

TRANSACTIONS  
AMERICAN OTOLOGICAL SOCIETY, INC.

VOLUME 94

One hundred Thirty-Ninth Annual Meeting



May 20-21, 2006  
Hyatt Regency Hotel  
Chicago, IL

**OFFICERS**  
**JULY 1, 2005-JUNE 30, 2006**

**PRESIDENT**  
John K. Niparko, MD  
The Johns Hopkins Hospital  
Baltimore, MD

**PRESIDENT ELECT**  
Antonio De La Cruz, MD  
House Ear Clinic, Inc.  
Los Angeles, CA

**SECRETARY-TREASURER**  
Clough Shelton, MD  
University of Utah School of Medicine  
Salt Lake City, UT

**EDITOR-LIBRARIAN**  
C. Phillip Daspit, MD  
Phoenix, AZ

**COUNCIL**  
The above officers and  
Jeffery P. Harris, MD, PhD  
Sam E. Kinney, MD  
Antonio De La Cruz, MD  
Joseph B. Nadol, MD

**MINUTES**  
American Otological Society, Inc.  
Annual Meeting  
May 20-21, 2006  
Hyatt Regency Hotel  
Chicago, IL

**MINUTES OF THE BUSINESS MEETING - SATURDAY, MAY 20, 2006**

I. **CALL TO ORDER:** The President, Dr. John K. Niparko called the Business Meeting to order at 12:30 p.m.

II. **APPROVAL OF MINUTES:** The minutes of the May 14-15, 2005, Annual Meeting of the American Otological Society held at Boca Raton Resort & Club, Boca Raton, Florida, were approved.

III. **INTRODUCTION OF NEW MEMBERS:** The following new members were introduced to the Society by their respective proposers:

**EIGHT ACTIVE MEMBERS**

Douglas B. Backous, MD - Proposed by: Herman A. Jenkins, MD; Seconded by: Newton J. Coker, MD  
Carol A. Bauer, MD - Proposed by: Leonard P. Rybak, MD, PhD; Seconded by: A. Julianna Gulya, MD  
James E. Benecke, Jr., MD - Proposed by: Terrence Murphy, MD; Seconded by: David M. Barrs, MD  
John P. Carey, MD - Proposed by: Lloyd B. Minor, MD; Seconded by: Howard W. Francis, MD  
Steven W. Cheung., MD - Proposed by: Karen J. Doyle, MD, PhD; Seconded by: Anil K. Lalwani, MD  
Hussam K. El-Kashlan, MD – Proposed by: Steven A. Telian, MD; Seconded by H. Alexander Arts, MD  
Lawrence R. Lustig, MD – Proposed by: Lloyd B. Minor, MD; Robert K. Jackler, MD  
Cliff A. Megerian, MD – Proposed by: Gordon B. Hughes, MD; Michael J. McKenna, MD

**ONE ASSOCIATE MEMBER**

Alec N. Salt, PhD – Proposed by: Richard A. Chole, MD, PhD; Joel A. Goebel, MD

**TWO CORRESPONDING MEMBERS**

Richard T. Ramsden, FRCS - Proposed by: Derald Brackmann, MD; Seconded by: Robert K. Jackler, MD  
Masafumi Sakagami, MD, PhD - Proposed by: Patrick J. Antonelli, MD; Seconded by: Saumil N. Merchant, MD

Dr. Niparko acknowledged the efforts of Dr. Julia Gulya who has made this exercise of bringing new potential candidates to the AOS on a regular basis a lifetime commitment.

IV. NOMINEES FOR NOMINATING COMMITTEE: A Nominating Committee composed of Dr. Gregory J. Matz, Chairman, Drs. A. Julianna Gulya, David Barrs, Richard Wiet, and Richard Chole was elected to prepare the slate of nominees for AOS officers for 2006 – 2007.

V. REPORT OF THE SECRETARY-TREASURER: Dr. Clough Shelton presented the following items:

- A. The present membership totals 310 and includes the induction of new members on May 20 2006 as follows:  
141 Active, 78 Senior, 44 Associates, 14 Emeritus, 23 Corresponding, and 10 Honorary.

Membership applications are available on the AOS website at [www.americanotologicalsociety.org](http://www.americanotologicalsociety.org) or through the AOS Administrative Office.

- B. Members deceased since the 2005 Annual Meeting:

Dr. Richard Bellucci  
Dr. J. Booth  
Dr. Jerome Hilger  
Mr. Andrew Morrison  
Dr. William D. Neff  
Dr. James L. Sheehy  
Dr. Catherine Smith

- C. Members transferred to senior status:

Dr. F. Owen Black  
Dr. Arnold G. Schuring

- D. Members transferred to emeritus status:

Dr. Lee A. Harker  
Dr. Nelson Y.S. Kiang  
Dr. K. J. Lee

- E. Income and Expense Statements:

The following Income and Expense Statements were presented to the membership.

AMERICAN OTOLOGICAL SOCIETY INC.  
FINANCIAL STATEMENT  
July 1, 2005– April 30, 2006

SUMMARY of INCOME (July 1, 2005-April 30, 2006)

Membership Dues & Initiation	62,817.00
AOS Ties	405.00
Interest & Dividends	3,649.39
Medtronic Grant 2006 mtg*	1,500.00
O&N 2005 Profit Share	25,000.00
COSM 2005	26,384.93
Total Income	119,756.32

\*Grants from Advanced Bionics and Cochlear Americas in the amount of \$2500 each have not been received as of this meeting date.

DISBURSEMENTS (July 1, 2005-April 30, 2006)

Annual Meeting	10,357.94
Midwinter Council Mtg.2006 & 2007	19,732.27
Office Expenses (Postage, Supplies, AOL, Ph, Mileage	5,511.45

Accounting Fees/Professional Fees	2,758.50
AOS Secretarial Stipend	18,165.00
ACCME Dues & Reaccreditation	2,300.00
AOS Basic Science Lectureship	27,306.00
O&N 2005-2006 Subscriptions	15,533.00
Insurance	6,389.00
Miscellaneous	3,135.78
<b>Total Disbursements</b>	<b>111,188.94</b>

The AOS Basic Science Lectureship balance as of 4/30/2006 is \$77,040. The lectureship supports basic science lecturers at the AOS Annual Meeting. The profit share of the journal is used to fund this lectureship, and the goal is to have the interest share from the fund pay the travel expenses for the lecturer.

**AOS Research Fund Report:** Dr. Clough Shelton presented the AOS Research Fund Report. The market value of the research fund as of April 30, 2006, was \$8,436,345. The value of the research fund on April 30, 2005, was \$7,625,674.

The expenses to the research fund were \$219,941.96. This includes the grants funded in the amount of \$196,750, the RAB Annual Meeting, journal advertising and administrative support. The balance in the checking account as of 4/30/2006 was \$175,388.68.

The membership approved the Secretary-Treasurer's report.

**VI. EDITOR-LIBRARIAN REPORT:**

Dr. C. Phillip Daspit reported the Transactions for the 2005 meeting are being transcribed and will soon be on the website as well as all of the back issues of the Transactions. In the future the AOS may publish a few of the Transactions for historical purposes.

**VII. PROGRAM ADVISORY COMMITTEE -** Dr. Niparko thanked the following individuals for serving on the 2006 Program Advisory Committee: Drs. Moises A. Arriaga, Sujana S. Chandrasekhar, Karen J. Doyle, Herman A. Jenkins, Michael J. McKenna, Lloyd B. Minor, Edwin M. Monsell, Seth Rosenberg, Leonard P. Rybak, Samuel H. Selesnick, D. Bradley Welling. This group reviewed 43 abstracts, selected about three-quarters of them for presentation. The abstracts covered a variety of topics of interest to the American Otological Society members and serve the mission of the AOS very nicely.

**VIII. PRESIDENT'S REMARKS, INTRODUCTION OF GUEST OF HONOR, PRESIDENTIAL CITATION, SPECIAL PRESIDENTIAL AWARDS, May 20, 2006:** The Business Meeting was adjourned and the first Scientific Session started at 1:00 p.m. with brief remarks from the President, Dr. John K. Niparko. The Presidential Citation was presented to Malcolm D. Graham, MD and Paul R. Kileny, PhD. The President introduced the Guest of Honor, Richard A. Chole, MD, PhD

**MINUTES OF BUSINESS MEETING - SUNDAY, MAY 21, 2006**

The President, Dr. John K. Niparko, called the Business meeting to order at 7:00 am.

**IX. REPORTS OF COMMITTEES:**

**AOS Research Advisory Board Report:** Dr. Lloyd B. Minor presented the AOS Research Advisory Board Report.

The AOS Research Advisory Board (RAB) held their annual meeting in New York on April 22, 2006.

The RAB reviewed a total of 19 applications, 5 clinician scientist award applications, 5 research fellowship award applications, and 9 research grants. The total requested funding from these 19 applications was just over one million dollars. We recommended for funding and the AOS Council at its meeting on Friday approved for funding 2 clinician scientist award applications, 2 research fellowships and one research grant. The total amount of funds awarded was \$302,885.

The awarded proposals were as follows:

Research Grant

John P. Carey (Johns Hopkins University) (Renewal) Effects of Low-Dose Gentamycin on Labyrinthine Structure \$55,000

Research Fellowships

Ms. Karen Mu (University of California Davis) (Renewal) The Role of Chloride Channels in Inner Ear Fluid Homeostasis \$44,000

Vincent Lin, MD (University of Washington) The Role of Direct Trans-differentiation in Hearing Recovery after Drug Damage in an Avian Model \$44,000

Clinician Scientists Awards

Joni Doherty, MD (University of California, San Diego) ErbB receptor regulation of Vestibular Schwannomas \$80,000

Anthony Mikulec, MD (Saint Louis University) Optimization of Local Drug Delivery to the Cochlea \$79,885

The budget for the Research Advisory Board meeting was \$28,000.00. Expenses thus far are just over \$20,000. There is some reimbursement for travel that had not been received by the AOS at the time of this meeting but anticipate that total expenses will be within the budgeted amount. The budget for the 2007 meeting is the same amount.

Dr. Larry Lustig will be a new member of the RAB, replacing Dr. Bruce Gantz, who rotated off the advisory board this year.

There were actions taken with regard to the grant mechanisms. The RAB requested and the Council approved to change the submission requirements to one original signature application and an electronic version either a .pdf or a .doc format on a CD and then applicants will be required to scan the original proposal and all attachments and send a CD with the electronic version to the executive secretary of the RAB by 5:00 p.m. on the deadline. This will enable the RAB to start doing some Web based reviews. The RAB looked at the possibility of doing this through some commercially available companies but the expenses are too great to be justified at this point. The RAB will put together their own web site from the documents that are submitted to the RAB.

The CSA was too originally to be a 3-year funding mechanism with annual re-approval, but this would encumber a large amount of money for a long period of time. The RAB recommended that the anticipated length of funding be two years, again one year and anticipated approval for a second year but that the award terminates after two years. The Council approved this recommendation and the two-clinician award recipients will be notified of this change.

