacher-centered rather than self-directed or student-centered.
3. Junior Interns: fourth year medical students.
4. Pretest: exam given to junior interns prior to intervention.
5. Posttest: exam given to junior interns after the intervention.
6. Nedelsky Method: sets "absolute standards" for setting a cutoff score on multiple choice examinations. This method is based on the theory that marginal test takers will eliminate as many incorrect choices from an item and guess from the remaining alternatives.

Limitation of the Study

The two-week rotation of the interns is to short to cover the important topics in ENT-HNS that should be learned to fully assess the effectiveness of either teaching Strategies.

RESULTS

One-hundred four (104) students were included in the study. Fourty-nine (49) belonged to the problem-based learning group and the rest (55) in the traditional didactic lecture. Table 1 showed a 1:2 male: female ratio of students under the problem-based learning and 1:3 male: female ratio of students under the traditional didactic lecture. Both PBL and TDL have the same number of groups. The average number of students per group was 8 in the PBL and 10 in the TDL.

TABLE 1
Distribution of students in Problem-based learning (PBL) and Traditional didactic lecture (TDL) in Otitis Media in a tertiary teaching hospital based on sex and grouping.

Characteristics	PBL	TDL
Sex M : F	1 : 2	1 : 3
No. of groups	6	6
Ave. no. of student/group	8	10

Table 2 showed that more students under the traditional lecture achieved a grade ≥ 60 % in the posttest compared with those under the problem-based learning. Only 9% of the students under the TDL failed compared with 16% of those under PBL. Z statistics revealed no significant difference (0.1379) between TDL and PBL in the proportions of students who achieved ≥ 60%.

TABLE 2
Test scores of students in the problem based-learning (PBL) andtraditional didactic lecture (TDL) in Otitis Media in tertiary teaching hospital from September 2002 to February 2003.

Test Score	PBL No. (%)	TDL No. (%)	TOTAL No. (%)	p-value
≥ 60%	41 (84%)	50 (91%)	91 (88%)	0.1379
< 60%	8 (16%)	5 (9%)	13 (12%)	-
Total	49 (100%)	55 (100%)	104 (100%)	-

Table 3 showed that there was an improvement in the results of the posttest compared to the pre test results. The mean grade of 48 (range 20 –68) was raised to 67 (range 48-80).

TABLE 3
Descriptive Statistics of Problem-based learning group.

	N	Mean	Std. Deviation	Minimum	Maximum
PRETEST	49	47.6735	9.6553	20	68
POSTTEST	49	66.8571	8.3267	48	80

Table 4 showed that all the students (49) under the PBL improved their posttest scores compared with their pre test grade. Wilcoxon Signed Rank Test revealed a significant difference between the pre and posttest grade of the students under the PBL group.

TABLE 4
Ranks of Problem-based learning group.

		N	Mean Rank	Sum of Ranks
POSTTEST – PRETEST	Negative Ranks	0[a]	0	0
	Positive Ranks	49[b]	25	1225
	Ties	0[c]		
	Total	49		

a. POSTTEST < PRETEST
b POSTTEST > PRETEST
c. PRETEST = POSTTEST

Test Statistics[b]

	POSTTEST – PRETEST
Z	-6.110[a]
Asymp. Sig. (2-tailed)	0

a. Based on negative ranks.
b Wilcoxon Signed Ranks Test

Table 5 showed that the TDL group also improved in the posttest grade compared to the pretest grades. The mean grade of 47 (range 24-64) was raised to 69 (range 48-92).

TABLE 5
Descriptive Statistics of the Traditional Didactic Lecture (TDL) group

	N	Mean	Std. Deviation	Minimum	Maximum
PRETEST	55	47.4909	10.0974	24	64
POSTTEST	55	69.0909	9.0906	48	92

Table 6 showed that 54 out of 55 students under the TDL improved in their posttest grades compared with their pre test. Wilcoxon Signed Rank Test also revealed a significant difference between the pre and posttest grades of the students under the TDL group.

TABLE 6
Ranks of Traditional Didactic Lecture

		N	Mean Rank	Sum of Ranks
POSTTEST – PRETEST	Negative Ranks	1[a]	2.5	2.5
	Positive Ranks	54[b]	28.47	1537.5
	Ties	0[c]		
	Total	55		

a. POSTTEST < PRETEST
b. POSTTEST > PRETEST
c. PRETEST = POSTTEST

Test Statistics[b]

	POSTTEST – PRETEST
Z	-6.439[a]
Asymp. Sig. (2-tailed)	0

a. Based on negative ranks
b. Wilcoxon Signed Ranks Test

DISCUSSION

Medical training is multi-faceted, each factor being an important part without which doctoring skills would be incomplete. Some would say that traditional teaching is old fashioned and too detailed and produces doctors with poor interpersonal skills. Hence, the problem-based learning was conceptualized to address the shortcomings of the traditional method.

Generally, the results of this study showed an improvement in the grades of both groups based on their pre and posttest results. It implied that the students have the basic knowledge regarding Otitis

Media but need reinforcement to understand and know the subject matter well. Both methods were effective in improving their grades. Although students who were under the traditional didactic lecture had higher grades compared to those in the problem-based learning, the difference was not statistically significant. This implied that factual information must be kept to the essential minimum that students need at this stage of medical education regardless of the methods used.

