Program for the ARS Spring 2000 Meeting

Monday, May 15, 2000

1:00 – 1:08 PM	Neuronal Proliferation in the Olfactory Mucosa: The Effects of Dexamethasone in Vivo ~James N. Palmer, MD; David B. Conley, MD; Robert C. Kern, MD; Dimitri Z. Pitovski, MD
1:08 – 1:16	Evidence that Sensory Transduction in the Vomeronasal Organ is Mediated by Phospholipase C, but not Adenylyl Cyclase ~Andrew P. Lane, MD; Roland Block; Trese Leinders-Zufall, Ph.D.; Frank Zufall, PhD
1:16 – 1:24	The Porcine and Lagomorph Septal Cartilages: Models for Tissue Engineering and Morphologic Cartilage Research ~Brian J. F. Wong, MD; Hong K. Kim, BS
1:24 – 1:32	Analysis of the Sinus Lateralis ~Christopher B. Mawn, MD; William Bolger, MD, FACS

1:32 – 1:40 Discussion

1:40 – 1:48	Chronic Sinonasal Disease in Patients with Sarcoidosis ~Christopher M. Long, MD; Todd A. Loehrl, MD; Timothy L. Smith, MD, MPH; Robert J. Toohill, MD, FACS
1:48 – 1:56	The Role of Endoscopic Sinus Surgery in Chronic Sinonasal Sarcoidosis ~David J. Kay, MD; Gady Har-El, MD
1:56 – 2:04	Bony Abnormalities of the Nose and Paranasal sinuses in Wegner's Granulomatosis ~Caroline Yang, MD; Peter Hwang, MD; Michael Talbot, MD
2:04 – 2:12	Histopathologic Evaluation of the Ethmoid Bone in Chronic Sinusitis ~Renato Giacchi, MD; Richard Lebowitz, MD; Joshua Light, MD; Joseph B. Jacobs, MD; Herman Yee, MD

2:12 – 2:20 Discussion

2:20 – 2:50 Speaker – Joel Bernstein, MD

2:50 – 3:00 Discussion

3:00 – 3:15 Break

3:15 – 4:00 Panel – Osteitis, Facial Pain and Osteoneogenesis

Moderator – Frederick A. Kuhn, MD

Wm. E. Bolger – Gram Negative Sinusitis and Osteitis

David W. Kennedy – Bone Pathology in Osteitis

Joel Bernstein, MD – Molecular Biology of Osteitis Pain

Frederick Garner - Treatment of Osteitis/Osteoneogenesis

4:00 – 4:08 Endoscopic and Radiologic Evaluation of the Causes of Functional Endoscopic Sinus Surgery Failure: Review of 60 Consecutive Cases

~Winston Vaughan, MD

4:08 – 4:16 The Use of Porous Polyethylene Implants to Correct Nasal Valve Collapse

~Suzanne Yee, MD; Chris Danner, MD

4:16 – 4:24 The Use of Mitomycin-C to Reduce Adhesion Formation Following Sinonasal Surgery

~Mathew J. Cosenza, DO; Ralph Metson, MD; Reza Rahbar, MD, DMD

4:24 – 4:32 Endonasal Management of Cerebrospinal fluid (CSF) Rhinorrhea

~Lincoln H. Lippincott, MD; Jan Maurer, MD; Ronald G. Amedee, MD; Wolf J. Mann, MD

4:32 – 4:40 Use of an Electronic Nose to Distinguish CSF from Serum in Patients With Suspected CSF Leak

~Erica R. Thaler, MD; David W. Kennedy, MD; C. William Hanson, MD

4:40 – 4:48 A Four Year Review of Transnasal Endoscopic Hypophysectomy: The Minimally Invasive Approach

~Shawn S. Nasseri, MD; Jan L. Kasperbauer, MD; Scott E. Strome, MD; Thomas V. McCaffrey, MD, Ph.D., Jon L. Atkinson, MD

4:48 – 5:00 Discussion

TUESDAY, MAY 16, 2000

1:00 – 1:08PM Utility of Intraoperative CT-Guided Endoscopic Sinus Surgery: A National Survey

~Jeffrey A. Livingston, MD; Rodrigo A. Bolanos, MS; Roy R. Casiano, MD, FACS

1:08 – 1:16 Complicatons of Image-Guided Functional Endoscopic Sinus Surgery

~Winston Vaughan, MD

1:16 – 1:24 Malleable Registration Mask for Image Guided Surgery

~John M. Del Guadio, MD; Todd Kingdom, MD

1:24 – 1:32 Postoperative Antibiotic Use Following FESS: Practice Habits of the American Rhinologic Society, A Survey

~Mark K. Wax, MD; R.V. Paolini, MD; J.S. Rechtweg, MD; Michael Belmont, MD; Catherine Winslow, MD

1:32 – 1:40 Gentamycin Nasal Irrigation Induced Ototoxicity

~Michael A. Fritz, MD; Robert R. Lorenz, MD; John G. Oas, MD; Donald C. Lanza, MD

1:40 – 1:48 Pathogenesis of Viral Induced Rhinosinusitis in the Mouse

~Robert B. Meek III, MD; George S. Dawson, MD; Alfred Berrebi, Ph.D.; Hassan Ramadan, MD

1:48 – 1:56 Discussion

1:56 – 2:04	Granulocyte Transfusion in the Management of Fulminant Invasive Fungal Sinusitis ~Daniel S. Samadi, MD; Richard R. Orlandi, MD; Andrew Goldberg, MD
2:04 – 2:12	Endoscopic Sinus Surgery for Stage IV Hyperplastic Rhinosinusitis: Outcomes Assessment ~Markus Gapany; Trang Vo-Hguyen; Kathy Daly; George Goding; Holly Boyer
2:12 – 2:20	Endoscopic Resection of Ethesioneuroblastomas ~Roy S. Casiano, MD, FACS; William A. Numa, MD; Alberto M. Falquez, MS
2:20 – 2:28	Endoscope Assisted Craniofacial Resection: A Case Presentation with Review of the Literature ~Ashutosh Kacker; Jerry Huo
2:28 – 2:36	Computed Tomography Findings in Patients with Invasive Fungal Sinusitis ~Ron Swain, Jr., MD; Todd Kingdom, MD; Susan Muller, MD; John Del Guadio, MD; Patricia Hudgins, MD
2:36 – 2:44	Utility of Computed Tomography and Magnetic Resonance in Invasive Fungal Rhinosinusitis ~R. Charles Howells III, MD; Hassan H. Ramadan, MD
2:44 – 2:52	Rathke's Cleft Cyst, Diagnostic and Therapeutic Considerations for the Otolaryngologist ~Jan L. Kasperbauer, MD; Laura J. Orvidas, MD

2:52 – 3:00 Discussion

3:00 – 3:15 Break

3:15 – 3:45 Speaker – Gustaf Fernstrom, M.D.

3:45 – 3:53	Acoustic Rhinometry Findings in Patients with Mild Sleep Apnea ~Steven M. Houser, MD; Bulent Mamikoglu, MD; Benjamin F. Aquino, BS; Jaquelynne P. Corey, MD, FACS, FAAOA
3:53 – 4:01	Treatment of Hypoxemia in Obstructive Sleep Apnea ~Michael Friedman, MD; Roy Landsberg, MD; David Caldarelli, MD
4:01 – 4:09	Reflux and Chronic Sinusitis: Are They Related?