**American Board of Otolaryngology Report:** Dr. Richard Chole presented the ABOto report. The 2006 written examination was given to 274 individuals on April 9 and all of these individuals participated in the oral examination the day afterwards. There were 278 individuals giving the examination of board directors, senior examiners and guest examiners. The results of the exam are not available at this time. The neurotology examinations were also given the following day in oral form, 12 examiners and 17 candidates and those candidates are still participating in one of the two pathways, either the normal pathway, which is fellowship training in the ACGME fellowship residency. Fellowship trained individuals can take the examination or the alternate pathway. Also the pathway will close in 2011. The OTE examination was conducted on March 4, 2006, and the results are just coming out the exam. Changes in the Board of Directors are as follows: Dr. Jesus Medina is President of the Board at this time and will serve a two-year term. Dr. Wayne Larrabee is the President Elect and he will serve a two-year term as well. Dr. Paul Levine continues to

serve as treasurer. Dr. Gayle Woodson completed her term on the ABOto Board. Dr. Mark Richardson from Portland, Oregon replaced Dr. Woodson.

The Maintenance of Certification process is rolling forward. Currently all people who are required to be in the MOC is required to be those diplomates from 2002 forward, all neurotology diplomates and the Board of Directors. The MOC process is continuing to evolve and develop. There are four parts of the MOC: 1) the professional standing and that is CME credits, licensure, etc., 2) lifelong learning and self-assessment, 3) cognitive expertise – this will be an examination and Part III examination will first be given in 2009. It will consist of two modules, one a basic module where everyone takes the basic module written module and basic otolaryngology, basic sciences and the second module, they will be able to choose in their specialty or subspecialty. At the present time the diplomates before 2002 will not be required to do MOC unless you are a diplomate or certified by the neurotology board. Many states are requiring recertification within ten years and the Board is preparing to offer that type of recertification. The alternative would be to take the state examination. The other issue the ABOto is now participating in sleep medicine. ABOto is now established as a conjoint specialty for a certificate in sleep medicine, so ABOto is a sponsoring Board. Diplomates are now eligible to take a sleep medicine fellowship and get sleep medicine certification. This requires ABMS certification, ABOto, having 12 months of formal post residency training in sleep medicine, 12 months of experience in sleep medical care and other experience as needed.

It is critical everyone understand that the scope of knowledge of otolaryngology and neurotology is posted on the ABOto website. This is a very important regulator of the scope of knowledge in the otolaryngology specialty.

**Award of Merit:** Dr. Jeffrey P. Harris, Chairman, reported he and his committee members, Drs. Sam E. Kinney, John K. Niparko, Robert Jahrsdoerfer and Tom McDonald recommended a 2006 Award of Merit awardee to be presented at the banquet Sunday evening. (Dr. Silverstein received the 2006 Award of Merit)

**Audit Committee:** Dr. Herman A. Jenkins, Chairman, and committee members, Drs. Moises Arriaga and David Barrs reviewed the financial records of the Society. The committee felt that the accounting methods and the entries were all within line of the scope of the organization. The society is in good financial shape and the committee had no questions about any of the entries. The committee recommended the membership accept the report as an indication that the financial status of the American Otological Society is excellent and is being maintained appropriately. The members accepted the audit report as presented.

**American College of Surgeons:** Dr. Leonard P. Rybak presented the American College of Surgeons report. The American College of Surgeons met on Thursday, May 18, 2006, at the ACS headquarters. The American College of Surgeons is encouraging memberships among the fellows of the American Academy of Otolaryngology-Head and Neck Surgery and they are also trying to get the residents in joining as resident members. Currently the ACS offers PGY1 residents a free membership in the ACS as a resident member. The ACS is working on E-fax.org. This is a web portal project. There will be a tremendous amount of resources that the physician will be able to link in to including materials related to the otolaryngology specialty, some general information for residents, educational materials. It will also provide logs for surgery for the residents who are preparing to take Boards.

In June there will be a conference sponsored by the AAO-HNS, which Dr. David Nielsen has put together. Dr. John Niparko has been an advisor to the AAO-HNS with regard to the conference. It is called Translating Research into Cross Specialty Measures Conference (TRICM) and the conference will focus on reimbursement for surgery and services. This is an important step in trying to standardize the criteria by which people are judging our services. This will be held June 22-24 at the Marriott Crystal City, Arlington, VA. We are encouraging as many as possible to participate in this conference.

The ACS is encouraging everyone to participate in the clinical congress in the fall and many of the members are organizing exciting topics that will be cross-specialty topics. Dr. Rybak encouraged the AOS membership to attend.

**American Academy of Otolaryngology:** In the lieu of Dr. David Nielsen, Executive Vice-President of AAO-HNSF Dr. Clough Shelton presented the report. Dr. Shelton summarized the state of the Academy/Foundation and its initiatives. Dr. Shelton reported the report from Dr. Nielsen touches on a couple of different issues. One was the pay for performance conference that Dr. Rybak just mentioned. The Academy feels it is very important to develop measures that are quality based rather than have measures that do not assess what we do as physicians. It gets forced upon us. We would rather be in the forefront and help lead the way to develop these measures. The other important thing the Academy has been doing is working on scope of practice issues, particularly as it is with audiology. The Academy has met with AAA leadership, also including AOS and ANS leadership to deal with issues concerning legislative language for audiology licensure scope of practice. These discussions are ongoing. In addition, the Academy has participated in AMA scope of practice center which basically involves multiple specialties pooling resources to help deal with scope of practice issues on a state-by-state basis. Dr. Shelton stated it is important for the members to realize is that the Academy is still the otolaryngologists' political voice and that voice takes money. It is important for AOS members to contribute to the Academy PAC as that is our vehicle. The Academy is spending considerable resources now essentially on or behalf of the audiology scope of practice issues that could affect all of the otolaryngology practices.

### **American Otological Society**

Report of the Executive Vice President and CEO of the American Academy of  
Otolaryngology-Head and Neck Surgery  
David R. Nielsen, MD

Sunday, May 21, 2006

(For a more complete report on all Academy activities, please see the Board books of the AAOHNS/F for March, 2006.)

- ❖ Scope of practice continues to be a major agenda item for the Academy and its members. Of most import is the issue of continued state legislation and regulation of audiology services. The Academy assisted its members in the state of Maryland in defeating a proposal that would grossly expand the scope of practice of audiologists into the practice of medicine. AOS members were prominent in defeating this proposal. It will undoubtedly be back in next year's session.
  - Academy leadership, along with representation from AOS and ANS has been meeting with leadership of the American Academy of Audiology to discuss model legislative language for audiology licensure and scope of practice. At AAOHNS' request, language previously published by AAA on its website has been removed, and we are hoping to meet with AAA leadership this summer to address this in more detail. Additional discussion items include education, CPOP, coding and billing issues.
  - AMA Scope of Practice Center (SOPP) – A coalition designed to marshal resources around common scope of practice issues that tend to form at state levels has been formed through the AMA with AAOHNS serving as a key player in its formation, as one of 6 specialty organizations on the steering committee. The resources of both state and national specialty societies can be leveraged effectively to fight scope of practice issues by specialty and by state. We have committed as a specialty to formally support this coalition. We contribute \$25,000 per year, plus staff and

leadership time and travel to the SOPP. In the first few months of its existence the coalition has successfully fought state scope issues in Hawaii and Louisiana (expanded non-physician scope of practice into psychiatry by psychologists and nurse practitioners), in California (expanded independence and scope of practice of speech and language pathologists), and in Maryland as mentioned. Additional work is being done by Academy staff and local otolaryngologists to address audiology scope of practice issues in New Jersey and Pennsylvania.

- We applaud the AOS and its leadership for their extensive work and **ask the AOS to continue to commit people and resources and join the AAOHNS in fighting inappropriate expansion of scope of practice of audiologists** on local, state, and federal issues as they arise.
- ❖ The AAOHNS continues to lobby extensively to prevent physician measurement from being dictated by industry, CMS, or fiscal concerns and to focus on quality medical outcomes. The Academy works with the Physician Consortium for Performance Improvement in developing appropriate quality measures for the specialty. The Consortium's new structure is intended to facilitate this physician leadership in quality. The AMA and Congress have recently announced a contract by which the Consortium will be the vehicle for providing 140 multi-disciplinary clinical measures over the next several years for use both by CMS and legislative or other regulatory activity in which quality base purchasing is implemented. The Academy is holding its first quality conference, Translating Research Into Cross-specialty Measures (TRICSM) this summer. We have invited the leadership of all otolaryngology societies as well as our certifying board, ABOto, to be represented at this conference and to be prepared to commit to a process of identifying, prioritizing, developing, and implementing quality activity in an integrated and patient-centered manner. Only by aggregating the demand and unifying our response to performance measures can we assist our members in improving patient care and minimizing the influence of fiscal motivation by third party payers. **We urge AOS to support this conference and the development of appropriate otologic quality initiatives. We ask all Academic programs and specialty societies to be represented at this conference.** For more information go to the Academy website and register online at: <http://www.entnet.org/meetings/TRICSM.cfm>
- ❖ The AAOHNS has a long collegial relationship with the International Hearing Society (IHS) whose members are certified hearing aid dispensers. They have supported our scope of practice position and worked with us to prevent inappropriate expansion. We continue to meet at least annually with their leadership to discuss our common agenda and coordinate activity where appropriate. If interested, we would invite AOS leadership to join in our meetings. The next meeting is tentatively planned for Toronto at the time of the AAOHNSF Annual Meeting.
- ❖ The Academy is proud of the election of Dr. Gerry Healy as Chair of the Board of Regents of the American College of Surgeons. We are working to leverage his tenure with ACS to coordinate issues of joint interest to the College and the Academy.
  - Dr. Tom Russell, ACS EVP, has accepted the invitation to speak at our Opening Ceremony in Toronto as the Conley Lecturer.



- The Surgical Quality Alliance (SQA) quality and performance measures – In response to the Ambulatory Care Quality Alliance (AQA), the College has assembled many of its constituent surgical societies to address surgical quality in a like manner. General measure common to multiple surgical approaches have been discussed and promoted. More specialty specific measures will be required and we are working with ACS to produce compatible measures and sets for our physician fellows. There will be increasing opportunities to jointly venture in prioritizing, developing, and implementing quality measures throughout the house of surgery.

**Membership Development:** Dr. A. Julianna Gulya presented the membership development report. The AOS really needs to be proactive to assure continued entry of the very best otologic talents. The Council recently has approved a change in the membership guidelines to somewhat make us less dependent upon the decision-making process and approval process of other societies in getting new members for the AOS. These new guidelines should be available on the AOS website by July 1. Dr. Gulya stated the AOS members have to carefully monitor young otologists and encourage these brilliant individuals to follow the path to AOS membership. Similarly, it is important to keep an eye out for more senior otologists who are qualified and would be potential members of the society but have not been invited to make an application for membership. Dr. Gulya thanked the members for bringing the new members into the society this year.

**Report of the Nominating Committee:** Dr. Gregory J. Matz presented the following nominations for the slate of officers of the AOS for the 2006-2007 year: Drs. Antonio De La Cruz, President; Clough Shelton, President-Elect & Secretary-Treasurer; C. Phillip Daspit, Editor-Librarian; Paul R. Lambert, Secretary-Treasurer-Elect; Council Members: Drs. John K. Niparko, Sam E. Kinney, Joseph B. Nadol, Jr., Bruce Gantz and Herman Jenkins. There were no nominations from the floor. The nominated slate was elected by the membership.

Drs. D. Bradley Welling and Derald Brackmann were elected to serve on the 2007 Award of Merit Committee.

X. OLD BUSINESS - Dr. Niparko reported the results of the AOS Bylaws amendment was approved by membership for emeritus status for associate and corresponding members who have reached the age of 70, or have been a member of the society for 20 years. There were 221 ballots mailed to the active and senior members and 60 ballots were returned. There were no negative votes.