The key to a successful medical training is to explicitly state to students or trainees what they need to know and provide the means for them to achieve these skills and knowledge. There is no doubt that both traditional and PBL methods might have their strengths and weaknesses. Knowledge can be acquired in many ways including the PBL. However, the basic skills of history taking and clinical examination are too fundamental to be left for the medical students to self-teach. Medical students spend substantial time in the clinical component of the new curriculum in hospitals and yet, a large percentage finish their clinical course feeling unprepared. This may reflect gaps in clinical teaching. Factors affecting the outcome other than the two teaching methods may be considered. For whatever supporters of either method of teaching argue, surely it must seek to prepare students to perform basic clinical assessment in the most practical of all 'taking a good clinical history and performing a competent clinical examination'.

CONCLUSION

An randomized controlled trial was conducted from September 2002 to February 2003 involving 104 Junior Interns divided into 12 groups rotating every 2 weeks in the Department of Otolaryngology Head & Neck Surgery. The groups were randomly allocated to either PBL or TDL. The study revealed the following:

1. There was a statistically significant improvement ($p = 0.000$) from the pre to the posttests scores of interns in both groups.
2. The TDL group had a higher proportion (91%) of interns who obtained a grade of $\geq$ 60% in the posttest compared with the PBL group (84%).
3. There was no significant difference ($p = 0.1379$) between the PBL and TDL group in the proportion of the interns who achieved $\geq$ 60% in the posttest on Otitis Media.

There is insufficient evidence to show that a difference exists between problem-based learning and traditional didactic lecture in the proportion of the students who achieved $\geq$60% in the posttest on Otitis Media.

RECOMMENDATION

A regular evaluation of teaching strategy should be performed to assess its effectivity, applicability and practicability.

BIBLIOGRAPHY

1. Rideout E. "A comparison of Problem-based and conventional curricula in Nursing education". Advances in Health sciences education January 2002;7 (1), 3-17.
2. Colliver J. Effectiveness of problem based learning curricula Acad Med 2000 75: 259-66, as cited by Norman, G. "Effectiveness of Problem-based learning curricula: theory, practice and paper darts." Medical Education. Vol. 34. 2000. (721-728).
3. Wendelberger KJ, et al 1996, "Problem-based learning in a third year pediatric clerkship". Teaching and learning in medicine 8, 28-32 as cited by Burrows E. Center for Clinical Effectiveness, Efficacy of problem-based learning versus didactic teaching of medical students or junior medical staff in clinical units, Southern Health Care Network/Monasch Institute of Public Health & Health Services Research, Clayton, 1999, http://www.med.monasch.edu.au/publichealth/cce.
4. Schwartz, RW et al 1992, "Problem-based learning: An effective method for a surgery clerkship" Journal of Surgical Research 53, 326-330 as cited by Burrows E. . Center for Clinical Effectiveness, Efficacy of problem-based learning versus didactic teaching of medical students or junior medical staff in clinical units, Southern Health Care Network/Monasch Institute of Public Health & Health Services Research, Clayton, 1999, http://www.med.monasch.edu.au/publichealth/cce

5. Fajutana NS. "PBL in Undergraduate Medical Curriculum" FEU-NRMF Academic Council Handouts 2002.
6 Mendoza et al. Foundation of Statistical Analysis for the Health Sciences. Department of Epidemiology and Biostatistics College of Public Health UP Manila 2000.

APPENDIX 1

Research Question

Is there a difference in the proportion of students who will achieve a score of $\geq$ 60% in the posttest on Otitis Media between the Problem-based learning and Traditional didactic lecture?

1. Hypothesis

H_o: $P_1 = P_2$

No difference exists between problem-based learning and traditional didactic lecture.

H_1: $P_1 \neq P_2$

A difference exists between problem-based learning and traditional didactic lecture.

2. Level of Significance; α = **0.05**

3. Test Criterion: Z statistics

$$Z = \frac{(p_1 - p_2)}{\sqrt{\frac{pq}{n1} + \frac{pq}{n2}}}$$

where: p = sample proportion possessing the characteristic of interest
q = sample proportion not possessing the characteristic of interest
q = 1- p
P = population proportion possessing the characteristic of interest
n = sample size

4. Critical Region. $z \geq 1.96$ and $z \leq 1.96$

5. Computation:

p_1 = proportion of PBL students who passed
p_2 = proportion of TDL students who passed

$\bar{P}$ = pooled estimate of p

$\bar{q}$ = proportion who do not possess the characteristic

$p_1 = \frac{41}{49}$ (.84 or 84%)

$p_2 = \frac{50}{55}$ (.91 or 91%)

$\bar{p} = \frac{41+50}{49+55} = \frac{91}{104} = 0.88$

$\bar{q} = 1 - \bar{p} = 1 - 0.88 = 0.12$

Sample size requirement*

$n_1pq = 49 * 0.88 * 0.12 * = 5.17$

$n_2pq = 55 * 0.88 * 0.12 * = 5.81$

*Satisfied sample size requirement of $\geq$ 5.

$$Sp_1 - p_2 \sqrt{\frac{\bar{pq}}{n1} + \frac{\bar{pq}}{n2}} = \sqrt{\frac{(0.88)(.12)}{49} + \frac{(.88)(.12)}{55}}$$

$$= \sqrt{0.0022 + .0019}$$

$$= \sqrt{.0041} = .064$$

$$z_c = \frac{(0.84 - 0.91)}{.064} = \textbf{-1.09 (p = .1379)}$$

6. Decision: z_c = -1.09 > z_α -1.96 therefore, do not reject H_o.

7. Conclusion: There is insufficient evidence to show that a difference exists between problem-based learning and traditional didactic lecture in the proportion of the students who achieved $\geq$60% in the posttest on Otitis Media.

Power = 1 - β
= 1 - .1379
= 0.8621
= 86%