~Stacey Silvers, MD; Henry Kim, MD; Scott Gold, MD; Robert Pincus, MD

4:09 – 4:17 Creating an Osteoplastic Flap: A Quantitative Comparison of Three Techniques

~Michael H. Callahan, MD

4:17 – 4:25 Discussion

4:25 – 4:33 Histomorphometric Analysis of Human Sphenoid and Maxillary Mucosa: Measurement of Relative Density of Goblet Cells and Basal Cells

~Shane R. Smith, MD; Margaret Brandwein, MD; William Lawson, MD, DDS

4:33 – 4:41 Effective Application of Nasal Steroid Spray in common Practice

~Richard A. Lebowitz, MD; Suzanne K. Doud Galli, MD, Ph.D.; Renato Giacchi, MD

4:41 – 4:49 The Middle Meatal Antrostomy: Is it Necessary?

~Peter Catalano, MD, FACS; Reuben Setliff III, MD

4:49 – 4:57 Unusual Paranasal Sinus Tumors Presenting with Common Nasal Complaints

~Hannah Vargas, MD; Lisa T. Galati, MD

4:57 – 5:05 Discussion

SCIENTIFIC MEETING

American Rhinologic Society
Scientific Session
Monday, May 15, 2000
Orlando World Center Marriott
Orlando, Florida

1:00 PM **Neuronal Proliferation in the Olfactory Mucosa: The Effects of Dexamethasone *in Vivo***

James N. Palmer, MD; David B. Conley, MD; Robert C. Kern, MD; Dimitri Z. Pitovski, MD

Olfactory receptor neurons are exposed within the nasal lumen, rendering them vulnerable to infectious and environmental agents. As an adaptive mechanism, the olfactory mucosa retains the lifelong ability to produce new receptor neurons from progenitor cells as a response to injury. Failure of this mechanism results in clinical anosmia. This unique regenerative capacity is a natural target for pharmacologic intervention. An ideal therapeutic agent would increase the neuronal proliferation rates facilitating a return of olfaction following injury. We devised an *in vivo* system to evaluate the effects of potential mitogens on cell proliferation in the rat olfactory mucosa. In the current study dexamethasone was evaluated since corticosteroids are often used in the treatment of smell loss. Rats were pretreated with dexamethasone, anesthetized and injected with radio-labeled thymidine. Olfactory mucosa and control tissue were harvested 1 hour later and then subjected to lysis. Genomic DNA was bound to a membrane, washed to eliminate background, and then eluted from the membranes. Total radioactivity incorporated into the DNA was assessed using a scintilation counter. Total radioactivity is a relative measure of DNA synthesis and therefore a measure of cell division. This system allows us to quantify basal rates of cell division in the olfactory mucosa and the influence of dexamethasone. Olfactory bulbectomy was performed as a known positive control, demonstrating a statistically significant increase in radioactive uptake. Dexamethasone, however, failed to produce any changes in the current study, indicating no effect on olfactory neuronal proliferation.

1:08 **Evidence that Sensory Transduction in the Vomeronasal Organ is Mediated by Phospholipase C, but not Adenylyl Cyclase**

Andrew P. Lane, MD; Roland Bock; Trese Leinders-Zufall, Ph.D.; Frank Zufall, PhD

Relatively little is known about the mechanisms of signal transduction in the mammalian vomeronasal organ (VNO), an accessory olfactory structure thought to be involved in the sensing of pheromones. VNO neurons in the mouse differ from main olfactory neurons in that they do not express adenylyl cyclase III and lack a subunit of the olfactory cyclic nucleotide-gated channel. These findings imply that distinct signaling pathways exist in these two nasal sensory systems. It remains a subject of debate whether cyclic nucleotides are involved as second messengers in the VNO or whether there is an alternative tranduction pathway involving phospholipase C. To investigate these possibilities, the electrophysiological technique of the electro-olfactogram was adapted to allow measurement of odor responses in the mouse vomeronasal organ. The method was further modified to permit pharmacological manipulation of the odor response using specific inhibitors of adenylyl cyclase and phospholipase C. We found that chemoresponses in the mouse VNO could be obtained to a variety of odors and putative pheromones. Inhibition of adenylyl cyclase with the compound SQ 22536 did not have a significant effect on the chemoresponse of the VNO. However treatment with the phospholipase C blocker U73122 caused complete inhibition of the odor responses. This effect was fully reversible after washing in drug-free solution and was not observed with an inactive analog of U73122. These findings indicate that the signal transduction in the VNO is unlikely to proceed via an adenylyl cyclase-mediated pathway, but rather utilizes a phospholipase C-dependent mechanism.

1:16 **The Porcine and Lagomorph Septal Cartilages: Models for Tissue Engineering and Morphologic Cartilage Research**

Brian J. F. Wong, MD; Hong K. Kim, BS; Eugene A. Chu, BS; Alexandre Rasouli, BS; Xavier Dao; Mark Gaon; J. Stuart Nelson, MD, PhD

Recent advances in tissue engineering technologies have increased interest in reconstruction of the cartilagi-

nous frameworks of facial aesthetic structures. Despite increasing interest in this field, there is no established animal tissue model which provides adequate morphologic cartilage tissue in bulk quantities. As many tissue engineering studies have focused on murine models, relevance to large mammal species is limited. The objective of this study was to characterize porcine and lagomorph (rabbit) nasal septal cartilage tissue. As these animals are readily obtained from local abattoirs at low cost and high quantity, they are ideal for use in experiments which require large quantities of the same tissue with minimal elastic fibers. They are also useful for evaluation of bulk material properties. We review our techniques used to harvest intact septal cartilages from these species for ex vivo study. In particular, we discuss specific elements of the porcine septal cartilage including evaluation of cellular (membrane integrity), metabolic (proteoglycan synthesis), and bulk tissue propertied determined by pulse-chase radiolabelling, flow cytometry, dynamic mechanical analysis, microscopy, and light scattering techniques. Similar characterization with lagomorph tissue is also discussed. We have characterized both the porcine and lagomorth nasal septal cartilages and determined relative synthetic rates, mechanical properties, cell density, and cell distribution. As tissue engineered cartilage research progresses, the need for a well characterized tissue model becomes increasingly important. Both porcine and lagomorph nasal septal cartilages share great similarity with their human counterpart and provide a low-cost, high volume, and easily obtained source of bulk cartilage tissue. Our comprehensive evaluation of these tissues establishes the basic biological and physical characteristics of these tissues, and in part establish both of these species as animal models for nasal septal cartilagenous surgery.

1:24 **Analysis of the Sinus Lateralis**

Christopher B. Mawn, MD; William Bolger, MD, FACS

Introduction: The anatomy of the anterior ethmoids is reported to be variable and multiple descriptions of the sinus lateralis are found. Many have adopted this term yet it is poorly defined in the literature. The object of this study is to review previous descriptions of the anterior ethmoid anatomy, specifically that above and posterior to the ethmoidal bulla, and correlate these with detailed anatomic dissections to improve our understanding of the anatomy.

Methods: A literature search was performed at the National Library of Medicine regarding the descriptions

of the anterior ethmoid anatomy. These were compiled and similarities and differences documented. 10 cadaveris heads were sagitally sectioned through the midline. Dissections with photo documentation and drawings were completed regarding the presence of a hiatus semilunaris superioris, all pneumatization tracts from this recess, and its relationship to the basal lamella and frontal recess.

