PROGRAM and ABSTRACTS

of the

One Hundred Thirty-Eighth Annual Meeting

AMERICAN OTOLOGICAL SOCIETY, INC.

May 14-15, 2005

Boca Raton Resort & Club
Boca Raton, Florida

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JULY 1, 2004- JUNE 30, 2005

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Credit Statement: The American Otological Society designates this educational activity for a maximum of 8.0 hours in Category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

Certificate of Attendance will be issued at the close of the meeting upon completion of the questionnaire required by us for the certifying organizations.

AMERICAN OTOLOGICAL SOCIETY, INC.

MISSION STATEMENT

The mission of the American Otological Society, Inc., shall be

- to advance and promote medical and surgical otology/neurotology including the rehabilitation of the hearing and balance impaired.
- to encourage, promote, and sponsor research in otology/neurotology and related disciplines.
- to conduct an annual meeting of the members for the presentation and discussion of scientific papers and the transaction of business affairs of the Society.
- to publish the peer reviewed papers and discussions presented during the scientific program and the proceedings of the business meetings.

EDUCATIONAL MISSION STATEMENT

The Educational Mission of the American Otological Society is to foster dialog on, and dissemination of, information pertaining to advances in the understanding and management of otologic and neurotologic disorders. It is expected that the CME program of the AOS will enhance the competency of the participant in otology and neurotology.

Goals & Objectives: The overall goal of this course is to provide up-to-date information pertaining to advances in the understanding and management of otologic and neurotologic disorders. The **target audiences** are otologists, neurotologists, and otolaryngologists with specific interests in otologic and neurotologic disorders.

After attending this meeting, the participant will be informed about new aspects of otology and neurotology in their practice including:

- evaluating non syndromic sensorineural hearing loss
- focused beam irradiation for acoustic neuroma
- the latest progress in vestibular research

First Author/Presenter's signature on the following statements were required on all papers submitted to the American Otological Society. The author was advised that the submitted paper becomes the property of ***Otology & Neurotology*** and cannot be reprinted without permission of the Journal.

FULL DISCLOSURE POLICY STATEMENT

In accordance with the ACCME Essential Areas and Policies, it is the policy of the American Otological Society to ensure balance, independence, objectivity and scientific rigor in all of its educational activities. All faculty participating in American Otological Society sponsored activities are expected to disclose to the audience the existence of any significant financial or other relationships with the manufacturer(s) of any commercial product(s) or provider(s) of any commercial service(s) discussed in an educational presentation. Faculty must disclose significant support or substantial financial relationships with commercial entities in relevant situations whether or not there is direct commercial support for the CME activity. The intent of this policy is not to discourage speakers who have relationships with commercial entities from presenting, but to identify these relationships to the listeners so that they may form their own judgments. It remains for the audience to determine whether the speaker's outside interest may reflect a possible bias in either the exposition or the conclusions presented. Speakers are also expected to openly disclose any off-label, experimental, or investigational use of drugs or devices in their presentations. *Failure to disclose this information on submission forms, or failure to return this disclosure form will result in exclusion from this activity and from future CME activities for up to two years.* The American Otological Society is committed to the non-promotional advancement of knowledge and science and to a free exchange of medical education in otology and neurotology.

PUBLICATION STATEMENT

The material in this abstract, ____(Name of Abstract)_____, has not been submitted for publication, published, nor presented previously at another national or international meeting and is not under any consideration for presentation at another national or international meeting. The penalty for duplicate presentation/publication is prohibition of the author and co-authors from presenting at a COSM society meeting for a period of three years.

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FACULTY DISCLOSURES

The following faculty disclose

John R. Adler, MD—Consultant & Director of Accuray Inc.

John Carey, MD—Off Label Drugs—Intratympanic Gentamicin

George A. Gates, MD—Consultant and Grantee from Xomed; Consultant to Gyrus ENT

Jeffrey P. Harris, MD—Otoimmune Diagnostic Otoblot used in analysis of patient responses
Off-Label Drugs—Enbrel

Li-Mei Lin, BA—Entific Corp: Partial Research Support

Dennis Poe, MD—Off Label Drug—Hydroxylopatite into the Eustachian Tube

Dheerendra Prasad, MD—Consultant for Elekta, Inc.

Thomas R. Van De Water, PhD—Med-El Medical Electronics Recipient of Grant

The following faculty have nothing to disclose

Moises A. Arriaga, MD
Ricardo Cristobal, MD, PhD
Roberto A. Cueva, MD
Hamid R. Djalilian, MD
Joni K. Doherty, MD, PhD
Camille C. Dunn, PhD
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Ophir Handzel, MD, LLB
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Margaret A. Kenna, MD
Sam E. Kinney, MD
John J. Kresl, MD
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Herbert Silverstein, MD
Eric E. Smouha, MD
Jennifer L. Smullen, MD
Zoltan Vass, MD
P. Ashley Wackym, MD
Phillip E. Zapanta, MD

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SATURDAY, May 14, 2005

REGISTRATION – 7:00 am

BUSINESS MEETING – 7:00 am
ROOM: Royal Palm Ballroom—Salons VI-X
(Restricted to Members)

Minutes of the Annual Meeting 2004

Introduction of New Members

Election of Nominating Committee

Report of the Secretary-Treasurer

Report of the Editor-Librarian

SCIENTIFIC PROGRAM – 7:30 am
ROOM: Royal Palm Ballroom—Salons VI-X
(Open to Non-Members)

Moderators: Sam E. Kinney, MD
Clough Shelton, MD

7:30 am **Remarks by President**
Sam E. Kinney, MD

Presidential Citation – Jack Pulec, MD
Presentation to Marlene Pulec

7:35 am **Introduction of the Guest of Honor**
George A.Gates, MD

7:40 am **Science in Otology: Past, Present, and Future**
Guest of Honor: *George A. Gates, MD*