**Adjournment:** The Business Meeting was adjourned at 7:25 am. At the opening of the scientific session at 7:30 a.m., Dr. Robert K. Jackler was presented an award for his eleven years of service as the Editor of the Otology & Neurotology Journal. The Scientific Program continued until 12:00 p.m.

Respectfully submitted,

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Clough Shelton, MD

Secretary-Treasurer

Scientific Program May 20, 2006

Session: Chronic Suppurative Otitis Media Surgery

Simple Underlay Myringoplasty Which Is Commonly Performed In Japan

Masafumi Sakagami, MD, PhD

Ryo Yuasa, MD, Yu Yuasa, MD

Objective: To introduce simple underlay myringoplasty (SUM) which is commonly performed in Japan.

Study design: retrospective

Settings: tertiary referral center

Patients: 423 ears with perforated ear drum underwent SUM at Sendai Ear Surgicenter from 2000 to 2004. They aged from 4 to 87 years (mean: 46.0 years). The surgical indications were for cases without cholesteatoma, with hearing gain in a paper patch test, and with no shadow in the tympanic cavity on CT.

Interventions: Through the ear canal, the margin of the perforation was removed with a fine pick under local anesthesia. A connective tissue obtained from the retroauricular region was inserted through perforation. The stretched graft was gently lifted to make a reliable contact with the edge of the perforation, and a few drops of fibrin glue were applied to the contact area. There was no packing in the external canal. If the perforation was left, re-closure was attempted at the office by using the patient's frozen material.

Main outcome measures: rate of closure of perforation

Results: Overall rate of closure was 341/423 (80.6%), and that after re-closure was finally 404/423 (95.5%). In 82 ears with failure of closure, the initial size of perforation was small in 46 ears, middle in 26 ears, large in 9 ears, and multiple in 1 ear.

Conclusions: SUM has been spread into all over Japan for the last 10 years because it was a simple procedure with fibrin glue and showed a high closure rate of the ear drum.

Masafumi Sakagami, MD, PhD

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## *Incidence of Dehiscence of the Facial Nerve in Cholesteatoma*

Marcus W. Moody, MD, Paul R. Lambert, MD

**Objective:** To determine the incidence and location of dehiscence of the facial nerve in patients with cholesteatoma.

**Study Design:** Retrospective case series.

**Setting:** Tertiary referral centers.

**Patients:** Charts and operative details from 1287 chronic ear cases performed by a single surgeon were reviewed for anatomic details regarding the facial nerve. The study group was limited to 376 ears in which cholesteatoma was confirmed at the time of surgery.

**Main Outcomes Measure:** Facial nerve dehiscence was graded as present or absent for both the tympanic and the mastoid segments; the location of dehiscence in the tympanic segment was further characterized as above the oval window, anterior to the oval window, posterior to the oval window or entirely dehiscent. Adherence of cholesteatoma to any area of dehiscence was noted.

**Results:** There were no cases of mastoid segment dehiscence. The tympanic segment was dehiscent in 25% of patients in the study group. Of those, 18% were dehiscent anterior to the oval window, 27% above the oval window, 14% posterior to the oval window, and 41% were entirely dehiscent. Cholesteatoma was directly adherent to the facial nerve in 21% of these cases.

**Conclusions:** This study represents the largest group of patients evaluated to date for dehiscence of the facial nerve in the setting of cholesteatoma. The most common variant found was complete dehiscence of the entire tympanic segment, followed by dehiscence above the oval window.

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Mastoid Obliteration Combined with Soft-wall Reconstruction of Posterior Ear Canal

**Haruo Takahashi, MD, Tetsu Iwanaga, MD, Satoru Kaieda, MD  
Tomomi Fukuda, MD, Hidetaka Kumagami, MD, Kenji Takasaki, MD**

Objective: To determine the clinical efficacy of the combined procedure of mastoid obliteration and soft-wall reconstruction of the posterior ear canal.

Study design: retrospective case review was done.

Setting: Tertiary referral centers

Patients: Ninety six patients (98 ears) with their age ranging from 5 to 82 (average 51.3), including 62 ears with chronic otitis media (COM) with cholesteatoma, 18 ears with non-cholesteatomatous COM, 14 ears with postoperative cavity problem, and 4 ears with adhesive-type COM

Intervention(s): all the patients had soft-wall reconstruction of the posterior ear canal and mastoid obliteration using mainly bone powder following mastoidectomy, and were followed more than a year.

Main outcome measure(s): Clean and dry condition was defined as success, and any of the following conditions including pocket formation, accumulation of debris or excessive crust, persistent wet condition, exposure of obliterated material was defined as failure.

Results: Overall success rate was 76.5% (75/98), and fresh cases showed better success rate (84.8%) than those with multiple surgeries (69.2%). Among unsuccessful cases, crust accumulation and persistent wet condition were observed most (7 ears each) followed by exposure of the obliterated material (5 ears), while only 2 ears showed pocket formation. Success rate showed no difference according to whether artificial material (apatite ceramics chip) was used in addition to bone powder or not. In 60 ears on which postoperative hearing was assessed, 41.7% showed less than 15 dB of air-bone gap (ABG), and 61.7% showed less than 20 dB of ABG.

Conclusions: Mastoid obliteration with bone powder in combination with soft-wall reconstruction of the posterior ear canal appeared a useful method for obliterating mastoidectomized cavity especially for prevention of postoperative pocket formation.

Haruo Takahashi, MD

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## **Botulinum Toxin Injection and Surgical Intervention for Treatment of Middle Ear and Palatal Myoclonus**

**John M. Ryzenman MD, Richard J. Wiet MD  
Timothy C. Hain MD**

**Objectives:** To report on the use and present video documentation of Botox and surgical therapy for the management of objective tinnitus due to middle ear and palatal myoclonus.

**Study Design:** Retrospective case review

**Setting:** Tertiary neurologic private practice

**Patients:** A retrospective chart review was performed for patients evaluated from 2002 to 2005 for tinnitus. Of 626 patients, 5 patients (one female and four males, ages 13-52 years) were diagnosed with non-pulsatile objective tinnitus, often described as a "clicking sound". Bilateral symptoms were present in three patients.

**Interventions:** Three patients were diagnosed with palatal myoclonus, of these one had obvious tympanic membranes contractions and levator palatini muscles spasms. Two patients had middle ear myoclonus (stapedial or tensor tympani myoclonus). All patients with palatal myoclonus underwent bilateral injections of the soft palate with Botox A (10-20 units each side). One patient underwent staged sectioning of the tensor tympani tendon followed by sectioning of the stapedial tendon. One patient was managed conservatively.

**Results:** All patients who received Botox injections reported complete relief for 3-5 months within 10 days. One of these patients experienced transient velo-palatal insufficiency. The surgically treated patient experienced 70% relief of symptoms following sectioning of the tensor tympani tendon, with complete resolution after sectioning of the stapedius tendon. The conservatively managed patient has persistent symptoms.

**Conclusion:** Middle ear and palatal myoclonus are well known etiologies of objective tinnitus that are frequently under diagnosed. These patients can be successfully treated with either office-based Botox injections or a stepwise surgical approach.

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## **Ototoxicity in the Guinea Pig Associated with the Oral Administration of Hydrocodone/Acetaminophen**

**Rita M. Schuman, MD, Neena Agarwal, MD  
Agnes Oplatek, Michael Raffin, PhD  
Sam Marzo, MD, Gregory Matz, MD**

**Hypothesis:** This prospective study intended to investigate and confirm that the daily oral administration of high doses of hydrocodone/acetaminophen caused ototoxicity in the guinea pig.

**Background:** Hydrocodone and acetaminophen taken in combination is a frequently prescribed and well tolerated analgesic. However, case reports have recently been published demonstrating a rapidly progressive sensorineural hearing loss associated with overuse or abuse of this medication. Currently, there are no published animal studies confirming this. This animal study intended to further investigate and confirm this hypothesis.

**Methods:** 30 female Hartley guinea pigs were randomly assigned to 2 groups of 15. The experimental group was given daily oral doses of hydrocodone/acetaminophen and the control group a daily placebo. All 30 guinea pigs were tested with baseline ABRs on day 0, and post drug/placebo administration on day 30 and 60.

**Results:** There was no significant difference between the control and experimental baseline ABR thresholds with mean hearing thresholds of 11.0 dB and 12.6 dB respectively. The experimental group had average ABR threshold of 25 dB at day 30 and 28.3 dB at day 60. The control group had average ABR threshold of 18.6 dB at day 30 and 21.4 dB at day 60. The experimental group demonstrated a greater significant average threshold shift as compared to the control group with a p value < 0.02.

**Conclusion:** Oral administration of hydrocodone/acetaminophen in the guinea pig caused a significant hearing threshold shift as compared to normal controls.

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*The Effects of Floxin and Ciprodex on Tympanic  
Membrane Perforation Healing*

Jeffrey A. Buyten, MD, Matthew Ryan, MD

Hypothesis: Exposure to Ciprodex, but not Floxin, prolongs tympanic membrane (TM) healing.

Background: Exposure to hydrocortisone has been shown to delay TM wound healing. No published studies have compared the effects of Ciprodex and Floxin on TM healing.

Methods: Non-infected tympanic membrane perforations were created in thirty rats. The rats were split into three groups and Ciprodex, Floxin or normal saline drops were instilled for seven days. Tympanic membrane healing was determined at specified intervals using photographic documentation and blinded observers.

Results: The normal saline control and Floxin exposed TMs healed at similar rates. There was a statistically significant delay in TM healing in the Ciprodex exposed TMs by post-operative day 10. However, All TM perforations were healed by postoperative day 20.

Conclusion: Ciprodex delays healing of experimental tympanic membrane perforations, but the brief exposure in this study did not cause persistent perforation.

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## **Protection Against Cisplatin-Induced Ototoxicity by AAV-Mediated Delivery of the X-linked Inhibitor of Apoptosis (XIAP)**

Dylan K. Chan, PhD, David M. Lieberman, BA  
Sergei Musatov, PhD, Samuel H. Selesnick, MD  
Michael G. Kaplitt, MD, PhD

Cisplatin, an effective chemotherapeutic agent, is limited clinically owing to ototoxicity associated with the apoptosis of cells in the inner ear. In this study, we assessed the role of the X-linked inhibitor of apoptosis protein (XIAP) in regulating and preventing cisplatin-mediated hearing loss and outer-hair-cell death in rats. We administered unilaterally through the round-window membrane adeno-associated viruses (AAV) harboring genes encoding wild-type XIAP, YFP, or either of two XIAP mutants— one deficient in caspase inhibition, and the other additionally deficient in the binding of the upstream pro-apoptotic factors Smac and Omi. After a three-day systemic course of cisplatin, the uninjected ears of all animals demonstrated significant hearing loss, as measured by auditory-brainstem response (ABR) thresholds, and outer-hair-cell loss, as detected by staining of hair bundles and cuticular plates. By both measures, ototoxicity was most profound at high frequencies. Whereas injection of AAV harboring YFP had no effect, ears injected with wild-type XIAP exhibited 68% less ABR threshold elevation at 32 kHz and 50% less basal-turn outer-hair-cell loss compared to the contralateral, untreated ears, demonstrating that XIAP can protect against cisplatin-mediated ototoxicity. Furthermore, the XIAP mutant lacking both anti-caspase and Smac/Omi binding activity showed no protection, whereas the mutant lacking only anti-caspase activity, but retaining the ability to bind Smac/Omi, significantly protected against hearing loss and hair-cell death, shedding light on the basic mechanism by which Smac and XIAP regulate apoptosis in the inner ear. These results suggest that gene therapy with XIAP may be effective to protect against cisplatin-mediated ototoxicity.