Results: Our literature review produced multiple descriptions of the anterior ethmoids dating back to the 1860's with Grundwald to the 1990's with Stammberger. Zuckekandl, Killian, Mosher, Van Aylea, and Moret are summarized. Dissection revealed that a hiatus semilunaris superioris was present in all specimens. A retrobullar cleft was present in all specimens while a suprabullar cleft was present in 19/20 cases. These two clefts were distinct with no connection between the two. The suprabullar cleft was likewise separate from the frontal recess without a connection between the two. A projection of the basal lamella divides the suprabullar and retrobullar recesses in all cases.

Conclusion: The term sinus lateralis is widely accepted and frequently used by modern sinus surgeons yet its definition between experts is inconsistent. We found this space to be composed of a retrobullar and suprabullar recess which usually extend to the skull base and lamina papyraccea. Both tracts open into the hiatus semilunaris superioris and are separated by a lateral extension of the basal lamella. Our findings reveal that the space called the sinus lateralis is more consistently present than previously described and that is is present in a predictable pattern. These findings suggest that refinement of the sinus lateralis nomenclature may be in order.

1:32 **Discussion**

1:40 **Chronic Sinonasal Disease in Patients with Sarcoidosis**

Christopher M. Long, MD; Todd A. Loehrl, MD; Timothy L. Smith, MD, MPH; Robert J. Toohill, MD, FACS

Sarcoidosis is a chronic systemic disease of unclear etiology with a propensity to involve the upper and lower respiratory tracts. Histologically, it is characterized by noncaseating granulomas of various organ systems. It is our intention to define the histological characteristics of sarcoidosis and become familiar with the management options for sinonasal sarcoidosis. We reviewed the cases

of 6 patients with pulmonary sarcoidosis who developed chronic sinonasal disease. All 6 patients had physical findings consistent with sinonasal sarcoidosis, but only 4 had histologic diagnosis of sarcoidosis despite aggressive biopsies including ethmoidectomies. These 4 patients remain symptomatic despite extensive medical and surgical therapy including topical steroids, systemic steroids, intralesional steroid injections, nasal irrigations, and endoscopic sinus surgery.

Patients with histologic sinonasal sarcoidosis are difficult to manage and their symptoms and physical findings are often persistent despite aggressive medical and surgical therapy.

1:48 The Role of Endoscopic Sinus Surgery in Chronic Sinonasal Sarcoidosis

David J. Kay, MD; Gady Har-El, MD

Sarcoidosis is a systemic chronic granulomatous disease of unknown etiology. Cases involving the nose and paranasal sinuses have been well described. The hallmark in management of sinonasal sarcoidosis has been corticosteroid therapy. While some cases response to such treatment, others progress to chronic disease refractory to medical therapy. Previous authors have relegated the role of surgery in sinonasal sarcoidosis to simply obtaining biopsy specimens to confirm the diagnosis. Others include the management of intranasal complications as a surgical indication. We describe the role of endoscopic sinus surgery (ESS) in the treatment of chronic sinonasal sarcoidosis. Our patients suffered from chronic sinonasal sarcoidosis refractory to corticosteroid therapy, but had not progressed to more serious complications. The goal of surgery was not the complete eradication of disease and prevention of recurrence, but rather the symptomatic improvement of an afflicting condition which markedly detrimented quality of life. Our patients experienced long term symptomatic relief following ESS, although recurrence of disease in some patients may require revision surgery. We advocate ESS for the treatment of sinonasal sarcoidosis in two sets of patients: 1) those whose severe symptoms are refractory to prolonged medical therapy, and 2) those who suffer complication of sinonasal sarcoidosis. It must be emphasized that surgery will not cure the disease nor prevent its local recurrence. Its judicious use is for the temporary improvement in quality of life for those patients severely afflicted by their disease.

1:56 **Bony Abnormalities of the Nose and Paranasal Sinuses in Wegener's Granulomatosis**

Caroline Yang, MD; Peter Hwang, MD; Michael Talbot, MD

Chronic sinusitis is a well-known clinical feature of Wegener's granulomatosis. Mucosal abnormalities of the nose and paranasal sinuses have been well characterized and range from granulomatous lesions to diffuse mucosal thickening. In contrast, abnormalities of the underlying bone in Wegener's have not been well characterized and have only been sporadically reported. In order to characterize bony abnormalities of the nose and paranasal sinuses in Wegener's granulomatosis, we performed a retrospective review of all patients with Wegener's granulomatosis who underwent a sinus CT scan between 1989-1999. Nine patients were identified. A total of 12 abnormalities were identified in 5 of the 9 patients. Specific bony findings included septal erosion along with neo-osteogenesis and bony obliteration of the maxillary, frontal, and sphenoid sinuses. The presence of bony abnormalities did not appear to correlate with the extent of mucosal sinus disease or c-ANCA levels. Bony changes on sinus CT scan may provide radiologic evidence of underlying Wegener's granulomatosis in high suspicion patients.

2:04 **Histopathologic Evaluation of the Ethmoid Bone in Chronic Sinusitis**

Renato Giacchi, MD; Richard Lebowitz, MD; Joshua Light, MD; Joseph B. Jacobs, MD; Herman Yee, MD

Chronic rhinosinusitis (CRS) is defined as inflammation of the paranasal sinuses for a period longer than 12 weeks. The mucosal changes that occur in CRS have been well described, and include edema, deceased ciliated cells, and goblet cell hyperplasia. However, the changes that occur in the underlying ethmoid bone have only recently been investigated. We evaluated decalcified ethmoid bone specimens from 20 patients undergoing endoscopic sinus surgery for CRS. Our analysis revealed histopathologic changes consistent with osteitis. Polarized light microscopy demonstrated changes in the extracellular matrix such as bone resorption and neo-osteogenesis. Preoperative clinical data and CT staging was recorded on all patients and correlated with the histopathologic findings. These findings suggest that

osteitis may play a significant role in CRS, and implications for therapy are discussed.

2:12 **Discussion**

2:20 Speaker – Joel Bernstein, MD
Molecular Biology of the Upper Respiratory Tract Using a Nasal Polyposis Model

2:50 **Discussion**

3:00 **Break**

3:15 **Panel – Osteitis, Facial Pain and Osteoneogenesis**

Moderator – Frederick A. Kuhn, MD

Wm. E. Bolger, MD – Gram Negative Sinusitis and Osteitis

David W. Kennedy, MD – Bone Pathology in Osteitis

Joel Bernstein, MD – Molecular Biology of Osteitis Pain

Frederick Garner, MD – Treatment of Osteitis/Osteoneogenesis

4:00 **Endoscopic and Radiologic Evaluation of the Causes of Functional Endoscopic Sinus Surgery Failure: Review of 60 Consecutive Revision Cases**
Winston Vaughan, MD

Objective: To evaluate the causes of previous functional endoscopic sinus surgery (FESS) failure in a cohort of revision cases.

Design: A prospective analysis of clinical symptoms, preoperative endoscopy and cultures, preoperative triplanar computer tomography (CT) and operative findings of 60 patients who underwent revision FESS was performed over 18 months. Patients' symptoms were studied with Rhinosinusitis Outcome Measure-31 Survey (RSOM-31). All patients had a detailed preoperative

endoscopy. One-millimeter axial CT scans were obtained and reconstructed into saggital and coronal images. All subjects underwent revision FESS with image guidance by one surgeon. Their cultures and pathology were also reviewed.