Session: Inner Ear, Hearing Aids, Cancer of the Ear

8:00 am **Cogan Syndrome: 60 Patients Over One Half-Century**
Michael B. Gluth, MD
Colin L. W. Driscoll, MD
Keith H. Baratz, MD
Eric L. Matteson, MD

8:10 am **Long Term Hearing Preservation Following the Partial Labyrinthectomy Petrous Apicectomy Approach to the Skull Base**
Philip E. Zapanta, MD
David A. Schessel, MD, PhD

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8:20 am **Incidence and Interval of Contralateral Ear Involvement after Diagnosis of Meniere's Disease or Endolymphatic Hydrops**
Joni K. Doherty, MD, PhD
Laurel M. Fisher, PhD
Zarina Iqbal, MPH
John W. House, MD

8:30 am **Experience with CROS/BiCROS Digital Hearing Aids**
Herbert Silverstein, MD
Samuel Hill III, MD
Avron Marcus, MD
Nancy Gilman, MS, CCC-A

8:40 am **Complications of the Bone Anchored Cochlear Stimulator**
Sam J. Marzo, MD
John P. Leonetti, MD

8:50 am **Squamous Cell Carcinoma of the External Auditory Canal and Middle Ear: Proposal of Modification of Pittsburgh TNM Staging System**
Takashi Nakagawa, MD, PhD
Yoshihiro Natori, MD, PhD
Yoshihiko Kumamoto, MD
Hideki Shiratsuchi, MD, PhD
Shizuo Komune, MD, PhD

9:00 am **Approach Design and Closure Techniques to Minimize CSF Leak Following Cerebellopontine Angle Tumor Surgery**
Roberto A. Cueva, MD
Bill Mastrodimos, MD

9:10 am **Discussion**

9:20 am **Break with Exhibitors**

Session: Cochlear Implants, BAHA

9:40 am **Histopathology of the Peripheral Vestibular System Following Cochlear Implantation in Human**
Ophir Handzel, MD, LLB
Barbara J. Burgess
Joseph B. Nadol, Jr, MD

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9:50 am **Minimally Invasive Approaches in Pediatric Cochlear Implantation**
Daniel J. Lee, MD
Elizabeth J. Mahoney, MD

10:00 am **Choosing Sides in Cochlear Implantation: Is The Worse Ear Better?**
D. A. Millar, BS
Todd A. Hillman, MD
Clough Shelton, MD

10:10 am **Residual Hearing Conservation and Electro-Acoustic Stimulation with the Nucleus 24 Contour Advance**
Bernard Fraysse, MD
Klaus Albegger, MD
Rolf Battmer, PhD
Didier Bouccara, MD
et. al.

10:20 am **Bilateral Cochlear Implants with 8-Channels/ 813 pps or 16-Channels with Rates of Either 2900 and 5100 pps**
Camille C. Dunn, PhD
Richard S. Tyler, PhD
Shelley A. Witt, MA
Beth J. Macpherson, MA
Bruce J. Gantz, MD
Diana Kain, MA

10:30 am **Extended Assessment of Bone-Anchored Hearing Aid in the Rehabilitation of Unilateral Deafness**
Li-Mei Lin, BA
Stephen Bowditch, MS
Bradford J. May, PhD
Kenneth M. Cox MA, CCC-A
John K. Niparko, MD

10:40 am **The Usefulness of Head-Shaking Nystagmus as a Screening Test for Vestibulopathy**
Jennifer L. Smullen, MD
Simon I. Angeli, MD

10:50 am **Discussion**

NOTES

11:00 am **Panel Presentation**
Non-Syndromic Genetic Hearing Loss, Diagnosis and Patient-Family Counseling
Moderator: *Margaret A. Kenna, MD*
Panel: *Kenneth M. Grundfast, MD*
Rick A. Freidman, MD, PhD

Genetic Counseling for Hearing Loss: How and Why to do It
Margaret A. Kenna, MD

Genetic Diagnosis of Hearing Loss: What to Test for and Why
Kenneth M. Grundfast, MD

Finding and Cloning New Hearing Loss Gene: The Future is Now
Rick A. Friedman MD, PhD

11:50 am **Discussion**

12:10 pm **Group Photograph (AOS Members)**
Location to be announced

6:30 pm **President's Reception & Banquet**
Addison Ballroom
(Members and Invited Guests Only)

Sunday, May 15, 2005

REGISTRATION – 12:00 Noon

BUSINESS MEETING – 12:30 pm
ROOM: Royal Palm Ballroom—Salons VI-X
(Restricted to Members)

REPORT OF THE
A. Board of Trustees of the Research Fund
B. American Board of Otolaryngology
C. Award of Merit Committee
D. American College of Surgeons
E. American Academy of Otolaryngology-HNS

Report of the Audit Committee

Report of the Membership Development Committee

Report of the Nominating Committee

Unfinished Business

New Business

SCIENTIFIC PROGRAM – 1:00 pm
ROOM: Royal Palm Ballroom—Salons VI-X
(Open to Non-Members)

Moderators: Sam E. Kinney, MD
Clough Shelton, MD

Session: External Ear, Middle Ear

1:00 pm **The Evaluation and Management of Salivary Fistula in Aural Atresia**
Robert Sean Miller, MD
Robert A. Jahrsdoerfer, MD
George T. Hashisaki, MD
Bradley W. Kesser, MD

1:10 pm **Patulous Eustachian Tube Reconstruction (PETR)**
Dennis S. Poe, MD

1:20 pm **Comparison of the SMART Stapedotomy Prosthesis with Conventional Piston Prosthesis**
Jeffrey P. Harris, MD, PhD
Shusheng Gong, MD, PhD

1:30 pm **Enhanced Hearing in Heat-Activated Crimping Prosthesis Stapedectomy**
Moises A. Arriaga, MD
Douglas A. Chen, MD
Rebecca Y. Arriaga

1:40 pm **Cholesteatoma in the Normal Hearing Ear**
Eric E. Smouha, MD
Javanshir Javidfar, BS