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**Percutaneous Cochlear Access Using Bone-Mounted,  
Customized Drill Guides: Demonstration of Concept In Vitro**

**Frank M. Warren, MD, Robert L. Labadie, MD, PhD  
J. Michael Fitzpatrick, PhD**

Hypothesis: Percutaneous cochlear access can be performed using bone-mounted drill guides custom made based on pre-intervention CT scans.

Background: We have previously demonstrated the ability to use image guidance to obtain percutaneous cochlear access in vitro (Otolology & Neurotology 2005; 26:557-562). A simpler approach that has far less room for application error is to constrict the path of the drill to pass in a pre-determined trajectory using a drill guide.

Methods: Cadaveric temporal bone specimens (n=8) were affixed with three bone-implanted fiducial markers. Temporal bone CT scans were obtained and used in planning a straight trajectory from the mastoid surface to the cochlea without violating the facial nerve, horizontal semicircular canal, external auditory canal, or tegmen. These surgical plans were used in rapid prototyping customized drill guides (FHC Inc.; Bowdoinham, ME) to mount onto anchor pins previously used to mount the fiducial markers. Specimens then underwent traditional mastoidectomy with facial recess. The drill guide was mounted and a 2mm drill bit was passed through the guide across the mastoid and facial recess. The course of the drill bit and its relationship to the aforementioned vital structures were photo documented.

Results: Eight cadaveric specimens underwent the study protocol. For all specimens, the drill bit trajectory was accurate; it passed from the lateral cortex to the cochleostomy site without compromise of any critical structures.

Conclusions: Our study demonstrates the ability to obtain percutaneous cochlear access in vitro using customized drill guides manufactured based on pre-intervention radiographic studies.

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The 2:34 pm discussions were not recorded secondary to a technical problem.

## **Session    Otosclerosis Surgery**

### **Stapedectomy -Changing Practice Patterns**

Michael J. Ruckenstein MD, MSc, Alexandra Tuluca BA  
Jeffery P. Staab MD, MS

**Objectives:** To demonstrate that (1) recent graduates of training programs in OTO-HNS are less likely to recommend/perform Stapedectomy than more senior otolaryngologists. (2) When surgery is recommended, referral is most commonly made to an otologist/neurotologist.

**Study Design:** Survey of 500 regional otolaryngologists pertaining to their treatment of patients with hearing loss secondary to otosclerosis.

**Results:** Data were obtained from 179 general otolaryngologists treating adults and children in solo or group private practices in the Pennsylvania and New Jersey. The majority (66%) diagnosed 1 – 5 new cases/year. Ten percent of surgeons graduating in the 1970's, 25% graduating in the 1980's, 50% graduating in the 1990's, and 90% of graduates in 2000 have never performed Stapedectomy as part of their practices ( $p < 0.001$ ). Similarly, a significant number of surgeons who formerly performed stapedectomies no longer do this surgery. A trend toward greater use of hearing aids for the treatment of otosclerosis was seen in more recent graduates ( $p > 0.08$ ). When surgery was recommended, otologists/neurotologists received the majority of referrals from the practitioners surveyed.

**Conclusions:** Stapedectomy is performed and recommended less often by more recent graduates of otolaryngology training programs. Given that the majority of referrals for Stapedectomy are made to otologists/neurotologists, current fellowship requirements should likely include Stapedectomy as a component of training.

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## **Current Otologic Opinion on the Treatment of Hearing Loss in Patients with Intermittent Disequilibrium**

John W. Seibert, MS, MD, Christopher J. Danner, MD  
John L. Dornhoffer, MD, Jeffrey P. Harris, MD, PhD

**Objective:** There is a general unease in the otologic community when presented with a patient who has probable otosclerosis and symptoms of vertigo. Considering possible complications, otologists fall into one of three different camps: refuse to perform stapes surgery on anyone who has symptoms of vertigo, proceed with surgery only if certain criteria are met (normal ENG, quiescent period free of vertigo, etc), or perform stapedotomy regardless of vertigo symptoms.

**Study Design:** Survey

**Methods:** Our survey mailed in the spring of 2005 when out to 250 members of the American Otologic Society. A one sentence case study was presented to the respondents which described a 45 year old with history of balance problems and hearing loss suggestive otosclerosis. Participants were given the option of immediately proceeding with stapedectomy/stapedotomy or further management and work up.

**Results:** Sixteen (22%) of respondents said that they would proceed with stapedectomy after assuring that the presence of a balance disorder in the study patient was not due to a retrocochlear cause. Forty-nine (69%) recommended further work up or treatment that could included a diuretic trial, electrocochleography, trial of fluoride, electronystagmography, and/or computed tomography scan. Looking at overall initial management, 31 (44%) would consider diuretics an initial management. Twenty-two (31%) agreed with using some form of fluoride prior to intervention. Thirty-one (43%) chose electronystagmography. Twenty (28%) choose to perform electrocochleography.

**Conclusions:** Although opinions will differ, current standards of practice can be brought forth from these series of questions.

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## **Magnetic Properties of Middle Ear and Stapes Implants In a 9.4 Tesla Magnetic Resonance Field**

Michael H. Fritsch, MD  
Jason J. Gutt, MD, Ilke Naumann, MD

**Hypothesis:** A 9.4 Tesla (T) Magnetic Resonance (MR) field may cause motion displacements of ME and stapes implants not previously seen with 1.5 and 3.0 T magnets.

**Background:** Publications have described the safety limitations of some otologic implants in 1.5, 3.0, and 4.7 T fields and resulted in several company-wide patient safety related recalls. To date, no studies have been reported for otologic implants in a 9.4 T MR field, nor have comparisons been made with 1.5, 3.0, or 4.7 T field strengths.

Methods: 23 ME and stapes prostheses were selected and exposed to 1.5, 3.0, and 9.4 T MR fields in vitro within Petri dishes and 8 of the 23 implants were further studied ex-corpore in temporal bones (TB). IRB approved.

Results: 8 prostheses grossly displaced in Petri dishes at 9.4 T, 3 of which had not previously moved in either the 1.5 or 3.0 T magnets. The 8 TB preparations showed no avulsions or motion indicators after exposures at 9.4 T.

Conclusions: ME and stapes implants can move dramatically in Petri dishes at 9.4 T, more so than at 1.5 and 3.0 T. Finding no avulsions in the TB group strongly suggests that the surgical means used to fixate ME implants to ME structures successfully overcomes the magnetic moment produced at 9.4 T. MR usage is not contraindicated by this study's findings.

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## **Panel: Challenges in Stapes Surgery**

Chair: Michael J. McKenna MD

Sujana S. Chandrasekhar, MD  
Antonio De la Cruz MD  
Joseph B. Nadol MD  
D. Bradley Welling MD

Our ability to surgically restore hearing in otosclerosis calls for an understanding of the underlying pathology, anatomic variations that can hamper access, and technical aspects of footplate and prosthesis management. This panel will examine challenges to successful hearing results after stapes surgery through case presentations. Intraoperative findings and surgical options will be discussed, and the AOS audience will participate through response feedback.

Session: Advances in the Assessment and Management of Vestibular Disorders.

### **Significance of Bilateral Caloric Loss**

Neel Varma, MD; Brian W. Blakley, MD, PhD FRCSC

**Objective:** To study the presentation and prognosis of persons with bilaterally reduced caloric responses.

**Study Design:** Retrospective database review.

**Setting:** Tertiary Referral Center

**Methods:** Data from the charts was obtained for forty-two patients who met the criteria for bilaterally reduced caloric response on ENG from 1999-2002. These patients were then followed by means of a questionnaire in 2004.

**Intervention:** Neither rehabilitation or antidepressant therapy was effective.

**Results:** Twenty-two patients presented essentially with spinning vertigo, 1 with mild turning, 21 with imbalance and 1 with pre-syncope (3 patients reported more than one type of symptom). Contrary to expectations, 32 (76%) patients reported that their dizziness was episodic or occurred in spells rather than constant dizziness. Only 50% of the patients reported some improvement that occurred after 11 +/- 12 (mean +/- s.d.) months. The patients were seen 40 +/- 105 months after onset of symptoms. Differences in the improvement rate for men vs. women or the presenting symptoms were not statistically significant. Neither rehabilitation treatment, antidepressants nor other treatment was associated with improvement different from untreated cases.

Conclusion: Bilateral caloric loss is usually associated with prolonged impairment and is refractory to treatment. It is a significant cause of disability that otolaryngologists are in the most appropriate position to evaluate.

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## **Semicircular Canal Function Before and After Surgery For Superior Canal Dehiscence**

**John P. Carey, MD, Americo A. Migliaccio, PhD  
Lloyd B. Minor, MD**

**Objective:** To characterize semicircular canal function before and after surgery for superior semicircular canal dehiscence syndrome.

**Study Design:** Retrospective case review

**Setting:** Tertiary referral center

**Patients:** Patients with superior semicircular canal dehiscence (SCD) syndrome documented by history, sound- or pressure-evoked eye movements, vestibular evoked myogenic potential testing, and high-resolution multiplanar CT scans.

**Intervention:** Nine subjects with SCD had quantitative measurements of their angular vestibulo-ocular reflexes (AVOR) in response to rapid rotary head thrusts measured by magnetic search coil technique before and after middle fossa approach and repair of the dehiscence. In 7 subjects the dehiscence was plugged, and in 2 it was resurfaced.

**Main Outcome Measures:** AVOR gains (eye velocity/head velocity) for excitation of each of the semicircular canals

**Results:** Vertigo resulting from pressure or loud sounds resolved in each case. Before surgery AVOR gains were normal (horizontal canals: 0.74 to 1.06; vertical canals: 0.64 to 0.96, 95% CIs) for all semicircular canals except for the affected superior canals (SCs) of 2 subjects in whom the dehiscence's were = 5 mm long. AVOR gains decreased by 32% for the operated SCs (from  $0.73 \pm 0.17$  pre-surgery to  $0.50 \pm 0.19$  post-surgery,  $p = 0.01$ ). Gains decreased by the same proportion after resurfacing as after plugging. AVOR gains did not change for any of the other canals.

**Conclusions:** Middle fossa craniotomy and repair of SCD reduces the function of the operated SC whether it is plugged or resurfaced. The surgery does not typically affect the function of the other semicircular canals.

Acknowledgments: NIDCD K23DC00196, R01DC05040

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## **Transmastoid-Translabyrinthine Labyrinthectomy versus Translabyrinthine Vestibular Nerve Section: Patient Survey of Postoperative Vertigo and Imbalance**

Karen B. Teufert MD, Antonio De la Cruz MD  
Karen I. Berliner PhD

**Objectives:** Determine frequencies and the difference in postoperative outcomes between labyrinthectomy with and without vestibular nerve section, including characteristics of postsurgical symptoms, and time course for improvement.

**Study Design:** Database review and patient survey.

**Setting:** Tertiary referral neurotologic private practice.

**Patients:** 292 translabyrinthine vestibular nerve sections (TLVNS) and 97 transmastoid labyrinthectomies for treatment of vertigo.