Results: The tri-planar CT scan and nasal endoscopy with cultures were the most useful studies for determining the causes of failure. The causes of failure included: remnant ethmoid cells (73.3%), maxillary mucous recirculation (41.7%), middle turbinate lateralization (33.3%), frontal sinus disease (23.3%), undiagnosed fungal sinusitis (23.3%), sphenoid sinusitis (18.3%), polyp recurrence (10%), remnant Onodi cell (6.7%), hemorrhage (3.3%), cerebrospinal fluid leak (1.7%), maxillary mucosal stasis (1.7%), and remnant Haller cell (1.7%).

Conclusion: Functional endoscopic sinus surgery may fail. The most common causes of failure were due to incomplete surgery, technical error or a missed diagnosis. Careful pre-surgical planning and dissection especially with CT image guided systems, should decrease these failures.

4:08 The Use of Porous Polyethylene Implants to Correct Nasal Valve Collapse

Suzanne Yee, MD; Chris Danner, MD

Nasal valve collapse is a significant cause of nasal airway obstruction. There are many surgical options that have been documented in the literature. Recently, Porex Surgical, Inc. introduced a porous polyethylene (Medpor) implant, developed by Dr. Romo, for external nasal valve collapse. Traditionally, nasal valve collapse is very difficult to correct. Many times the ideal grafting material, autogenous cartilage is limited or is not available. Additionally, a second operative site increases morbidity. The porous polyethylene implant seemed to be an ideal implant with regard to shape, rigidity and availability. The purpose of this study is to test the implant with regards to ease of use and efficacy. Patients found to have significant external nasal valve collapse by physical exam underwent an open rhinoplasty approach with place of the implant in the lower lateral cartilage/alar region. Other causes of nasal airway obstruction, such as a deviated nasal septum or turbinate hypertrophy, were corrected at the time of surgery also. Patients tolerated the procedure well. Postoperatively, patients were happy with the results of increased airway especially at night while sleeping. There were very few complications, such as infection, extrusion, exposure, or skin erosion. The

Medpor porous polyethylene implant is an effective alternative for use in correction of external nasal valve collapse. Its case of use, availability, ease of carving, ease of removal, if needed, are all desirable attributes of this implant.

4:16 The Use of Mitomycin-C to Reduce Adhesion Formation Following Sinonasal Surgery

Mathew J. Cosenza, DO; Ralph Metson, MD; Reza Rahbar, MD, DMD

Mitomycin-C is an antineoplastic antibiotic that has been shown to reduce postoperative scar formation following ophthalmologic surgery. We utilized this agent during sinonasal surgery in 10 patients in an attempt to reduce postoperative adhesions and ostial stenosis. A cotton-tipped applicator saturated with 0.5ml of mitomycin-C (0.5ml of a 0.4mg/ml solution) was applied topically to the lateral surface of the middle turbinate and maxillary ostium (n=5) or surgically enlarged frontal sinus ostium (n=5) at the conclusion of surgery. The nasal cavity was then irrigated with sterile normal saline. Routine cleaning and inspection of the surgical sites was performed one week and one month following surgery. All patients appeared to heal well without evidence of infection or delayed mucosalization. No patients developed postoperative adhesions. Mitomycin-C may have a role in the prevention of adhesion formation following sinonasal surgery.

4:24 Endonasal Management of Cerebrospinal Fluid (CSF) Rhinorrhea

Lincoln H. Lippincott, MD; Jan Maurer, MD; Ronald G. Amedee, MD; Wolf J. Mann, MD

This manuscript provides an update to the 1993 publication by the senior authors in which the technique and results of 22 patients undergoing microscopic endonasal surgery (MES) for CSF leaks were described. A large retrospective series has been accumulated at two large academic institutions over the past 6 years to include 79 patients suffering CSF liquorrhea through various etiologies, including 19 patients failing previous closure at outside institutions. The localization of these using computerized tomography with or without metrizamide, or nasal endoscopy, amongst other studies, is discussed, and preoperative versus intraoperative findings compared. MES with or without endoscopic management

using a variety of free tissue graft materials resulted in a 91% success rate with initial repair, and 100% within three attempts. Analysis of failure location as well as initial etiology show that the sphenoid sinus leaks are the most difficult to control and blunt trauma causes statistically more primary failures. MES is a valuable technique for the closure of CSF leaks and offers some advantages to purely endoscopic management. Our current approach to these patients will be presented and the prognostic implications inferred from this study discussed.

4:32 **Use of an Electronic Nose to Distinguish Cerebrospinal Fluid (CSF) from Serum in Patients with Suspected CSF Leak**

Erica R. Thaler, MD; David W. Kennedy, MD; C. William Hanson, MD

Efforts to reproduce artificially human olfaction have resulted in the development of an electronic nose, which distinguishes volatile substances by means of organic semiconductors. We have previously reported the use of an electronic nose to distinguish cerebrospinal fluid (CSF) from serum, in samples collected from in-patients undergoing lumbar puncture and phlebotomy. Further testing of the device has shown that it is capable of correctly distinguishing CSF from serum in a patient with a suspected CSF leak, suggesting promising clinical utility of the technology. The technology of artificial olfaction, data collected to date, and the extensive potential of such capability are reviewed.

4:40 **A Four Year Review of Transnasal Endoscopic Hypophysectomy: The Minimally Invasive Approach**

Shawn S. Nasseri, MD; Jan L. Kasperbauer, MD; Scott E. Strome, MD; Thomas V. McCaffrey, MD, PhD, Jon L. Atkinson, MD

Introduction: The Endoscopic Transnasal Approach is an evolving technique for addressing pathology in the sella turcica. Since the introduction of this method to our institution four years ago, the vast majority of transsphenoidal procedures are now undertaken using this approach.

Methods & Procedure: A retrospective review was

performed on all patients undergoing endoscopic transnasal hypophysectomy at our institution over the last four years. Criteria analyzed were safety, functional/cosmetic outcome, and duration of hospitalization. During the course of this series, the operative procedure was modified to improve operative exposure as well as safety. The results of our series demonstrate a significant reduction in hospital stay, operative time, need for nasal packing, as well as eliminating the need for a sublabial incision. The complication rate is equivalent to that reported for the traditional transseptal transsphenoidal approach.

Summary & Conclusions: This series reviews a four year institutional experience with the minimally invasive transnasal endoscopic hypophysectomy approach. This approach affords a decreased hospital stay, improved patient comfort through elimination of packing, decreased morbidity of a sublabial incision, and decreased operative time. Additionally, this approach is particularly helpful for revision cases due to the limited septal dissection.

The endoscopic transsphenoidal approach is the preferred method for addressing pituitary pathology at our institution in the majority of cases.

4:48 Discussion

1:00 **Utility of Intraoperative CT-Guided Endoscopic Sinus Surgery: A National Survey**

Jeffrey A. Livingston, MD; Rodrigo A. Bolanos, MS; Roy R. Casiano, MD, FACS

Objectives: To ascertain the utilization patterns of intraoperative CT-Guided Endoscopic Surgery amongst practicing Otolaryngologists and quantify the perceived value of these systems by analyzing users' personal ratings of efficacy.