1:50 pm **Revision Tympanoplasty Using Subcutaneous Scar Tissue Graft**
Hamid R. Djalilian, MD

2:00 pm **Role of Prophylactic Antibiotics in Reducing Postoperative Infection Rates in Mastoid and Middle Ear Surgery: Implications of the JCAHO Requirement for Postoperative Infection Rate Reporting**
Natasha Pollak, MD
William C. Kinney, MD, MPH
Taylor R. Tidmore, MD

2:10 pm **Discussion**

2:20 pm **Panel Presentation**
Symposium on Meniere's Disease: Basic Science
Moderator: *John P. Carey, MD*
Panel: *Zoltan Vass, MD*
Alec Salt, PhD

2:50 pm **Discussion**

3:00 pm **Break with Exhibitors**

Session: Inner Ear Medical Treatment, Research

3:20 pm **Distribution of Low Frequency Cochlear Nerve Fibers in the Auditory Nerve Temporal Bone Findings and Clinical Implications**
Jose N. Fayad, MD
Fred H. Linthicum, Jr., MD
Manuel Don, PhD

3:30 pm **Selective Gene Expression Profiling in Supporting Cells from the Inner Ear of the Rat**
Ricardo Cristobal, MD, PhD
P. Ashley Wackym, MD
Joseph A. Cioffi
Christy B. Erbe
Joseph P. Roche
Paul Popper

3:40 pm **Hyperbaric Oxygen Therapy for Sudden Sensorineural Hearing Loss: A Prospective Trial of Patients Failing Steroid and Antiviral Treatment**
Corinne E. Horn, MD, MS
Harvey Himel, MD, MPH
Samuel H. Selesnick, MD

3:50 pm **Etanercept Treatment for AIED: Results of a Randomized, Double-Blind, Placebo-Controlled Study**
Jeffrey P. Harris, MD, PhD, FACS
Stanley Cohen, MD
Michael Weisman, MD
Angela Shoup, PhD

4:00 pm **Corticosteroids are Otoprotective for Hair Cells and Stimulate Neurito-genesis by Auditory Neurons While Inhibiting Fibroblastic Outgrowth In Vitro**
Thomas R. Van De Water, PhD
Jose Guzman, MD
Jose Ruiz, MD
Adrien A. Eshraghi, MD
Marek Polak, PhD
Alexis Furze, BS
Deanna Kralik
Carolyn Garnham, PhD
Thomas J. Balkany, MD

4:10 pm **Discussion**

4:20 pm **Panel Presentation**
An Update on Stereotactic Radiosurgery
Moderator: C. *Phillip Daspit, MD*
Panel: *John J. Kresl, MD*
P. Ashley Wackym, MD
Dheerendra Prasad, MD
John R. Adler, MD
Rick A. Friedman, MD, PhD
Robert K. Jackler, MD

Radiobiology for Otologists/ Neurotologists
John J. Kresl, MD

Gamma Knife Radiosurgery and the Neurotologist
P. Ashley Wackym, MD

Gamma KnifeTreatment of Vestibular Schwannomas (primary lesions and surgical failures) and other Temporal Bone Lesions-Current Knowledge
Dheerendra Prasad, MD

Cyber Knife Treatment of Vestibular Schwannomas (primary lesions and surgical failures) and Other Temporal Bone Lesions-Current Knowledge
John R. Adler, MD

Surgical Salvage for Radiosurgery Failures
Rick A. Friedman, MD, PhD

Review of the Literature-Evidence Based Conclusions 2005
Robert K. Jackler, MD

5:10 pm **Discussion**

5:30 pm **Introduction of New President**
John K. Niparko, MD

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COSM 2006
139th AOS Annual Meeting
May 20-21, 2006
Hyatt Regency
Chicago, IL

Abstract Deadline: October 15, 2005

Abstract submission form
Website—www.americanotologicalsociety.org
E-Mail– segossard@aol.com

Journal Requirements
All abstract submissions must meet Journal requirements. To see those requirements, please consult "Instructions for Authors" in the printed Journal or online at www.otology-neurotology.org

Manuscripts must be submitted electronically to the Journal no later than two weeks before the presentation. One copy of the manuscript is to be submitted to the AOS Administrative Office.

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1.

Cogan Syndrome: 60 Patients over One Half-Century

Michael B. Gluth, MD; Colin L.W. Driscoll, MD
Keith H. Baratz, MD; Eric L. Matteson, MD

Objective:
To evaluate the spectrum of disease presentation and clinical course manifested in patients with Cogan syndrome at a single institution over an extended period of time.

Study Design:
Retrospective chart review

Methods:
Medical records of all patients ever diagnosed with Cogan syndrome at our institution were comprehensively reviewed including otolaryngologic, ophthalmologic, and systemic manifestations. Analysis included patient demographics, presenting and delayed manifestations, laboratory testing, physical exam findings, vision/hearing outcomes, therapeutic interventions, and disease course.

Results:
Records from a total of 60 patients with Cogan syndrome were identified from within the experience at a single institution over one half-century. Most patients presented initially with vestibuloauditory symptoms, sudden hearing loss being the most common initial manifestation. The most common inflammatory ophthalmologic condition noted was bilateral interstitial keratitis. Headache, fever, and arthralgia were the most frequently noted systemic manifestations. Deafness was eventually noted in 41% of patients. Cochlear implant outcomes were uniformly good. Permanent loss of any degree of vision was uncommon. Death directly attributed to an acute flare-up of systemic disease activity was confirmed in 3 patients.

Conclusions:
Cogan syndrome is a disease condition of presumed autoimmune etiology usually consisting of relapsing inflammatory vestibuloauditory and ophthalmologic manifestations. In general, patients now diagnosed with this condition have an increasingly better prognosis that may be attributed to earlier disease recognition and less delay in the administration of corticosteroid therapy. Newer chemotherapeutic medical treatment regimens are evolving. Cochlear implant technology has been of major benefit in modern hearing rehabilitation efforts within this patient population.