**Intervention:** Surgery for vertigo.

**Main Outcome Measures:** All patients undergoing TLVNS and transmastoid labyrinthectomy from 1974 through 2004 were identified. Frequency and relative prevalence of procedure was determined by decade. A mail questionnaire assessed frequency, severity and disability for vertigo and imbalance before and after surgery as well as the time course of improvements.

**Results:** Transmastoid labyrinthectomy comprised 2.7% of all surgeries for vertigo and TLVNS 8.0%. Through the decades, use of TLVNS decreased while use of labyrinthectomy increased. In preliminary analyses, no differences between groups achieved statistical significance. However, the AAO-HNS functional disability rating showed improvement for all TLVNS subjects but was not improved in 33.3% of the labyrinthectomy group. The labyrinthectomy group was more likely to rate current imbalance as extremely or quite severe (23.1% vs. 9.1%) and to rate imbalance as interfering more often (38.5% vs. 20.0%) than the TLVNS group. Class A vertigo treatment results were obtained in 84.6% and 81.8% of the two groups, respectively.

**Conclusions:** Both transmastoid labyrinthectomy and TLVNS provide complete control of vertigo spells in the majority (>80%) of patients. However, patients undergoing TLVNS were more likely to show improvement in functional disability and less likely to rate their current imbalance as extremely or quite severe or to have imbalance interfere in daily activities.

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## **Survey of Meniere's Disease in a Subspecialty Referral Practice**

**Lawrence M. Simon, MD, Jeffrey T. Vrabec, MD  
Newton J. Coker, MD**

**Objectives:** We sought to define the prevalence of definite Meniere's disease (MD) in a tertiary care otology practice among patients presenting with Meniere's like symptoms.

**Study Design:** Retrospective case review.

**Setting:** Academic tertiary referral practice.

**Patients:** Patient visits using ICD-9 codes for Meniere's disease (386.0-386.04) were retrospectively reviewed. The 1995 AAO-HNS Committee on Hearing and Equilibrium guidelines were used for classification.

**Main Outcome Measures:** Data extracted included duration of disease, gender, laterality, comorbid conditions, and treatment administered.

**Results:** The prevalence of definite MD in this population was 62%. The next largest classification was cochlear hydrops (18%), consisting of patients with only cochlear symptoms. Those classified as probable are often reclassified as definite with extended follow-up. Of those with definite MD, the mean duration of disease at presentation was 4 years, 54% were female, 17% had bilateral disease, and 30% required surgical management for vertigo. Coexisting autoimmune disease and migraine were less common than in other reports. A treatment algorithm for medical and surgical management is presented.

**Conclusions:** The AAO-HNS guidelines produce stratification of cases according to certainty of diagnosis and severity of disease. Individuals presenting with typical symptoms frequently lack all of the criteria necessary to assign classification to the definite category. Application of consistent diagnostic criteria is essential for epidemiological, genetic, or outcomes studies of Meniere's disease.

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Discussion 5-20-06 4:54pm

Sujana Chandrasekhar MD

Thank you all of the presenters of the preceding papers. They are now open for discussion. Just a little housekeeping, please don't walk away with your voting machines. Even though this is Chicago, you have to leave it here. The members will gather here at the conclusion for the group photograph.

Joseph Nadol                      Boston, MA

Thank you and this question if for Dr. Tiefert. I really appreciated the presentation. Two questions—first, how do you know that the caloric function was normal in the opposite ear in the two groups? Second, even with selective vestibular nerve sectioning done with the hope of preserving hearing, there have

been examples of apparent regeneration and restoration of caloric function. Can you tell us what you did to ensure complete sectioning to absolutely prevent regeneration of vestibular fibers?

Karen Tiefert                      Los Angeles, CA

We did not look at the patient's charts but only sent them questionnaires. We don't have any information on caloric function. We definitely plan to go back and review the charts to find out why we are noting these differences in imbalance and vertigo. We will look for predictive factors. Dr. De La Cruz, do you have added comments regarding the surgical technique? A preganglionic section of the nerve is done in the translab nerve sectioning which means the Scarpa's ganglia are also included. This may account for our findings. As long as we can keep the cochlear nerve intact, there is always a possibility of a future CI in that ear.

Steve Telian                      Ann Arbor, MI

Dr. Carey, I have great admiration for your group and the vigor with which you look at these problems and it is very informative for us all. Can you tell why the angular vestibular-ocular gain in the superior canal doesn't go to zero when the canal is plugged?

John Carey                      Baltimore, MD

Thank you. There are probably a couple of reasons. One is that this is mechanical and not neurosensory so we are probably not killing the hair cells, we are not killing the afferents on that side. They can still respond and although we plug the canal and hydrodynamically eliminate endolymph motion in that thin portion of the canal, point of fact is that with rapid head movements with very high acceleration does cause movement of the cupola which means there is some high frequency information getting through. Second is the inhibitory contribution from the contralateral posterior canal which is still working. But these gain values are much higher than what we see after a labyrinthectomy or nerve section and they are about comparable to what we see after low doses of gentamycin.

Jack Wazen                      Sarasota, FL

This question is for Dr. Tiefert. How did you divide the two groups between translab and translab vestibular nerve sectioning? Was one group sicker than the other and could that have contributed to the differences?

Karen Tiefert                      Los Angeles, CA

Do you mean in terms of the number of patients?

Jack Wazen                      Sarasota, FL

Yes, who got the labyrinthectomy and who got the nerve section?

Karen Tuefert Los Angeles, CA

You mean in terms of indication for surgery.

Jack Wazen Sarasota, FL

Right!

Karen Tuefert Los Angeles, CA

When we first selected them we went back to 1990 and pulled the data base and looked at the ones that underwent each procedure. We had almost the same number and we sent questionnaires to all 135. In terms of indication of who had each procedure, I will defer to Dr. De La Cruz and ask him to tell you the indications for each procedure. Older patients would be offered a labyrinthectomy in order to prevent serious complications such as CSF leak or meningitis. This also applied to those with serious medical conditions-we tended to do the least invasive procedure.

Antonio De La Cruz Los Angeles, CA

Yes, I think that the main element was age. As you will see in the paper, the translab nerve section patients tended to be younger. There were no other specific criteria.

Sujana Chandrasekhar New York, NY

We have time for two more questions. Please remember to turn in your key pads and for all members to stay for the group photograph. Also, I request that the nominating committee remain for a meeting immediately after the photo session.

Hamid Djalilian Orange, CA

Dr. Fritsch, I enjoyed your presentation. How long was the exposure time? As you know as we go up in Tesla your image acquisition time has to increase because of the signal to noise ratio.

Michael Fritch Indianapolis, IN

Each temporal bone implanted prosthesis was placed into the magnet for one minute and then withdrawn, turned 90 degrees and then put back in for another minute until we had covered all three axis. The Petri dish went in 15 secs. later and then came out. They either moved or they did not immediately in the Petri dish. We noted that they would slide to the end of the Petri dish as they were going in.

Owen Black Portland, OR

For John Carey, excellent presentation as usual. Could you summarize your results for VEMP threshold changes postoperatively?

John Carey

Baltimore, MD

Sorry I can not. We have not systematically been doing them postoperatively but we have, in some cases, we have seen the thresholds normalize in the few patients we have done this test.

Moderator

Thank you all for attending.

Sunday May 21, 2006

Session: Advances in Prosthetic Approaches to Hearing Loss

### **Results from the Nucleus® Freedom Clinical Trial**

Thomas J. Balkany, MD, Christine Menapace, MS, CCC-A  
Annelle V. Hodges, PhD, CCC-A, Stacy L. Payne, AuD  
Linda A. Hazard, MS, CCC-A, Fred F. Telischi, MEE, MD

**Objective:** To evaluate the effects of stimulation rate and input processing on performance using measures of speech perception and subjective preference.

**Study Design:** Randomized, prospective, single-blind clinical study.

**Setting:** 14 academic and private tertiary referral centers in the U.S. and Canada.

**Patients:** 73 severely to profoundly hearing impaired adults.

**Interventions:** Subjects received a Nucleus Freedom cochlear implant (CI) and were randomly programmed at two different sets of rate: standard ACE (500Hz, 900Hz, 1200Hz) and a higher rate ACE RE (1800Hz, 2400Hz, 3500Hz) using an ABAB study design.. Subjects were blinded to the order and the stimulation rates they received as well as three input processing strategies they ranked in quiet and noise.

**Main Outcome Measures:** Auditory function was evaluated using the Hearing in Noise Test (HINT) sentences administered in quiet and in noise, CUNY Sentences and the Consonant Nucleus Consonant (CNC) monosyllabic words/phonemes administered in quiet. Subjective outcomes were evaluated using the Abbreviated Profile of Hearing Aid Benefit (APHAB).

**Results:** Data will be reported on sixty subjects who completed their six-month data point. Preliminary outcomes suggest that speech perception scores may not improve at higher rates and most subjects expressed a preference for moderate rates of stimulation. Input processing preferences vary with stimulation rate and in noise. Overall performance is superior to that achieved with the prior generation device by the same manufacturer.

**Conclusions:** These data suggest that higher stimulation rates do not necessarily correlate with improved performance or patient satisfaction. No single input processing strategy is ideal for patients in all listening conditions.

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***Current Steering and Spectral Resolution in the  
Advanced Bionics Cochlear Implant***

Jill B. Firszt, PhD, Dawn B. Koch, PhD  
Mark Downing, PhD, Leonid Litvak, PhD

**Objective:** The number of spectral channels is the number of discriminable pitches that can be heard as current is delivered to distinct locations along the cochlea. This study aimed to determine whether CII and HiRes 90K implant users could hear additional spectral channels using current steering. Current steering involves simultaneous delivery of current to adjacent electrodes so that stimulation can be “steered” to sites between the contacts by varying the proportion of current delivered to each electrode of a pair. Current steering may serve to increase the number of spectral channels beyond the number of fixed electrode contacts.

**Setting:** Fifteen tertiary care centers in the United States and Canada.

**Subjects:** Postlinguistically deafened adults who use the Advanced Bionics CII or HiRes 90K cochlear implants.

**Study Design/Outcome Measures:** After loudness balancing and pitch ranking three electrode pairs (2-3, 8-9, 13-14), subjects identified the electrode with the higher pitch while current was varied proportionally between electrodes in each pair. The proportion yielding the smallest discriminable change in pitch was defined as the spectral resolution.

**Results:** Data from 90 ears indicate that the number of spectral channels averages 4.0 for the basal electrode pair, 6.3 for the mid-array pair, and 5.4 for the apical pair. Assuming the number of channels on these three electrode pairs are representative of the entire array, the total potential number of spectral channels can be calculated and ranges from 7 to 451.

**Conclusions:** These results indicate that additional spectral resolution can be created using current steering.

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## ***Hybrid Cochlear Implantation—Preliminary Clinical Results***

Charles M. Luetje, MD, Bradley S. Thedinger, M.D.  
Lisa R. Buckler, M.A., CCC-A, Kristen L. Dawson, M.A., CCC-A  
Kristin L. Lisbona, M.A., CCC-A

**Objective:** To substantiate the benefits of Hybrid cochlear implantation in patients with residual low frequency hearing.

**Study Design:** Prospective study of patients within a manufacturer sponsored clinical trial.  
**Setting:** Independent 501(c)(3) referral center for cochlear implantation.