Study Design: Retrospective Opinion Survey.

Methods: A 4 page survey was administered via facsimile regarding the utilization patterns and personal ratings on the efficacy of CT-guided surgery. One hundred and fifty Otolaryngologists with access to a system, both in private and academic practice settings, were surveyed.

Results: Ninety-five (63.3%) completed surveys were returned and reviewed. All of the participants returning a survey reported that they are currently using CT-guidance. Ninety-one (95.8%) felt that they would recommend usage of a system to other surgeons. Eighty-six (90.5%) felt that the typical operating cost of using a system was justified. Most reported that utilization of intraoperative CT guidance subjectively decreased the incidence of serious complications, improved clinical outcomes, improved endoscopic surgical skills and precision of tissue removal, and improved educational benefits, while having a negative effect on intraoperative costs. Statistically significant differences in usage patterns and opinions regarding efficacy were found between Otolaryngologists in community versus academic settings. Academic Otolaryngologists reported their surgical skills benefited less.

Conclusions: In the opinion of many practicing Otolaryngologists intraoperative CT guidance is viewed as a useful adjunct for endoscopic surgery.

1:08 **Complications of Image-Guided Functional Endoscopic Sinus Surgery**

Winston Vaughan, MD

Objective: To evaluate the incidence of complications due to image-guided functional endoscopic sinus surgery (FESS).

Design: A prospective analysis of complications encountered intraoperatively and during the first 90 days after surgery was performed.

Ninety-six patients who underwent image guided FESS by one surgeon over 18 months were studied. All patients had detailed preoperative and postoperative endoscopies and CT scans when indicated. They were all followed weekly for the first month after surgery, every 2 weeks during the second month, then every three months thereafter.

Results: There were no major complications such as visual changes or cerebrospinal fluid leak. No patients required extended hospitalization (>1 day) or transfusion.

Fifteen complications were recorded (15.6%). These included: extended postoperative infection (4.2%), persistent headaches (3.1%), frontal recess scarring (2.1%), orbital fat exposure (2.1%), anterior ethmoid artery bleeding (1%), sphenoid ostium re-stenosis (1%), excessive intraoperative blood loss (1%), and persistent maxillary sinusitis (1%).

Sixty-nine percent of the patients were revision cases. All complications occurred in revision cases, except for one primary patient with orbital fat exposure.

Conclusion: Complications from functional endoscopic sinus surgery may be severe. Careful pre-operative planning and dissection, along with improvements in technology such as image guidance will lead to fewer complications. Revision cases still represent the more difficult cases.

1:16 **Malleable Registration Mask for Image-Guided Surgery**

John M. Del Gaudio, MD; Todd Kingdom, MD

Image-guided surgery is becoming more widely used in endoscopic sinus and skull base surgery. All systems require initial registration to correlate the computerized tomography (CT) scan images to the patient's anatomy. Multiple registration techniques can be used. The ideal

technique is one that is easy, reproducible and provides the most accurate registration in the least amount of time. This study is designed using the LandmarX image-guided system to test a unique mask registration technique, and compare this to an anatomic registration technique which we have been routinely using. A heat-labile malleable mask mounted with 10 rivets was molded to the patient's face and worn during the CT scan. Fourteen patients have been scanned with the mask, and 7 patients have undergone surgery, with the remainder scheduled for surgery in the near future. Patients who have undergone surgery have had registration performed both with the registration mask and with anatomic landmarks, and each method was timed. One patient was not included in the results due to movement during the CT scan that distorted the reconstructed images. Mean registration error for the mask technique was 0.9 mm and took a mean of 42 seconds. Anatomic registration using 5 or 6 points resulted in a mean initial error of 2.2 mm, taking 39 seconds. Mean final anatomic registration was 1.6 mm, requiring re-registration of a mean of 4.5 points, and taking 144 seconds. In conclusion, we believe that the registration mask technique is a superior technique in ease, accuracy, and time of registration. All subsequent patient data will be reported.

1:24 **Postoperative Antibiotic Use Following FESS: Practice Habits of the American Rhinologic Society, a Survey**

Mark K. Wax, MD; R.V. Paolini, MD; J.S. Rechtweg, MD; Michael Belmont, MD; Catherine Winslow, MD

Background: Prophylactic antibiotics are routinely used in otolaryngologic surgery. While they have efficacy in oncologic ablative procedures, little objective data exists concerning their use in sinonasal procedures. There are no guidelines for the use of postoperative antibiotics in rhinologic surgery, specifically FESS. We wished to determine the practice patterns of otolaryngologists concerning prophylactic antibiotics in their FESS patients.

Materials and Methods: Survey of members of the American Rhinologic Society regarding their rationale for using antibiotics after FESS.

Results: 743 surveys were mailed with 448 responses (60.3%). 85 percent of respondents used antibiotics routinely. Postoperative infection and toxic shock syn-

drome were the primary concerns. 62.5% used packing (99.6% used Ab) while 12.5 percent used splints (78.7% used Ab) p=.003. Of those who performed greater than 50 procedures per year (75%) were more likely to use antibiotics (67.1%) to prevent infection. Those who did less than 10 procedures per year used antibiotics to prevent toxic shock (58.1%) (p>.01). Medical-legal concerns were a reason for antibiotic usage in less than five percent of respondents.

Conclusions: This survey of the American Rhinologic Society shows great variability in the usage of antibiotics following FESS. Respondents tended to use antibiotics in patients who were packed out of concern for toxic shock or infectious complications.

1:32 Gentamicin Nasal Irrigation Induced Ototoxicity

Michael A. Fritz, MD; Robert R. Lorenz, MD; John G. Oas, MD; Donald C. Lanza, MD

Antibiotic irrigations for chronic rhinosinusitis (CRS) have recently become more prevalent as adjunctive treatment. Gentamicin nasal irrigation has been promoted as safe because of its low absorption from the alimentary tract and lack of effect upon *in vitro* ciliary beat frequency of respiratory epithelium. It has been used to maintain as clean nasal irrigation systems, and because of its inherent anti-staphylococcus and anti-pseudomonal coverage, it is thought to be ideal for the treatment of the leading bacteria found in CRS.

Recent evidence has identified that gentamicin ototoxicity is not related to peak and trough serum concentrations but rather to total antibiotic dose. Topical use of other aminoglycosides has produced rare cases of ototoxicity.

The clinical course and vestibular work up of two patients using gentamicin irrigation document the first reported cases of irrigation induced vestibulotoxicity. Vestibular pathology was demonstrated by electronystagmography and rotational chair studies. After diagnosis, therapy was immediately discontinued and vestibular rehabilitation therapy was instituted. After an average of two years follow-up, one patient has recovered from a functional standpoint, while the other remains symptomatic.

These cases challenge the benignity of topical gentamicin use for CRS and underscore the need for patient

education regarding this rare adverse effect prior to choosing it as therapy.