Long Term Hearing Preservation Following the Partial Labyrinthectomy – Petrous Apicectomy Approach to the Skull Base

Philip E. Zapanta, MD; David A. Schessel, MD, PhD

OBJECTIVE: The partial labyrinthectomy petrous apicectomy (PLPA) has been refined and utilized at our institution to enable improved access for more definitive treatment to the petroclival region while avoiding the inherent hearing loss associated with related transpetrosal approaches. Despite the removal of portions of the membranous labyrinth, hearing can be preserved. In this study we review the long-term audiologic outcomes of our patients and quantitate the hearing loss risk associated with the PLPA.
STUDY DESIGN: An IRB-approved, retrospective chart review.
SETTING: George Washington University Medical Center, a tertiary academic hospital.
PATIENTS: All individuals undergoing treatment of petroclival pathology via the PLPA.
INTERVENTIONS: Diagnostic and therapeutic.
MAIN OUTCOME MEASURES: Pre-operative and post-operative audiograms: pure tone averages (PTA) and speech discrimination (SD) scores.
RESULTS: From 1991 to 2004 150 PLPAs were performed and 92 patients had post-operative audiometric data available. The mean follow-up was 20 months (range 3 days to 8 years). Following an initial mixed hearing loss, hearing stabilized and typically returned to near baseline values. 95% retained serviceable hearing (PTA </= 50 dB and SD >/= 60 dB) and 5% had ipsilateral deafness. The mean pre-operative and post-operative PTA were 12 dB (median 7 dB) and 22 dB (median 19 dB) respectively. The mean pre-operative and post-operative SD were 89% (median 96%) and 79% (median 92%) respectively.
CONCLUSIONS: This study demonstrates the long-term stability of auditory function associated with the PLPA approach. The risk of severe loss of hearing is approximately 5%.

Incidence and Interval of Contralateral Ear Involvement after Diagnosis of Meniere's Disease or Endolymphatic Hydrops

Joni K. Doherty, MD, PhD; Laurel M. Fisher, PhD
Zarina Iqbal, MPH; John W. House, MD

Objective: Determine the percentage and time interval for conversion from unilateral to bilateral involvement with Meniere's disease (MD) and endolymphatic hydrops.
Study design: Retrospective
Setting: Tertiary referral center
Patients: 374 patients (748 ears) with a diagnosis of MD or hydrops diagnosis between 1959 and 2004
Intervention: Patients, who consented, filled out a survey detailing symptom onset, frequency, disability index, and treatments. Medical charts were reviewed.
Main outcome measures: (1) Incidence of hydrops relative to MD (2) Progression from unilateral to bilateral involvement; (3) Interval between unilateral onset of symptoms and bilateral involvement.
Results: Diagnosis was hydrops in 26% and MD in 74%. MD involvement was unilateral in 88%, bilateral in 1% at presentation, and 10% became bilateral. For hydrops, 92% were unilateral, 5% were bilateral at presentation, and 3% became bilateral. Conversion from endolymphatic hydrops to Meniere's occurred in 0.7 %. The time interval for conversion from unilateral to bilateral was 5.4 years, ranging from 1 – 11 yrs. Treatment was medical in 70% and surgical in 30% cases across both diagnoses.
Conclusions: Contralateral ear involvement after diagnosis of both endolymphatic hydrops and Meniere's disease is significant, requires long-term follow-up for detection, and may necessitate further treatment.

Experience with CROS/BiCROS Digital Hearing Aids

Herbert Silverstein MD; Samuel Hill III, MD
Avron Marcus MD; Nancy Gilman, MS, CCC-A

Objective: To assess patient satisfaction and acceptance rate with digital CROS/BiCROS hearing aids.

Study design: Retrospective case review.

Setting: Neurotology clinic/referral center.

Patients: 87 patients with severe to profound asymmetric hearing loss and poor speech discrimination (below 40% in the worst ear) due to Meniere's disease, acoustic neuroma, autoimmune inner ear disease, temporal bone fracture, or noise exposure.

Interventions: Patients underwent hearing evaluation (audiometry, OAEs, ECOG, and BAER). Patients were fit with digital BiCROS (N=74) or CROS (N=13) aids in various configurations (BTE/ITE, corded/uncorded). A one-week follow-up for adjustments and soundfield testing was performed. A one-month follow-up was initiated to evaluate hearing aid performance and patient satisfaction. Questionnaires were completed to assess patient satisfaction.

Main outcome measures: Acceptance rate and patient satisfaction.

Results: A 68% overall acceptance rate was found after the 30-day trial period. A 71% acceptance rate was demonstrated after exclusion of suboptimal candidates. A 69% and 62% acceptance rate was noted for the BiCROS and CROS aids respectively. A 79% and 33% acceptance rate was noted for the corded and cordless aids respectively. Reasons for returning the aids included: dissatisfaction with device aesthetics, no perceived improvement over previous aid, complexity of aid, cost, and suboptimal candidacy selection.

Conclusion: Historically, CROS/BiCROS systems have shown poor patient satisfaction and approximately 20% acceptance rates. This study demonstrates high patient satisfaction and a 71% acceptance rate with newer, digital CROS/BiCROS aids in appropriate candidates. In addition, corded aids showed a substantially higher acceptance rate as compared with the cordless devices.

Complications of the Bone Anchored Cochlear Stimulator

Sam J. Marzo, MD; John P. Leonetti, MD

Objective: The objective of this study is to discuss complications of the bone-anchored cochlear stimulator (BAHA) and their management.

Study design: Prospective

Setting: Tertiary referral center

Intervention: Implantation of BAHA

Main outcome measure: Postoperative complications

Results: Between September 2003 and October 2004, 34 patients underwent implantation of a BAHA for unilateral conductive, mixed, or sensorineural hearing losses. There were 16 female patients and 19 male patients, with an average age of 47 years (range 11 - 77 years). Complications occurred in 26% of patients, and most were early in the series. The most common complication was partial or complete loss of the skin graft, occurring in 5 patients. These were managed successfully with local wound care. Three patients had skin growth over the abutment. Two of these cases were managed with office debridement, while one patient required revision under general anesthesia. There were 2 implant extrusions, and both of these patients later underwent successful reimplantation. All patients underwent implant activation three months after surgery. There were no perioperative or postoperative deaths.