**Patients:** Patients include those who meet the candidacy criteria for hybrid cochlear implantation. Candidacy is defined as those who have a profound hearing loss by 1500Hz and above, who also score up to 60% on CNC words in the aided condition. As of the submission of this abstract 10 patients are implanted with three more scheduled for surgery. **Intervention:** Pre-operative evaluation, cochlear implantation with a Cochlear Americas Hybrid cochlear implant, subsequent programming and diagnostic testing.

**Main Outcome Measures:** Each patient is monitored for preservation of residual hearing and to determine the benefits of high frequency electrical stimulation from the hybrid cochlear implant as measured by speech discrimination testing at quarterly intervals per protocol requirement. **Results:** Preliminary data on the first six subjects who have completed at least 9 months of testing at the time of submission show a range of scores. Testing includes CNC monosyllabic word testing, BKB-SIN (sentence is noise) and conventional audiometry to confirm preservation of residual hearing. Five of six patients have maintained their residual hearing and patients show a range of scores of up to 83% on CNC words when tested in the “hybrid” mode (cochlear implant + ipsilateral hearing aid).

**Conclusions:** Residual hearing was preserved in all subjects. However, one patient has bilateral progressive hearing loss that is considered unrelated to the surgical procedure. Audiometric results confirm simultaneous stimulation of low pitches with the hearing aid and high pitches with the cochlear implant give the patient adequate aided gain across the frequency range. Speech testing reveals increased discrimination over pre-op scores and better discrimination in noise.

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## **Outcomes in Speech Perception Following Left and Right-Sided Cochlear Implantation**

**Luc G. Morris, MD, Pavan S. Mallur, MD  
J. Thomas Roland, Jr., MD, Susan B. Waltzman, PhD  
Anil K. Lalwani, MD**

**Objective:** Emerging evidence in auditory neuroscience suggests that central auditory pathways process speech asymmetrically. In concert with left cortical specialization for speech, a “right ear advantage” in speech perception has been identified. The purpose of this study is to determine if this central asymmetry in speech processing has implications for selecting the ear for cochlear implantation.

**Study Design:** Retrospective chart review

**Setting:** Academic university medical center

**Patients:** Post-lingually deafened adults with bilateral severe-to-profound sensorineural hearing loss (n=101).

**Intervention:** Cochlear implantation with the Nucleus Contour device.

**Main Outcome Measurements:** Patients were divided into four groups: right handed/right ear implanted, right handed/left ear implanted, left handed/right ear implanted, and left handed/left ear implanted. Postoperative pure-tone audiograms and scores on speech perception tests (HINT, CUNY quiet and in noise, CNC words and phonemes) at one year were compared using one-way analysis of variance.

**Results:** The four groups were equally matched in terms of age, duration of hearing loss, duration of hearing aid use, percentage implanted in the better hearing ear, and preoperative audiologic testing. Postoperatively, there were no differences between groups in hearing outcome and improvement on speech perception tests.

**Conclusion:** Despite central asymmetry in speech processing, our data does not support a “right ear advantage” in speech perception outcome with cochlear implantation. Therefore, among the many factors in choosing the ear for cochlear implantation, central asymmetry in speech processing is not likely to be a significant consideration.

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***Morphological Changes Following Partial Cochlear Implantation in the Animal Model***

Arthur M. Castilho, MD, Ricardo F. Bento, MD, PhD  
Raimar Weber, MD

**Objectives:** The objective of this study was to describe the histology and the audiological findings created by the cochlear implant electrode array when inserted at the basal turn, using an animal model (guinea pig), and correlate these findings with previous reports.

**Material and Methods:** Thirty female young guinea pigs were used for this investigation. They were divided in two groups. Fifteen animals had the round window opened with no implantation (control) and fifteen animals had the round window opened and inserted with a 4mm x 0,5mm silicone tube. Auditory brainstem response (tone burst) was performed prior the procedure and 3 months after, when the animals were sacrificed. The organ of Corti was removed from the cochlea second turn for analysis with immunofluorescence TRITC-phalloidin reaction.

**Results:** The damage caused by the silicone tube insertion on the base turn of the cochlea was greater (66,7%) when compared with the control group (33,3%)  $p=0,25$ . The hair cell cilia was preserved in 40% of the animals at control group against 6,7% of implanted animals ( $p=0,31$ ). The ABR was absent in 93,7% of implanted group and 60% of the control group ( $p=0,31$ ).

**Conclusion:** The damage caused by the silicone tube can be compared with the damage caused by the cochlear implant array. When the basal turn of the cochlea is implanted the damage extends to the second turn and is greater when compared with group that had the cochlea opened but not implanted, which is important for hearing preservation purposes.

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## **Intracranial Complications Following Cochlear Implantation**

Kelley M. Dodson, MD, Patrick G. Maiberger, BA  
Aristides Sismanis, MD

**Objective:** To describe intracranial complications following cochlear implantation in the pediatric and adult population.

**Study Design:** Retrospective chart review.

**Patients and Setting:** A chart review of the intracranial complications and their management in 322 patients undergoing cochlear implantation at a tertiary referral center was undertaken.

**Main Outcome Measures:** Variables including age, gender, implant manufacturer, etiology of deafness, intraoperative findings, and intracranial complications were collected and analyzed.

**Results:** There were 122 Nucleus-22 devices, 50 Nucleus-24 devices, 106 Med-EI devices, and 32 Advanced Bionic Corporation devices in 141 adults and 181 children. There was a 7.8% overall complication rate, with the majority (64%) being related to device failure. There were 3 intracranial complications (<1%), 2 in elderly individuals and 1 in a child. Two minor dural defects with CSF leak at the site of the receiver/stimulator recess in Med-EI devices were repaired intraoperatively with temporalis fascia. One elderly patient experienced an acute extensive subdural hematoma after Nucleus-24 implantation, which was treated successfully with immediate evacuation.

**Conclusions:** Intracranial complication rates associated with cochlear implantation are low although potentially very serious. Surgeons should be aware of intracranial complications, especially in older individuals, and take immediate appropriate action.

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## **Anatomical Vibration Considerations in Fully Implantable Microphones**

Herman A. Jenkins, MD, James Kasic, MS  
Nicholas Pergola, MS

**Hypothesis:** The goal of this study was to measure tissue vibration as it pertains to totally implantable microphones.

**Background:** Totally Implantable Hearing Devices have been desired by the hard of hearing community for some time. However, an implanted microphone must be capable of receiving acoustic signals in the presence of undesired vibration signals. In order to design an effective microphone, the level of tissue vibrations originating from anatomical sources and the implanted transducer must be understood.

**Settings:** University Temporal bone laboratory and Otologics LLC engineering laboratory

**Methods:** Using a Laser Doppler Vibrometer, microphone, and an accelerometer, tissue vibrations were measured under the following conditions; control subjects (N=6); semi implantable hearing device wearer (N=1); and cadavers implanted with a transducer (N=4).

**Results:** Mastoid vibration levels measured on a patient are equivalent to that in cadavers. Vibration levels do not vary significantly with respect to location on the skull next to the pinna. Anatomical noise vibrations are 20-25 dB greater in soft tissue for frequencies below 1000 Hz than on the skull whereas vibrations due to implanted transducers are 20-25 dB greater on the skull than in soft tissue inferior to the mastoid. Chewing vibrations are 10-15 dB greater than vocalization on the mastoid.

**Conclusion:** The cadaver is an appropriate model for transducer skull vibration studies. The greatest anatomical vibrations that an implanted microphone must overcome are due to vocalization in the soft tissue inferior to the mastoid and chewing vibrations on the mastoid. If the implantable microphone is placed on the skull near the pinna it makes little difference where it is placed.

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**Bone-Anchored Hearing Aids: Incidence and  
*Management of Postoperative Complications***

J. Walter Kutz, Jr., MD, John W. House, MD

Objectives: Determine the incidence of complications associated with implantation of the bone-anchored hearing aid (BAHA) and the management of these complications.

Study design: Retrospective case review.

Setting: Tertiary referral center.

Patients: 124 consecutive patients between 10/25/01 and 6/29/05 underwent implantation of a BAHA. The majority of patients had unilateral profound sensorineural hearing loss after removal of an acoustic neuroma (59.7%) with the next most common etiology of deafness secondary to sudden sensorineural hearing loss (14.5%).

Intervention(s): Implantation of a BAHA.

Main Outcome Measure(s): Incidence of complications occurring after implantation of a BAHA.

Results: There were no intraoperative complications. Significant postoperative complications requiring intervention occurred in 18 (14.5%) patients. Problems with loosening of the titanium abutment occurred in 7 patients, with 3 requiring revision surgery. 1 patient elected not to have the device reimplanted. 5 patients developed a local wound infection requiring oral antibiotics with 1 patients requiring debridement in the operating room. Skin overgrowth of the abutment occurred in 4 patients, and all 4 patients required revision surgery. 1 patient had postoperative bleeding that was successfully treated with a pressure dressing and 1 patient developed partial flap necrosis.

Conclusions: Significant complications are uncommon after implantation of a BAHA; however, these complications may require local wound care, antibiotics, or revision surgery.

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Basic Science Seminar

Session: Audition: Peripheral and Central Mechanisms.

## How we hear, how we listen

Bradford J. May, PhD  
*Johns Hopkins University*

Beverly Wright, PhD  
*Northwestern University*

Charles J. Limb, MD  
*Johns Hopkins University and NIDCD/NIH*

The auditory system separates the elemental frequency and temporal components of sound into parallel processing streams to enhance the coding of perceptual attributes such as loudness, pitch, and timing. These processing streams enable a listener to establish the meaning of complex sounds such as speech and music. Sensorineural hearing loss not only lessens our sensitivity to the presence of sound, it impedes our ability to resolve the frequency changes that convey this crucial information. Consequently, an impaired listener cannot be restored to normal function by simply making sounds louder. Our presentation will begin with a review of frequency coding and auditory cortical activation patterns in the normal auditory system and discuss how these processes are altered by sensorineural hearing loss. We then will evaluate the strengths and weaknesses of current assistive devices, such as cochlear implants, from the perspective of frequency coding. Finally, we will report recent data showing the influence of training on the perception of frequency information in humans with normal hearing, and relate those results to possible therapeutic training regimens to improve the benefits of hearing aids in impaired listeners.

0936 Discussion                      Moderator Herman Jenkins, MD                      Denver, CO

The previous eight papers and panel discussion are now open for discussion. Please state your full name and current location. Thank you.

John Niparko                      Baltimore, MD

I would like to congratulate the panel on a very elegant, very enlightening set of presentations, absolutely marvelous. Dr. May, I would like to ask a question if I may. You mentioned near the end of your talk the need to restore the spectral content within vowels and other speech sounds in order to compensate for the lack of filtering activity. Could you give us a little more of a practical sense for exactly what that involves? Is it simply amplification within a very narrow frequency range or what other sorts of strategies can be adopted?

Bradford May                      Baltimore, MD

The way that we have approached this physiologically is really just sort of a simple approximation where we can take the stimulus where we know what the critical features are. There is a steady state stimulus like a vowel and we can boost those spectral features to make them a bit more represented in the auditory

nerve response. Basically this approach seems to work but there is a lot of limitations to this approach because these features really are not steady state, they are often relative across speakers so it is a fairly complex task and, in fact, even under these simple conditions I think we found that we just did not have absolute freedom in the amplification approaches that we are using because of the recruitment affects that we are doing.

John Niparko

Baltimore, MD

Dr. Wright, would you care to speculate on the ability of tone training generalized to speech and language tasks? This has been quite controversial in the past decade or so. Some of these training paradigms are available commercially with touted benefits for speech and language. I am interested in your ideas of how that generalizes.