1:40 **Pathogenesis of Viral Induced Rhinosinusitis in the Mouse**

Robert B. Meek III, MD; George S. Dawson, MD; Alfred Berrebi, Ph.D.; Hassan Ramadan, MD

Viral upper respiratory infection is one of the most common diagnoses seen in primary care offices today. Although many patients have resolution of symptoms within one week, a certain percentage goes on to develop rhinosinusitis and receive antibiotics. We have developed a model of viral rhinosinusitis utilizing intra nasal inoculation of reovirus into mice. The purpose of this study is to gain a better understanding of the role of viruses and the immune response in the production of rhinosinusitis. Mice were inoculated and sacrificed on post inoculation days 2, 4, 7, 10, 14, and 21. Axial sections through the paranasal sinuses were cut and stained with antibodies specific for reovirus antigen, B-cells, T-cells, and macrophages. Gram stains of the slides were obtained to exclude bacterial contamination or secondary infection. Reovirus antigen was noted on days 2 and 4 with scant staining on day 7. Complete absence of viral staining was seen on days 10, 14, and 21. By day 7, a large mucosal influx of B-cells were seen with a moderate influx of macrophages and smaller influx of T-cells. By day 10, there was a peak in the number of B-cells with a corresponding peak in T-cells although less pronounced. Macrophages began to decrease by day 10, and by day 14, there was a decrease in B-cells by twofold with trace amounts of macrophages and T-cells remaining. By day 21, the immune markers returned to the levels seen in control animals. The results of this study suggest that the immune system continues recruitment and thus a more reactive mucosal surface for as long as a week following clearance of viral antigen. One proposed mechanism for this phenomenon is that local factors such as cytokines and interleukins continue to be released following infection despite the absence of persistent viral antigen or bacteria.

1:48 **Discussion**

1:56 **Granulocyte Transfusion in the Management of Fulminant Invasive Fungal Sinusitis**

Daniel S. Samadi, MD; Richard R. Orlandi, MD; Andrew Goldberg, MD

Fulminant, invasive fungal sinusitis is most commonly observed in the immunocompromised patient and is associated with significant mortality (>70%). A high index of suspicion and early diagnosis is imperative for optimizing outcome. Mainstays of treatment include: reversal of the underlying medical condition, antifungal agents and radical resection of necrotic tissue. In the neutropenic population, granulocyte transfusion may represent an adjunct to current therapy. We report the first case in which this intervention was employed.

Brief Description: MW is a 66-year-old female admitted for chemotherapeutic management of Acute Myelogenous Leukemia associated with an acute-onset of left orbital apex syndrome. MRI revealed an inflammatory mass of the ethmoid and maxillary sinuses. Optic nerve and dural enhancement was present. Endoscopy demonstrated a violaceous, insensate lesion of the middle turbinate. Pathology specimens from emergent, intraoperative debridement were suspicious for invasive aspergillosis. Intravenous Amphotericin B was initiated.

Summary of Management: After consultation with the Hematology/Oncology service, a trial of granulocyte transfusion was attempted. Five units of HLA-compatible, human neutrophils were infused with an improvement in leukopenia (2.4 to 7.1 tho/ L). Over a fourteen-day hospitalization, visual acuity improved and no radiologic signs of fungal progression were evident. At eighteen-month follow-up, the patient remains free of recurrence.

Conclusion: Invasive fungal sinusitis requires rapid diagnosis, aggressive debridement, and systemic antifungal therapy. Reversal of the underlying medical disorder contributing to the immunocompromised state, may have significant clinical impact on patient survival. Granulocyte transfusion with reversal of neutropenia may impede the progression of invasive fungal sinusitis and facilitate recovery.

2:04 **Endoscopic Sinus Surgery for Stage IV Hyperplastic Rhinosinusitis: Outcomes Assessment**

Markus Gapany; Trang Vo-Nguyen; Kathy Daly; George Goding; Holly Boyer

The objective of this study was to assess the long-term outcomes of functional endoscopic sinus surgery (FESS) in the management of chronic hyperplastic rhinosinusitis with diffuse mucosal disease. Thirty-seven patients with radiographically proven severe pansinusitis (stage IV disease), who failed long-term conservative management and underwent FESS, were included in the study. Mean follow-up was twenty-three months. Two instruments, the Sinonasal Outcomes Test (SNOT-20) and the Chronic Sinusitis Survey (Otolaryngol Head Neck Surg 117:S58-68, 1997), were utilized for outcomes assessment. The study showed statistically significant improvement (student's t-test, $p<0.05$) in all measured chronic sinusitis-related symptoms. This outcomes assessment lends support for the beneficial role of FESS in the management of refractory hyperplastic rhinosinusitis.

2:12 **Endoscopic Resection of Ethesioneuroblastomas**

Roy S. Casiano, MD, FACS; William A. Numa, Jr., MD; Alberto M. Falquez, MS

Objectives: Esthesioneuroblastoma (ENB) is a rare malignant neoplasm originating from neuroepithelial cells. Treatment for this tumor has traditionally required a craniofacial resection. The safety and efficacy of transnasal endoscopic resection is unknown.

Study Design: Retrospective.

Methods: A series of four patients with Kadish stage A or B lesions of the anterior skull base were resected and reconstructed entirely endoscopically over a nine year period. There were 2 males and 2 females with a mean age of 60 years. Three patients were treated for a primary lesion and one patient underwent endoscopic resection for a secondary recurrence of the skull base years after traditional craniofacial resection and radiotherapy. All primary lesions received adjuvant radiotherapy. The mean follow-up time is 32 months (range of 16-63 months).

Results: All patients were discharged within 4 days. There was a tendency to have prolonged nasal crusting for up to one year due to a variety of factors; large cavi-

ties, radiation therapy, and exposed lyophilized dural graft. However, all skull base defects healed without any short or long term sequelae. There have been no local recurrences in the primary group. Two patients (1 primary and 1 secondary) developed regional metastasis to the orbit or cervical lymph nodes managed with primary transorbital excision or modified neck dissection, respectively. All patients remain free of disease by clinical, endoscopic, and radiographic (CT or MRI) surveillance.

Conclusions: In experienced hands select cases of ethesioneuroblastoma can be safely excised and reconstructed endoscopically with comparable degrees of tissue removal as with external approaches. Short-term oncologic results in this small series of patients appear to be comparable to traditional methods. Longer follow-up on a larger series of patients is warranted.

2:20 Endoscope Assisted Craniofacial Resection: A Case Presentation with Review of the Literature

Ashutosh Kacker; Jerry Huo

Hypothesis: Endoscope assisted craniofacial resection as an alternative to conventional craniofacial resection in the elderly and medically high-risk patients to decrease procedure related morbidity and mortality by reducing operative time.

Study Design: Case report with review of literature.

Institution: Tertiary care teaching hospital.

Material and Methods: 89-year-old female with a large frontal sinus chondrosarcoma with an associated mucocoel with pressure affect on the frontal lobe. The patient underwent surgery using a bi-coronal flap and endoscope assisted trans-nasal approach for excision of the lesion. Oncologic margins were achieved with complete excision of the lesion. There were no procedure-related complications.

Results: Endoscope assisted craniofacial resection seems to be a safe alternative to conventional craniofacial resection in the elderly and medically high-risk patients. This approach reduces the operative time significantly.

Conclusion: Endoscope assisted craniofacial resection is a safe and effective procedure. A large multi-institutional study is required to study the role of endoscope assisted craniofacial resection in management of nasal and paranasal sinus malignancies.