Conclusion: The bone anchored cochlear stimulator has an acceptable complication rate. The extrusion rate is low. Most complications are minor and related to partial or complete loss of the skin graft.

Squamous Cell Carcinoma of the External Auditory Canal and Middle Ear: Proposal of Modification of Pittsburgh TNM Staging System

Takashi Nakagawa, MD, PhD
Yoshihiro Natori, MD, PhD
Yoshihiko Kumamoto, MD
Hideki Shiratsuchi, MD, PhD
Shizuo Komune, MD, PhD

Objective: We evaluated therapeutic strategy and survival status for squamous cell carcinoma of temporal bone regarding stage, treatment, and certain prognostic factors.
Study design: A retrospective case review.
Setting: The study was conducted at University hospital and outpatient clinic.
Patients: Twenty-eight patients with primary squamous cell carcinoma of the external auditory canal and middle ear.
Intervention: Lateral temporal bone resection was done for T2 lesions. Subtotal temporal bone resection was performed with pre-operative radiation (60Gy) to T3 and T4 lesions unless there was no invasion to pyramidal apex, carotid canal, dura, and metastasis. Other T4 lesions were conservatively treated by combination of radiation and chemotherapy.
Main outcome measures: The survival rates for T2, T3 and T4 lesions.
Results: The 3-year survival rate for T2 lesions (n=5) was 100%. The 5-year survival rates for T3 (n=6) and T4 (n=17) were 80% and 40%, respectively. The 5-year survival rate improved up to 75% for T4 tumors with operation (n=5), whereas 20% for the 3-year survival rate for T4 tumors without operation (n=12). Lymph node metastasis and concomitant otitis media were significant factors for poor prognosis.
Conclusions: Radical surgery with pre-operative radiation was remarkably effective to T3 tumors. When T4 lesions did not involve pyramidal apex, carotid canal, dura and any lymph nodes, the survival rate was as good as T3 lesions. According to the outcome, the lateral extension of T4 tumors could be classified into T3.

Approach Design and Closure Techniques to Minimize CSF Leak Following Cerebellopontine Angle Tumor Surgery

Roberto A. Cueva, MD; Bill Mastrodimos, MD

Objective: The purpose of the study is to identify specific aspects of surgical approach design and closure technique aimed at reducing the incidence of cerebral spinal fluid (CSF) leak following cerebellopontine angle (CPA) tumor surgery.

Study design: Retrospective case review.

Setting: Tertiary referral center.

Patients: All patients undergoing CPA tumor surgery at the study institution from January 1996 through September 2004.

Main outcome measure: The presence or absence of CSF leak following various surgical approaches for a wide variety of CPA tumors.

Results: Three hundred forty three patients underwent surgery for CPA tumors at the study institution during the study period. Tumor types in descending order of frequency were: acoustic neuroma – 244, CPA meningiomas – 33, petroclival meningiomas – 32, foramen magnum meningiomas – 10, epidermoid tumor – 9, facial nerve tumors – 6, hemangiopericytoma – 3, schwannomas of glossopharyngeal/spinal accessory nerves – 3, unusual internal auditory canal tumors – 3.

Surgical approaches employed for tumor resection included: translabyrinthine, retrosigmoid, combined trans-petrosal approaches, far lateral/transcondylar, middle cranial fossa, and extended middle cranial fossa.

During the nearly 8 year study period four postoperative CSF leaks were encountered resulting in a leak rate of 1.2%. Two of these patients required surgical repair of their leaks, the other two stopped spontaneously. The authors describe specific aspects of approach design and closure which appear to have a positive impact on postoperative CSF leak rates.

Conclusions: Attention to specific aspects of surgical approach design and wound closure results in a reduced incidence of CSF leak following surgery for CPA tumors.

Histopathology of the Peripheral Vestibular System Following Cochlear Implantation In Human

Ophir Handzel, MD, LLB
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Objectives: The objective of this study was to describe the histology of the peripheral vestibular system in temporal bones from patients who in life had undergone cochlear implantation and to correlate the findings with previous reports of vestibular dysfunction after cochlear implantation. This is the first quantitative report of the impact of implantation on the vestibular neuronal end organ.

Material and Methods: There were 19 temporal bones available for histological study. Of these, 17 were suitable for the description of the morphology of the membranous labyrinth, 8 for counting Scarpa's ganglion cells and 6 for measuring the densities of vestibular hair cells. The bones were fixed, cut and stained according to previously published methods. Preferably, the implanted electrode was left in-situ. Vestibular hair cells were counted with Nomarski's optics.

Results: Differences in Scarpa's ganglion cell counts and hair cell densities between the implanted and non-implanted sides were not statistically significant. In 59% of the implanted bones the cochlea was hydropic and in the majority of these bones the saccule was collapsed.

Conclusion: Cochlear implantation does not cause deafferentation of the peripheral vestibular system. Cochlear hydrops accompanied by saccular collapse is common and may cause attacks of vertigo of delayed onset, similar to Meniere's syndrome as previously reported in several clinical series. Hydrops could be caused by obstruction of endolymphatic flow in the ductus reuniens or in the hook portion of the cochlea or by damage to the lateral cochlear wall caused by implantation.

9.

Minimally Invasive Approaches In Pediatric Cochlear Implantation

Daniel J. Lee, MD; Elizabeth J. Mahoney, MD

Objective: Efforts to make pediatric cochlear implantation less invasive and more efficient are essential to improve patient safety, facilitate recovery as well as enhance cost-effectiveness. We review our experience with a minimally invasive technique which combines a small skin incision and titanium screw fixation. Unlike a "keyhole" incision, this approach provides adequate exposure for resident and fellow teaching, while still minimizing the surgical incision. Additionally, carefully-designed flaps allow for the use of screw fixation, decreasing the risk of migration. The purpose of this review is to describe our experiences with this minimal access technique.