Beverly Wright

Chicago, IL

I know there is a lot of controversy about such things. My sense is that there probably is not much direct generalization from, say, pure tone training into speech cases. One reason that I think is because when we train on pure tones at 1000 hertz, we don't even get learning at 4000 hertz so how will this help in speech itself? On the other hand and as kind of a defense perhaps on both sides, we hope we can establish what the underlying basis for learning is by using these very simple sounds. What is it that triggers learning and what it is that stops it? One other short answer is that investigators working on speech learning in foreign languages find that timing tasks are much easier to train. For example, voice onset time. Differences in different languages are easy to train and they generalize very well across different speech signals. On the other hand, those speech signals in which the main differences of frequency difference are harder to train. Actually, the kind of learning that we see although you could not see it today is that kind of duration training is easier to do, more robust and has a very strong learning curve and generalizes in a particular way. The frequency learning has a much shallower slope and it has a different characteristic that has some of the implications that some of the things that we are looking at really are affecting how speech is learned, whether or not it transfers form one to the other is a different question.

David Eisenman

Baltimore, MD

Dr. Wright, Have you looked at the durability or stability of your training results? Let's say you brought people back two weeks later after not having done anything.

Beverly Wright

Chicago, IL

Yes, fairly often we bring them back a month after they have finished and of course we are assuming they are practicing at home and they are always exactly where they were when they left. We have got one case where we brought one

person in one year later and one 1.5 years later and they were literally exactly where they left off.

Jeffery Kim                      Washington, DC

I have a question for Dr. Limb. Really enjoyed your presentation! You mentioned that there was a subcortical stimulation with the stimuli. How do you know what their reaction to stimulation of the saccule in affecting the vestibular system in the brainstem and cerebellum? Do you see subcortical stimulation in patients with cochlear implants?

Charles Limb                      Baltimore, MD

In response to the first question, we know that it is not a saccular vestibular response because of the fact the very regular rhythm, same sounds are just temporally ordered and did not stimulate the cerebellum whereas if you scatter it over time, it did. So that is a cognitive phenomenon and not a basic phenomenon at the level of the saccule in the periphery. So we are pretty confident it is really related to the broad spectral temporal characteristics of the stimulus. In terms of the CI subjects, we did have in response to the rhythm condition some maturation of the cerebellum but the difference was that we actually had them perform a task afterwards. They had to duplicate the rhythm as a way of confirming that they heard it and so there is a possible interpretation that they were priming to get ready to duplicate it so I don't consider it as pure as this one because in this case there was no task, all they did was listen and they had no instructions of any sort. There were basically just closing their eyes and listening to these rhythms.

Richard Wiet                      Chicago, IL

Can you tell me, Dr. Limb, if the resolution on a functional MRI can tell the difference in a CI patient when a sound stimulus is given about the spiral ganglion since this could possibly be used to predict the results of a cochlear implant patient? Or is it just a broad indiscreet area that you just have an estimate about?

Charles Limb                      Baltimore, MD

First of all, you can not use fMRI on a patient with a CI because it is a 3 Tesla magnet so it would only be applicable pre-implant. The studies I am showing are all PET studies which are compatible with the CI. The difference in terms of resolution though is that PET scans have far poorer anatomic resolution than fMRI and so we are not able to see spiral ganglia in the periphery. These functional studies rely on changes in blood flow states and are not static images. We would have to see a change from a resting state to an experimental state in order to see a difference. In something like a Vestibular Schwannoma perhaps if you studied it at one point in time and then a month later you could see a change in blood flow but if you tried to study it from one minute to the next you would not likely see any differences.



Richard Wiet                      Chicago, IL

I think the point was if you could conceive of a way to stimulate the spiral ganglion functionally you might have the answer to who is a better candidate for a CI. I think there is a way to do that but it would have to be done with some type of non-magnetic stimulation. You have not done this?

Your Panel presentations were brilliant and I really appreciate your work.

Charles Limb                      Baltimore, MD

No, we have not done that yet. Thank you for your comments.

Unidentified Speaker

Dr. Limb there is a big push for children that have auditory neuropathy to receive cochlear implants for the improvement that is evident in their function. Have you done any of this work on children that have been diagnosed with auditory neuropathy and can you extrapolate what you have done with CI patients and these kids and what your thoughts are on this topic?

Charles Limb                      Baltimore, MD

Certainly! Unfortunately we have not done any of this work in children because we are doing this in PET scanning. Each run of PET scanning requires a dosage of radiation so typically we deliver 200 millicuries of radioactive water to the subjects and so there is dose limitations in children and we just can not get that many data sets in children. So I would not want to speculate. We have only looked at postlingually deafened adults with implants for music studies.

John Carey                      Baltimore, MD

Wonderful panel! Dr. Wright, how do you know that your findings generalize to the hearing impaired individual?

Beverly Wright                      Chicago, IL

We don't. My sense is that the brain of a hearing impaired person has the same basic principles in it as a normal hearing person. It may change over time. The idea would be the earlier the intervention the better but I am really working on the basis that the rules that we establish will actually apply to a wide variety of patients.

John House                      Los Angeles, CA

A question for the whole panel! Why do we see patients with a 40-50 dB hearing loss who have 100% speech discrimination and we see another patient with the same pure tone levels who have 40% or 30% discrimination? What is happening within the cochlear or the auditory nerve or the brain?

Bradford May      Baltimore, MD

I think I will give an answer from the physiological hearing perspective. I would say that there are a number of ways that the initial stages of processing can become disruptive that are not really reflected in pure tone thresholds. We are doing studies of age related hearing loss in mouse models of hearing and we can show that there is an orderly progression of hearing loss with the loss of sensitivity really being sort of the last stages of that progression. You can see changes in the fidelity of timing much earlier in the process and intermediate to that you can see a loss of frequency sensitivity. So I would say to some extent those individual variations can be explained by how we hear but my own prejudice is that I think a lot of this has to do with the cognitive abilities of the listeners as well. I think Dr. Wright would probably provide a better answer for that part of the question.

Beverly Wright      Chicago, IL

There are mysteries and I am really struck with the mysteries of the CI. The CI, as far as I understand, is not changing what the response is but over time these people become much better at being able to understand speech. The people I know who have gotten implants actually described improvement intuitively that is the same one I have shown here. At first, they said they were listening to the sounds and they really could not get it and then they started really trying to pay attention and to view it as though they could understand it. So they had this kind of different mind set that the attention is different and over time they became much better at speech. What this suggests to me is that there is some type of peripheral limit that is similar to what Brad talked about. I really think that there is a central limit also and that such people might be able to benefit considerably with the machinery they already have by having their brains being trained essentially to listen to speech in a different way that they have before.

Unidentified Questioner

Dr. Kutz, there have been reports of doing BAHA's and vestibular schwannoma resections in the same stage. In carefully, chosen cases we have done this. Are you doing this in one stage? Please comment.

Walter Kutz      Los Angeles, CA

About 40-50 patients have actually been implanted with the BAHA at the time of the tumor surgery. We do it as a one stage procedure. There is no change in our technique. We are careful not to elevate towards the auricle during the incision. The processor and the fixture may end up a little more posterior but not by much. We did have a patient not involved in this study that did have CSF leaking

through the BAHA site. We closed it with Dermabond and this took care of the problem. We do everything we can not to connect the tumor approach area with the BAHA area. The patients do well.

Ed Monsell                      Detroit, MI

Dr. Dodson, I enjoyed your paper very much. I would like to remind everyone that Paget's disease is a very highly vascular lesion and that it can be treated very well with bisphosphates and that will quiet down the hyperactivity. The bone is abnormal when seen is the setting of a severe enough hearing loss to warrant a CI. The bone is highly deformed and full of venous channels. This may explain why this patient had a subdural hematoma.

Moderator

I would like to thank the speakers and the panelists for their great talks this morning. Everyone was right on time. We now have a 30 minute break and I encourage everyone to visit the exhibitors and be back at 1015.

## **Advances In Imaging**

**Moderators:** Lloyd B. Minor, MD  
Samuel H. Selesnick, MD

### **3-D Virtual Model of the Human Temporal Bone: A Stand-Alone, Down-Loadable Teaching Tool**

Saamil N. Merchant, MD, Haobing Wang MA  
Clarinda Northrop BS, Barbara Burgess BS  
M. Charles Liberman PhD

**Objective:** To develop a 3-dimensional (3-D) virtual model of a normal human temporal bone based on serial histological sections.

**Background:** The 3-D anatomy of the human temporal bone is complex, and learning it is a challenge for students in basic science and in clinical medicine.

**Methods and Results:** Every fifth histological section from a 14 year old male was digitized and imported into a general purpose 3-D rendering and analysis software package called Amira (version 3.1). The sections were aligned, and anatomical structures of interest were segmented. The 3-D model is a surface rendering of these structures of interest, which currently includes the bone and air spaces of the temporal bone, the perilymph and endolymph spaces, the sensory epithelia of the cochlear and vestibular labyrinths, the ossicles and tympanic membrane; the middle-ear muscles, the carotid artery, and the cochlear, vestibular and facial nerves. For each structure, the surface transparency can be individually controlled, thereby revealing the 3-D relations between surface landmarks and underlying structures. The 3-D surface model can also be "sliced open" at any section, and the appropriate raw histological image superimposed on the cleavage plane.

Conclusions: This model is a powerful teaching tool for learning the complex anatomy of the human temporal bone and for relating the 2-D morphology seen in a histological section to the 3-D anatomy. The model can be downloaded from our website at: <http://epl.meei.harvard.edu/~hwang/3Dviewer/3Dviewer.html>, packaged within a cross-platform freeware 3-D viewer, which allows full rotation and transparency control.

Acknowledgments: Supported by NIDCD.  
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### **3 Tesla MRI Evaluation of Meniere's Disease**

**Matthew J. Carfrae, MD, Steven M. Parnes, MD  
Adrian Holtzman, MD, Fred Eames, MD  
Allison Lupinetti, MD**

**Objective:** To determine if three teals MRI with delayed contrast imaging will have sufficient anatomic resolution to image the intracochlear fluid spaces (i.e. the scala tympani, scala media, and scala vestibuli) of the inner ear, and identify endolymphatic hydrops in vivo.

**Study Design:** Prospective, nonrandomized

**Setting:** Tertiary medical center

**Patients:** Normal subjects without previous otologic history, and patients that meet the diagnostic criteria for unilateral definite Meniere's disease are included in this study.

**Intervention:** Normal subjects underwent serial 3T MRI scanning after the administration of gadodiamide IV contrast agent. MRI Region of Interest (ROI) signal intensity was used to determine the diffusion of gadodiamide into the perilymphatic fluid spaces over time. This data was then applied to delayed contrast imaging of subjects with unilateral Meniere's disease.

**Main Outcome Measure:** Post-contrast MRI signal intensity of the intracochlear fluid spaces.

**Results:** Perilymphatic fluid contrast enhancement was noted after the administration of contrast, allowing for the differentiation of intracochlear fluid spaces on 3T MRI. The perilymph appeared to be preferentially enhanced over the endolymph.

**Conclusion:** Delayed post-contrast imaging of the inner ear with 3T MRI allows for spatial resolution and differentiation of the intracochlear fluid spaces to allow for identification of endolymphatic hydrops.