2:28 **Computed Tomography Findings in Patients with Invasive Fungal Sinusitis**

Ron Swain, Jr., MD; Todd Kingdom, MD; Susan Muller, MD; John Del Gaudio, MD; Patricia Hudgins, MD

The role of radiographic imaging in the evaluation of invasive fungal sinusitis has not been clearly established. We retrospectively reviewed the computed tomography (CT) findings in nineteen cases of documented invasive fungal disease of the sinonasal cavities in an attempt to identify factors predictive of invasive disease. All patients were immunocompromised, had CT scans for review, and documented invasive fungal elements on tissue histopathology. Fifteen patients had fungal organisms isolated by tissue culture: 10 with Aspergillus and 5 with Mucoraceae species. CT features included severe soft tissue edema of the nasal cavity (12/19), facial soft tissue involvement (8/19), orbital involvement (10/19), and unilateral sinonasal involvement (11/19). Only 4 patients had bony erosion, one had air-fluid levels, and no patient had intracranial involvement. We found that severe soft tissue edema of the turbinates, septum, and nasal cavity was an early finding on CT and suggestive of underlying invasive disease. Bony erosion and orbital involvement, although present in our series, was not uniformly found. Several reports have suggested that CT is sensitive in detecting invasive fungal disease of the sinonasal cavities based on specific radiologic findings. In contrast, our experience suggests that many patients do not have these classic CT findings. The clinician must maintain a high index of suspicion when evaluating these patients in order to establish a prompt diagnosis, and early intervention must be considered despite the frequent absence of invasive CT findings.

2:36 **Utility of Computed Tomography and Magnetic Resonance in Invasive Fungal Rhinosinusitis**

R. Charles Howells II, MD; Hassan H. Ramadan, MD

Invasive fungal rhinosinusitis is an aggressive, destructive process most commonly affecting the immunocompromised host. While frequently fatal, prognosis is directly related to early recognition and aggressive treatment. Various reports advocate computed tomography (CT) scanning as the study of choice in evaluating suspected invasive fungal disease, reserving mag-

netic resonance (MR) imaging for select cases. Others report lack of correlation between CT and surgical or pathological findings. Our aim was to investigate the utility of CT and MR in the diagnosis of invasive fungal rhinosinusitis. We retrospectively reviewed four cases of biopsy-proven invasive disease. Correlations between radiographic, endoscopic, and surgical findings were investigated. *Rhizopus* species were detected in three cases and mixed *Mucor* and *Aspergillus* species in another. Superimposed bacterial sinusitis was confirmed in all cases. CT findings were non-specific revealing pansinusitis; no bone destruction or intracranial extension was noted. Mild orbital cellulitis was noted in one case. Anterior rhinoscopy revealed non-viable tissue in two patients. Nasal endoscopy later confirmed tissue ischemia in a third patient, while a final patient had normal findings on both exams. Non-specific findings resulted in delay of diagnosis by 48 to 72 hours in 2 patients with presumed bacterial sinusitis. MR revealed intracranial extension in two patients and better represented intraoperative findings. In conclusion, CT findings in invasive fungal rhinosinusitis may be non-specific and underestimate extent of disease. A high index of suspicion and early endoscopic examination with biopsy is mandatory for evaluation. MR imaging may better represent disease progression and should be considered early.

2:44 **Rathke's Cleft Cyst, Diagnostic and Therapeutic Considerations for the Otolaryngologist**

Jan L. Kasperbauer, MD; Laura J. Orvidas, MD

Rathke's cleft cysts are unusual lesions of the sella, which have received little attention in the literature. The presenting symptoms may prompt referral to an otolaryngologist, and removal often includes a transsphenoidal approach to the sella. This study is a retrospective review of patients diagnosed with Rathke's cleft cysts between the years of 1988-1998. Data collected included presenting symptoms, visual acuity, surgical treatment, complications, recurrences, and effect on daily activity. Twenty-nine patients were diagnosed with a Rathke's cleft cyst (11 males, 18 females) whose mean age was 45 years. The majority (52%) presented with symptoms of headache with pituitary dysfunction a frequent finding on preoperative evaluation. All but two were managed with a transsphenoidal approach to the sella. The majority of the lesions (56%) demonstrated

suprasellar extension on preoperative imaging. Six patients developed complications postoperatively related to cyst removal. Five patients developed diabetes insipidus (the majority of which were transient), and one patient was noted to have a small CSF leak, which was managed with nasal packing. Recurrence has been documented in eight patients (30%). Postoperatively visual function improved or remained stable in all patients. Persistent pituitary dysfunction required hormonal supplementation in 56%. Only a single patient with an astrocytoma in addition to a Rathke's cleft cyst did not maintain the ability to perform normally on an assessment of activities of daily living, a striking contrast to patients with craniopharyngioma. These results support the following conclusions: (1) Rathke's cleft cysts need to be considered as sources of head pain and pituitary dysfunction (2) Persistent or recurrent cyst formation occurs in approximately one third of patients. (3) Maintenance of the ability to perform the activities of normal daily living can be expected after surgical management.

2:52 **Discussion**

3:00 **Break**

3:45 **Acoustic Rhinometry Findings in Patients with Mild Sleep Apnea**

Steven M. Houser, MD; Bulent Mamikoglu, MD; Benjamin F. Aquino, BS; Jaquelynne P. Corey, MD, FACS, FAAOA

Nasal obstruction may contribute to the development of obstructive sleep apnea (OSA). Acoustic rhinometry (AR) measures nasal patency and congestion which are useful parameters in objectively evaluating nasal obstruction. The nasal obstruction produced by allergic rhinitis may contribute to the development of OSA, and can be easily assessed with acoustic rhinometry. The acoustic rhinometry data from 10 patients with, and 40 patients without, mild OSA were compared. The mean congestion factors at the first cross-sectional area (CSA1) on the AR graph were found to be significantly higher in the OSA group compared to the non-OSA group. ($p=0.03$) The classification of change in congestion factors demonstrated significant differences at CSA1, 2, 3, and volume. (t-distributions: <0.001,

0.0312, <0.001, and <0.001 respectively) The non-OSA patients noted a significant subjective improvement in nasal congestion after topical nasal decongestion, while the OSA patients did not. (p= <0.0001, and 0.064 respectively) Though the role of nasal obstruction in OSA is controversial, our study lends evidence to the thought that the nasal obstruction associated with allergic rhinitis is associated with the presence of mild sleep apnea. Whether or not allergic rhinitis is a direct cause of OSA is debatable, but we have shown that greater nasal congestion is related to the presence of sleep apnea in a population of allergic rhinitis patients.

3:53 **Treatment of Hypoxemia in Obstructive Sleep Apnea**

Michael Friedman, MD; Roy Landsberg, MD; David Caldarelli, MD

Many patients suffering from obstructive sleep apnea (OSA) have intermittent oxygen desaturation associated with periods of apnea or hypopnea. Oxygen saturation levels below 90 percent are considered harmful. Treatment is usually directed at correcting the apnea, which will in turn prevent hypoxemia. Unfortunately, many patients fail or are not candidates for CPAP or surgical correction of their OSA. Fifty patients who had persistent OSA and hypoxemia below 90 percent and were not candidates for additional surgical or CPAP therapy were treated with nocturnal oxygen supplementation. Standard symptoms associated with OSA and the Epworth sleepiness scale were recorded before treatment and 30 days after the start of treatment. The treated patients were divided into two groups: Group 1 - hypoxia with apnea; Group II - hypoxia with hypopneas or upper airway resistance syndrome and minimal apnea. The results will be presented. When OSA cannot be completely corrected, correction of the hypoxemia may be beneficial in selected cases.