Study Design: Retrospective review of the records of pediatric patients (<18 years) undergoing cochlear implantation

Setting: Tertiary referral center

Patients: Pediatric patients undergoing cochlear implantation via a minimally invasive approach at our institution

Intervention(s): Cochlear implantation

Main Outcome measures: Surgical time, skin flap viability, device migration, and adequacy of exposure for resident teaching.

Results: Surgical time averaged less than two hours. No perioperative complications were encountered. Residents participating in these cases uniformly felt that this approach provided exposure appropriate for teaching.

Conclusions: Our modification of current pediatric cochlear implantation techniques combines a small skin incision and screw fixation. We propose that this technique, unlike its "keyhole" counterpart, preserves adequate exposure for both stable fixation as well as resident teaching while still ensuring a small surgical scar and short operative time. The continued evolution of minimally invasive surgical approaches is crucial to improving the safety and cost-effectiveness of pediatric cochlear implantation.

Choosing Sides in Cochlear Implantation: Is The Worse Ear Better?

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Clough Shelton, MD

Objective: To examine the effect that choice of ear has on hearing results in adult cochlear implantation.
Study design: Retrospective chart review.
Setting: University teaching hospital.
Patients: Adults with profound sensorineural hearing loss (n=53) with a better hearing ear prior to implantation.
Intervention(s): Cochlear implantation.
Main outcome measure(s): Postoperative Hearing in Noise Test (HINT) sentences, consonant-nucleus-consonant (CNC) monosyllabic word scores and pure tone threshold averages (PTA) (500, 1K, 2K, 3K) within 1 year of implantation.
Results: We identified 39 patients who underwent cochlear implantation in their worse hearing ear and 14 who underwent implantation in their better ear. The decision to implant the worse hearing ear was made to preserve the benefit many of these patients continued to receive from conventional amplification. Subjects implanted in the worst ear had mean scores of 64.3% on HINT, 33.4% CNC and a 31.4 dB PTA. The mean scores for subjects receiving implants in the better ear were 69% on HINT, 36% CNC and a 34.2 dB PTA. There was no statistically significant difference between these groups. The results indicate that selecting to the worse hearing ear does not compromise overall speech recognition results.
Conclusions: Patients receiving cochlear implants in their worse hearing ear showed similar outcomes in performance as those receiving better ear implants. Worst ear implantation gives the advantage of using a hearing aid in the non-implanted ear. By current implant indications some patients with significant residual hearing are being implanted, many who enjoy wearing a hearing aid in the non-implanted ear.

Residual Hearing Conservation and Electro-Acoustic Stimulation with the Nucleus 24 Contour Advance

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Sandro Burdo, MD; Naima Deggouj, MD
Olivier Deguine, MD; Norbert Dillier, PhD
Michel Gersdorff, MD; Chris James, PhD
Roland Laszig, MD; Thomas Lenarz, MD, PhD
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Ernst von Wallenberg, PhD; Benno Weber, MD, PhD

We describe a multi-centre prospective study of conservation of residual hearing in recipients of the Nucleus 24 Contour Advance electrode array and the benefits of combined electrical and acoustic stimulation.
Subjects were adult candidates for cochlear implantation. A "soft" surgery protocol was defined: 1-1.2mm cochleostomy anterior and inferior to the round-window, Nucleus Contour Advance perimodiolar electrode array inserted using the "advance-off-stylet" technique. The insertion depth limited to about 400 degrees or 17mm linear depth. Pure tone thresholds were measured pre-operatively and post-operatively at intervals. To assess the benefits of combined electrical and acoustic (El-Ac) stimulation patients who still retained thresholds less than 90dBHL up to 500Hz were fitted with an ITE hearing aid. Speech recognition was tested for cochlear implant alone for all patients and additionally with an ipsi-lateral hearing aid for El-Ac patients.
Preliminary results showed that hearing threshold levels were conserved to between of 10 to 20dB of pre-op levels for 7 of 12 subjects implanted. Half of these patients retained hearing threshold levels less than or equal to 90dBHL up to 500Hz. For three subjects with at least 3 months experience El-Ac stimulation improved words scores by 10-30 percentage points, and in noise the signal-to-noise ratio for the speech reception threshold could be improved by 0.5-3.0 decibels compared to that observed for the implant alone condition.

By the time of presentation hearing conservation data will be available for a further 12 patients (N=24) and speech perception data for 14 patients total.

Supported by Cochlear Europe and Phonak AG.

Bilateral Cochlear Implants with 8-Channels / 813 pps or 16-Channels with Rates of Either 2900 and 5100 pps

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Bruce J. Gantz, MD; Diana Kain, MA

Objective: Three different Advanced Bionics© processing strategies were evaluated:
1) 8-Channels / 813 pps (CIS), 2) 16-Channels / 2900 pps (HiResolution Sequential), and 3) 16-Channels / 5100 pps (HiResolution Paired). Increasing the rate might provide a better temporal representation and improved binaural cues.

Study design and outcome measures: Sentence recognition in multi-talker babble from the front and an eight-speaker everyday sounds localization test was administered to subjects using an eight-channel, 813 pps, Continuous Interleaved Sampling (CIS) processing strategy for at least 18 months. Subjects were then programmed with a 16-channel HiResolution Sequential strategy and 16-channel HiResolution Paired strategy. Sentence recognition and localization was again collected. An ABAB design was then implemented for one month whereby subjects alternated their HiResolution strategies every other day. For the next two months, subjects were given the choice to where the strategy they preferred. Sentence Recognition and localization abilities were repeated at one-month and again at three-months.

Subjects: Seven adult bilateral Clarion CII cochlear implant recipients participated in the study.