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**Sigmoid Sinus Diverticulum Causing Pulsatile Tinnitus:  
*A Novel Radiologic Finding and Proposed Surgical Treatment***

Douglas E. Mattox, MD, Kristen J. Otto, MD

**Objective:** Tinnitus represents a bothersome symptom frequently encountered in an otologic practice. Tinnitus can be the harbinger of identifiable middle or inner ear pathology, but more frequently, tinnitus stands alone as a subjective symptom with no easy treatment. When a patient complains of pulsatile tinnitus, a workup to rule out vascular pathology is indicated. We report of a novel diagnostic finding and proposed surgical correction for selected patients with pulsatile tinnitus.

**Study Design:** Retrospective case series.

**Setting:** Tertiary referral center.

**Patients:** Three patients referred for the treatment of either unilateral or bilateral pulsatile tinnitus. All patients had normal in-office otoscopic examinations, normal audiometry, and normal tympanometric evaluations. All patients underwent computed tomographic (CT) imaging and CT-angiography of the temporal bones. Scans revealed the presence of a sigmoid sinus diverticulum in either one or both ears. Auscultation of the pinna and mastoid revealed an audible bruit in most patients.

**Intervention:** Two of the three patients underwent transmastoid exploration of the sigmoid sinus and successful excision of the diverticulum and repair of the sigmoid sinus.  
**Main Outcome Measure:** Patients were evaluated clinically for presence or absence of pulsatile tinnitus following decompression surgery.

**Results:** The two patients who underwent surgical correction experienced complete resolution of tinnitus (mean follow-up 13 months). One patient declined surgical intervention.

**Conclusions:** The presence of a sigmoid sinus diverticulum represents a novel finding on CT imaging in select patients with pulsatile tinnitus. Surgical obliteration of the diverticulum has the potential to affect symptom relief for these patients.

Douglas E. Mattox, MD

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**CT and/or MRI before Pediatric Cochlear Implantation?  
Developing an Investigative Strategy**

**Keith Trimble, MB, FRCS, Adrian James, MA, FRCS(ORL-HNS)  
Susan Blaser, MD, FRCPC, Blake Papsin, MD, MSc, FRCSC**

**Objective:** To investigate and compare the utility of pre-operative magnetic resonance imaging (MRI) and high-resolution temporal bone computed tomography (HRCT) in pediatric cochlear implant candidates. To quantify the number of temporal bone anomalies in this population.

**Study Design:** Prospective, controlled.

**Setting:** Tertiary medical centre.

**Patients:** A consecutive sample of 100 pediatric patients with profound hearing loss of various etiologies. Inclusion criteria were MRI, CT and cochlear implantation.

**Intervention(s):** All patients had pre-operative imaging of the petrous temporal bone (HRCT, T2-weighted fast spin echo, axial 3D FIESTA MRI,) and brain (FLAIR MRI). Detailed measurements of the temporal bone images were performed with Picture Archiving and Communication Software (PACS) software.

**Main Outcome Measure(s):** Overall prevalence of inner ear dysplasias in this population and comparison of biometry of the structures of the inner ear to normal controls.

**Results:** Radiological abnormalities were seen in 34% and 54% of temporal bone MRI and CTs respectively. Synchronous intracranial findings were noted in 31% and incidental paranasal sinus and mastoid pathology in 9%. Cochlear nerve aplasia was seen in 2% ears and directed side of implantation. CT was more sensitive at detecting modiolar deficiency and enlarged vestibular aqueduct.

**Conclusions:** MRI and CT are complimentary in predicting cochlear anomalies. Analysis of this data enabled development of an algorithm for radiological investigation prior to pediatric cochlear implantation.

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John Niparko      Baltimore, MD

It is my pleasure to introduce our guest speaker Ric Harnsberger, MD. He is an incredible, extraordinary radiologist. He is very innovative and he has introduced a number of innovations to our field including the FSE imaging. These innovations have changed the way I practice on a day to day basis. In addition he is a great teacher. He has published a number of best selling text books and has a digital teaching set up that sets the standard for the industry. He is a very astute clinician and I have learned the hard way never to bet against him on a diagnosis.

He will discuss with us some of the imaging modalities available for the temporal bone.

**Guest Speaker: Advances in High Resolution CT & MR imaging of the Temporal Bone & CPA.**

H. Ric Harnsberger, MD

In this session we will show how multislice-CT and thin-section, high-resolution MR images can impact modern Neurotologic practices. Multislice-CT has increased the number of normal structures that can be viewed with high resolution within the temporal bone (e.g. chorda tympani nerve canal, Arnold & Jacobsen nerve canals, stapedius muscle). With such resolution, we are now able assist in the differential diagnosis of conductive hearing loss by being able to better visualize such lesions as otosclerosis & tympanosclerosis. High-resolution T2-weighted fast spin-echo MR imaging provides excellent depiction of the cisternal and intracanalicular segments of the vestibulocochlear and facial nerves. T2 high-resolution MR has thus enhanced our ability to evaluate candidacy for cochlear implantation and to evaluate lesions that may occur throughout the skull base.

**Advances in the Treatment of Skull Base Neoplasms**



## *Intracranial Schwannomas of the Lower Cranial Nerves*

John P. Leonetti, MD, Douglas A. Anderson, MD  
Sam J. Marzo, MD, Thomas C. O'rigitano, MD, PhD  
Mobeen Shirazi, MD

**Objective:** To present our experience in the diagnosis and management of 39 patients with lower cranial nerve schwannomas of the posterior fossa.

**Study Design:** A retrospective chart review of patient medical records.

**Setting:** Tertiary care, academic medical center.

**Patients:** All patients with intracranial lower cranial nerve schwannomas treated surgically at our institution between July 1988 and July 2005.

**Intervention:** A retrosigmoid, transcondylar, or combined approach was employed for tumor resection.

**Main Outcome Measure:** The extent of tumor resection and the incidence of tumor recurrence.

**Results:** Thirty-nine patients underwent surgical resection with complete tumor removal in 32, near-total resection in five patients, and subtotal tumor excision in two cases. Long-term (mean of 8.2 years) MRI surveillance demonstrated recurrent tumor in two of 32 complete resections, and show regrowth in two of seven patients with known residual disease. Only one of these four patients required re-operation.

**Discussion:** Intracranial schwannomas of the lower cranial nerves are relatively uncommon, and may present with subtle or no clinical symptoms. Successful surgical resection with low risk of tumor recurrence can be achieved with the retrosigmoid or transcondylar approach. Morbidity, in this series, was limited to isolated individual lower cranial nerve deficits.

**Acknowledgments:** The authors would like to thank Erin Sebastian for her work in the preparation and critique of this abstract.

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## **Prevention and Treatment of Cerebrospinal Fluid Leak Following Translabyrinthine Acoustic Tumor Removal**

Jose N. Fayad, MD, Marc S. Schwartz, MD  
Derald E Brackmann, MD, William H. Slattery, MD

**Objective:** To determine the incidence of cerebrospinal fluid (CSF) leak following translabyrinthine acoustic tumor removal using titanium mesh cranioplasty and compare to previous series and historical controls.

**Study Design:** Retrospective chart review.

**Setting:** Tertiary referral neurotologic private practice.

**Patients:** The series of 388 patients who underwent titanium mesh cranioplasty after translabyrinthine tumor removal between March 2003 and July 2005. Results were compared to those in a group of 1195 translabyrinthine tumor removal patients from a previously published series.

**Intervention:** Cranioplasty using titanium mesh following acoustic tumor removal.

**Main Outcome Measures:** Rate of CSF leak for this method and previous methods of closure.

**Results:** 13 patients (3.3%) had CSF leaks when using the new method of titanium mesh closure. This compares to a rate of 10.9% in a series in which previous methods of closure were used ( $p < .001$ ). The rates of CSF leak requiring reoperation were 0.8% and 2.5% for the new and older series, respectively ( $p < .001$ ).

**Conclusions:** Titanium mesh cranioplasty appears to reduce the rate of CSF leaks following translabyrinthine removal of acoustic tumors in our hands. A new paradigm to treat those leaks is described which includes blind sac closure and packing of the Eustachian tube, avoiding the re-exploration of the mastoid as is traditionally proposed.

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Discussion May 21, 2006 11:54 AM

Moderator

The previous papers are now open for discussion. Remember to identify yourself and location clearly.

Galdino Valvassori Chicago, IL

I congratulate Dr. Harnsberger for his excellent presentation. How do you evaluate recurrent tumors? How do you differentiate scar tissue, tumor and a flap? We have used CT PET scans to do this and it has been quite useful. You

should have gone back to the atlas published by Dr. Buckingham in 1972 that shows sections of the temporal bone in multiple planes.

Ric Harnsberger                      SLC, UT

Thanks for the question, Dino. This is obviously one of my mentors. CT PET is being used around the body for recurrent tumor. I do not have a specific experience with it in the temporal bone area. I am certain that it is a fantastic technique in terms of deciding what is metabolically active, tumor or tissue.

Michael Fritsch                      Indianapolis, IN

Dr. Carfrae, was your study done during an active attack and did you notice any difference between symptomatic episodes and asymptomatic episodes.

Matthew Carfrae                      Albany, NY

We were not able to coordinate the choosing of subjects that were having an active attack. That is certainly a valid consideration and would certainly be a future point of evaluation. Certainly the more symptomatic patients may at that time have a rupture of Reisner's membrane. It would be difficult to see any evidence of hydrops if there was a mixing of the perilymphatic and endolymphatic spaces. With greater numbers it should become clearer to us as to how the symptoms affect the imaging results.

Richard Ramsden                      Manchester, England

I have two questions for Dr. Leonetti. In my experience of lower cranial nerve schwannomas the vast majority have been in the context of NF-2. My impression is that your presentation was confined to non NF-2 patients. Is there any difference in your management strategy if NF-2 patients with multiple intracranial tumors? My other question concerns the problems with swallowing which you touched on briefly. What is your experience in the recovery of function? This can be very disabling for these patients. How often do you offer PEG feeding and how long would you watch them before doing this?

John Leonetti                      Chicago, IL

Three of these patients did have a history of NF-2 and none of these three had a lower cranial nerve neuroma on the contralateral side. Regarding the second question, we had two patients that had prolonged chronic aspiration problems and both required long term feeding tube management. We will do vocal cord medialization quickly while the patient is still in the hospital but not at the time of the initial surgery if CN 10 is the nerve of origin. Swallowing is the biggest problem and we get them enrolled in swallowing therapy while in the hospital. Each patient is different as to recovery of function. The elderly have a much more difficult time which is why we have several patients that we have not operated on. Thank you.

John Niparko

Baltimore, MD

I want to thank once again all of the speakers and moderators for a very educational two days. I learned a lot and I hope you did too. When we had the conference call this past November with the program committee we had no idea that the meeting would turn out the way it did. As usual the community comes through marvelously with help from people like Ric Harnsberger, Brad May and Beverly Wright. I would like to now introduce our next President. Antonio De La Cruz comes to us, as everyone knows, as one of the most charismatic and level headed leaders that we have in our field and many of us come to him for advice on a regular basis. Tony, it is going to be wonderful having you at the helm. Congratulations!

Antonio De La Cruz

Los Angeles, CA

Thank you very much, John. Yours will be a difficult show to follow. Everyone in this room owes so much to John. I have seen him working with government with reimbursement issues with a global level of knowledge that is very unique. We are all in debt to you and your leadership. We have a little memento for you. I did ask Shirley if your pin had a diamond and I note it is pure gold. Thank you all very much and we will see you in San Diego next year.