4:01 **Reflux and Chronic Sinusitis: Are They Related?**

Stacey Silvers, MD; Henry Kim, MD; Scott Gold, MD; Robert Pincus, MD

Much discussion has been generated about the association of reflux and chronic sinusitis. It has been well documented that reflux is associated with asthma and recently sinusitis in children. To further investigate we did PH monitoring on 36 patients with a history of chron-

ic sinusitis. Only nine of the patients in the study complained of reflux. Previous surgery and/or CT scan were used to diagnose chronic sinusitis. All patients had 24 hour PH monitoring with triple probe catheters, placed under fiberoptic guidance. The first probe was in the nasopharynx, the second just superior to the cricopharyngeus and the third above the lower esophageal sphincter. PH levels of four or less were considered positive for reflux. Of the patients tested two had no reflux, 34 had gastroesophageal reflux, 24 had reflux at the cricopharyngeus and two had reflux in the nasopharynx. There appears to be a correlation between acid reflux and chronic sinusitis. The possible mechanisms and indications for treatment will be discussed. Protocols for further prospective studies are reviewed.

4:09 **Creating an Osteoplastic Flap: A Quantitative Comparison of Three Techniques**

Michael H. Callahan, MD

Purpose: In osteoplastic flap surgery, osteotomies are based on a template made from a 6-foot caldwell film or transillumination of the frontal sinus, either transcutaneously or via a trephine. This study will measure the accuracy of these three methods in delineating the frontal sinus boundaries.

Materials and Methods: The frontal sinus boundaries of 21 cadaver heads were estimated using the following techniques: 1) transillumination of the frontal sinus through the skin, 2) transillumination through a right-sided trephine, and 3) superimposing a caldwell template. The three different techniques were compared quantitatively to the true boundaries of the frontal sinus.

Results: The average error when using the caldwell template, transcutaneous transillumination, and transillumination through a trephine was -1.46, +1.65, and +1.14mm respectively. The difference in each method was statistically significant ($p<.0001$). The template, dependent upon correct placement, most often underprojected the boundaries, whereas both transillumination techniques tended to overproject the frontal sinus boundaries. The greatest error was noted at the lateral margins of the sinus. There was no significant correlation between sinus size and error.

Conclusion: Each of the three techniques is imperfect. Therefore, to maximize exposure and safety, we recommend using a template in conjunction with transillumination to aid in correct placement. These methods

are available to every otolaryngologist and may allow the osteoplastic flap to become a safer and more thorough procedure.

4:17 **Discussion**

4:25 **Histomorphometric Analysis of Human Sphenoid and Maxillary Mucosa: Measurement of Relative Density of Goblet Cells and Basal Cells**

Shane R. Smith, MD; Margaret Brandwein, MD; William Lawson, MD, DDS

The majority of malignant tumors of the paranasal sinus are squamous cell carcinomas and arise most commonly in the maxillary sinus, and less commonly in the nasal cavity and other sinuses. Adenomatous tumors are much less common than squamous and also have a divergent distribution among the paranasal sinuses. The majority of adenomatous tumors arise from the surface mucosa, or submucous seromucinous glands, and recent theories of tumorogenesis propose that the distribution of these tumors is based on the variance of different cell types among the sinuses. We used morphometric analysis to measure the relative density of goblet cells and basal cells from maxillary and sphenoid specimens. Surgical specimens from ten patients for each subset were stained with Periodic-Acid Schiff stain. The area of goblet and basal cells in five representative areas of specimens were measured and compared to the total cross-sectional area of the mucosa, giving a relative density of each cell type. The average goblet cell density was 31.19% (StDev +/-10.27%) in maxillary tissue and 33.25% (StDev +/-20.80%) in sphenoid tissue. Student's t-test showed no statistically significant difference between the two. The average basal cell density was 9.53% (StDev +/-6.87%) for maxillary tissue and 10.91% (StDev +/-1.91%) for sphenoid tissue. Again, no statistically significant difference between the two existed. In conclusion, there is no clearly discernible difference in the histological composition of these two paranasal sinuses to explain the different incidence of glandular tumors, and other etiologic factors must be considered in explaining tumorogenesis at these sites.

4:33 **Effective Application of Nasal Steroid Spray in Common Practice**

Richard A. Lebowitz, MD; Suzanne K. Doud Galli, MD, Ph.D.; Renato Giacchi, MD

Nasal steroid sprays have become a mainstay in the medical treatment of chronic rhinosinusitis. Their effect depends on their targeted topical application to the mucous membrane of the inferior turbinate and middle meatus, two anatomic sites linked to the symptomatology of chronic rhinosinusitis. When used properly, the spray is aimed laterally, towards the inferior turbinate and middle meatus. We conducted a prospective study to determine the distribution of an aqueous steroid spray on the nasal mucous membrane. After obtaining informed consent, patients who regularly used a topical nasal steroid, were given a sample that had been colored with a non-toxic food dye. Participants were instructed to use the spray in their usual manner, after which fiberoptic nasal endoscopy was performed to determine the location of the spray on the mucous membrane. The intranasal examination was repeated after 15 min. to allow for redistribution by mucociliary transport. Findings were recorded and are discussed along with potential clinical implications and recommendations for more effective use of these medications.

4:41 **The Middle Meatal Antrostomy: Is it Necessary?**

Peter Catalano, MD, FACS; Reuben Setliff III, MD

A middle meatal antrostomy (MMA) is a routine part of traditional functional endoscopic sinus surgery (FESS). Its creation is associated with a potential increase in surgical morbidity, namely bleeding and postoperative pain. The merits of MMA are well stated in the literature, but its success is dependent on several factors. Failure of MMA is not uncommon with surgical revision rates reported as high as 30%. With the development and introduction of minimally invasive sinus techniques (MIST), the necessity of MMA has been questioned. Has the clinical indication for MMA changed? What is the risk/benefit ration of performing MMA? What is the risk/benefit ratio of not performing MMA? What is the philosophy of proponents of MIST with respect to a diseased natural maxillary sinus ostium? How does the MIST model manage the recirculation phenomenon? These queries are but a few at the heart of the controversy regarding the necessity of

MMA. This report will debate these issues in detail, discuss the advantages and disadvantages of MMA, and outline surgical treatment options for the chronically diseased maxillary sinus.

4:49 **Unusual Paranasal Sinus Tumors Presenting with Common Nasal Complaints**

Hannah Vargas, MD; Lisa T. Galati, MD

Epistaxis, sinus headaches and nasal obstruction are common complaints cared for by both the otolaryngologist and primary care physician. We present two cases which were referred for severe headaches, nasal obstruction and profuse epistaxis. Further workup revealed rare paranasal sinus tumors in both cases. The first was a fibroxanthoma of the frontal sinus, the second was extramedullary hematopoiesis (EM) of the maxillary sinus. In both cases, the history included long term, common rhinologic complaints of mild epistaxis and low grade headaches. Neither patient was referred, however, until they developed severe headaches and profuse epistaxis. These cases are rare. Fiboxanthoma of the frontal sinus is uncommon and EM in the maxillary sinus has not yet been reported. The objective of this report is to describe two unique cases of paranasal sinus masses both with delayed diagnosis. These cases serve as reminders that common rhinologic complaints may have life threatening etiologies and need a full evaluation by a trained otolaryngologist.

4:57 – 5:05 **Discussion**