Results: Comparisons between the 8-channel CIS and the 16-channel HiResolution programs showed immediate10-20% improvements on five subjects for the HiResolution programs (two subjects did not have complete test results at this stage in the study). After one month of alternating between the HiResolution Paired and Sequential programs, there were no differences between the two rates. However, remarkably two subjects showed improvements of 60%; two subjects showed improvements of 40 %; and two subjects showed improvements of 30% over the 8-channel / 813 pps CIS strategies they had previously worn for at least 18 months. Small or no differences were observed on the localization tasks. Results after three months of use were consistent with those obtained after one month.

Conclusions: The 16-channel, 2900 and 5100 pps Advanced Bionics HiResolution Sequential and Paired strategies resulted in dramatic improvements in speech perception in noise in subjects who had been using binaural 8 channel / 813 pps CIS strategies. Further work is needed to determine the independent affects of rate and number of channels.

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Extended Assessment of Bone-Anchored Hearing in the Rehabilitation of Unilateral Deafness

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John K. Niparko, MD

Objective: Vibromechanical stimulation with a semi-implantable bone-conductor (Entific BAHA device) overcomes some of the head-shadow effects in unilateral deafness. What specific rehabilitative benefits are observed when the functional ear exhibits normal hearing v. moderate SNHL?
Design: Prospective trial of subjects with unilateral deafness in a tertiary care center.
Patients: Adults with unilateral deafness (PTA>90dB; Sp.D.<20%) and either normal monaural hearing (n=18) or moderate SNHL (PTA=25-50dB; Sp.D.>75%) in the contralateral functional ear (n=5).
Intervention: Subjects fit with CROS devices for one month and tested before (mastoid) implantation, fitting, and testing with BAHA.
Outcome measures: 1) Subjective benefit; 2) source localization tests (SAINT); 3) speech discrimination in quiet and in noise assessed with HINT protocols.
Results: Consistent satisfaction with BAHA amplification; poor acceptance of CROS amplification. General directional hearing above chance for unaided and in BAHA conditions, but not for CROS. Relative to baseline and CROS, BAHA produced significantly better speech recognition in noise.
Conclusions: BAHA amplification on the side of a deaf ear yields greater benefit in subjects with monaural hearing than does CROS amplification. Advantages likely relate to averting the interference of speech signals delivered to the better ear, as occurs with conventional CROS amplification, while alleviating the negative head-shadow effects of unilateral deafness. The advantages of head-shadow reduction in enhancing speech recognition with noise in the hearing ear outweigh disadvantages inherent in head-shadow reduction that can occur by introducing noise from the deaf side. The level of hearing impairment correlates with incremental benefit provided by the BAHA: Patients with a moderate SNHL in the functioning ear perceived greater increments in benefit, especially in background noise, and demonstrated greater improvements in speech understanding with BAHA amplification.

Acknowlegements: Hardware and partial research support (S.B.) provided by Entific Medical Systems. Study approved by Johns Hopkins IRB: 00-04-07-08.

14.

The Usefulness of Head-Shaking Nystagmus as a Screening Test for Vestibulopathy

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OBJECTIVE: The objective of this study was to determine if the head-shaking nystagmus (HSN) test performed during clinical office examination is a useful tool in the diagnosis of vestibular dysfunction.
STUDY DESIGN: Retrospective chart review.
SETTING: Academic, outpatient, tertiary referral center.
PATIENTS: Forty-three consecutive adult patients with complaints of vertigo or disequilibrium met the inclusion criteria of documented HSN and electronystagmography (ENG) testing.
INTERVENTIONS: Clinical evaluation including the HSN test gave an initial clinical diagnosis followed by computerized ENG with bithermal caloric stimulation to achieve a final diagnosis.
MAIN OUTCOME MEASURES: The positive predictive value as well as the sensitivity and specificity of the HSN test in making a clinical diagnosis of vestibular dysfunction was compared to the final diagnosis made with gold standard of ENG.
RESULTS: The positive predictive value of the HSN test was 97%, and the specificity in detecting a vestibular lesion was 96%. However, the sensitivity of the HSN test in identifying vestibular disease is quite low (53%). When the HSN test is positive, the clinical diagnosis before and after ENG rarely changes. When the HSN is negative, however, the diagnosis after ENG and balance testing is frequently different from the initial clinical impression.
CONCLUSIONS: A positive test of head-shaking nystagmus predicts the presence of a vestibulopathy in patients with symptoms of vertigo or disequilibrium and can be useful in establishing the diagnosis of vestibular dysfunction. However, a negative HSN test is less clinically valuable and further vestibular testing is required. Furthermore, the direction of HSN was not predictive of the side of lesion in this series.

15.

The Evaluation and Management of Salivary Fistula in Aural Atresia

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Objective
Salivary fistula is an uncommon and unreported yet significant complication associated with the repair of congenital aural atresia. The capsule of the parotid gland may be violated during two steps of the operation: the initial dissection around the glenoid fossa or while aligning the auricle with the bony canal at the end of the case. We present the first described series of patients with salivary fistula after repair of atresia.

Study Design
Retrospective case review from 1985 to 2004.

Setting
Tertiary referral center.

Patients
We included all patients who were diagnosed with a salivary fistula after atresia repair.

Main Outcome Measure
The diagnosis of a salivary fistula or salivary tissue in the external auditory canal after atresia repair was based on one of the following criteria: 1) Identification of a fistula tract or salivary tissue in the EAC, 2) otorrhea positive for amylase, or 3) intermittent otorrhea associated with eating.

Results
Of over 1500 patients operated for atresia, we identified 6 patients with salivary fistula after atresia repair. Salivary fistulas were diagnosed from 10 days to 12 years postoperatively, and the duration ranged from 6 months to 14 years. Treatment included observation, medical management, and surgical intervention.

Conclusion
Salivary fistulas may present with granulation tissue, persistent crusting, or persistent otorrhea, and therefore it is necessary to have a high degree of suspicion when managing postoperative atresia patients. Salivary fistula secondary to repair of atresia may be managed conservatively or surgically.

Patulous Eustachian Tube Reconstruction (PETR)

Dennis S Poe, MD

Objective: The patulous eustachian tube (ET) appears to be due to a longitudinal concave defect in the mucosal valve at the superior aspect of its antero-lateral wall and causes troublesome autophony. It was hypothesized that submucosal graft implantation to fill in the concavity within the patulous tubal valve by PETR may produce lasting relief of symptoms.

Study design: Retrospective review

Setting: Tertiary referral center, ambulatory surgery

Patients: 11 eustachian tubes in 8 adults with two or more years of confirmed continuous patulous ET symptoms refractory to medical care.

Intervention: Endoluminal PETR was performed in 11 separate cases using a combined endoscopic trans-nasal and trans-oral approach under general anesthesia. A submucosal flap was raised along the antero-lateral wall of the tubal lumen up to the valve and mobilized superiorly off of the basi-sphenoid. The pocket was filled with Alloderm™ implant restoring the normal convexity and competence to the mucosal lumen valve.

Main outcome measure: Autophony symptoms were scored as 1) complete relief, 2) significant improvement, 3) unchanged, 4) worse.

Results: All cases reported immediate complete relief of autophony. Results with follow-up ranging from 2 to 18 months (ave 9.2mo), 6 (55 %) cases had complete relief of symptoms, 5 (45%) significant improvement. There were no complications. Correlation between patulous ET and other conditions was strongest with laryngo-pharyngeal reflux and rheumatological conditions.

Conclusions: Patulous ET appears to be caused by a concave defect in the tubal valve's antero-lateral wall. Submucosal graft implantation to restore the normal convexity to the valve wall appears capable of giving lasting relief of symptoms. Long-term study is needed.

Comparison of the SMART™ Stapedotomy Prosthesis with Conventional Piston Prostheses

Jeffrey P. Harris, MD, PhD
Shusheng Gong, MD, PhD

One of the well-recognized causes for stapedotomy failure is incus erosion or necrosis secondary to a loose crimp of a prosthesis. Recently, a new piston prosthesis was introduced that permits facile, tight self-crimping when heat is applied to the wire. In order to substantiate the favorable initial observations with the Gyrus SMART ™ piston, this study was undertaken to compare these results (N= 26) with those obtained with a stainless steel or platinum ribbon prosthesis (N=28) according to the guidelines established by the AAO/HNS Committee on Hearing and Equilibrium. Consecutive cases performed by the same surgeon were analyzed. The stainless steel piston and platinum ribbon piston showed a PTA of 22.58dB hearing improvement and a residual PTA air-bone gap of 6.38dB. The SMART ™ prosthesis showed a PTA of 25.33dB hearing improvement and a residual PTA air-bone gap of 7.07dB. These differences were not shown to be statistically significant ($p>0.05$). Results demonstrate that experienced surgeons may achieve comparable results with both prostheses. However the ease of self-crimping and the tightness of the crimp may provide advantages that have long-term benefits. The issue of a potential nickel allergy to the SMART ™ piston prosthesis will be discussed.

Enhanced Hearing in Heat-Activated Crimping Prosthesis Stapedectomy

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Douglas A. Chen, MD; Rebecca Y. Arriaga

Objectives: Compare short-term hearing outcomes with a heat-activated crimping versus mechanical crimping stapedectomy prosthesis.

Study Design: Retrospective chart review.

Setting: Tertiary care neurotology referral center.

Patients: 100

Intervention: Laser Stapedectomy

Main Outcome Measures: Audiometric

Methods: Retrospective study comparing one-month post op hearing in 50 consecutive mechanical crimp prostheses stapedectomies versus 50 consecutive heat-activated crimp prostheses stapedectomies.

Results: While the preoperative hearing characteristics were not statistically different, postoperative hearing was significantly improved for postoperative mean air-bone gap (3.8 dB) and percent of patients with <10 dB gap and <15 dB gap.

Conclusion: Heat-activated crimping prostheses may enhance stapedectomy hearing outcomes versus mechanical crimping prostheses. The effects of case selection and long term incus necrosis require prospective longitudinal analysis.

Cholesteatoma in the Normal Hearing Ear

Eric E. Smouha, MD; Javanshir Javidfar, BS

Objective: Surgical treatment of cholesteatoma in ears with normal or near-normal hearing represents a challenge, in that complete removal of disease may require sacrifice of the ossicular chain. Our aim was to identify the predictive factors and surgical strategies that favor hearing preservation in these patients.
Study design: Retrospective case review.
Setting: Tertiary otologic referral center.
Patients: 54 patients were identified who had cholesteatoma and a preoperative speech reception threshold (SRT) of < 25 dB. Complete audiometric data were available in 51.
Intervention(s): All patients had complete surgical removal of cholesteatoma. When indicated, ossicular reconstruction was performed at the time of the initial surgical procedure.
Main outcome measure(s): Early and late postoperative hearing thresholds, recidivistic disease, need for additional surgery.
Results: The pure-tone average was preserved to within 5 dB of pre-operative level in 71% of patients, but this declined to 57% long-term. An intact ossicular chain was found in 70% of the cases, and could usually be preserved at surgery. However, maintaining an intact ossicular chain resulted in hearing preservation to within 7 dB in only 77% of cases. Similar hearing outcomes resulted after ossicular reconstruction, and in open vs. closed mastoidectomies. The recidivism rate was 19%, and was not influenced by preservation of the ossicular chain.
Conclusions: Preservation of hearing is often possible in cholesteatoma presenting with normal or near-normal hearing levels. Preservation of the ossicular chain does not routinely lead to hearing preservation, however, and should not be allowed to compromise the complete removal of disease

20.

Revision Tympanoplasty Using Subcutaneous Scar Tissue Graft

Hamid R. Djalilian, MD

Objective: To evaluate the success rate of subcutaneous post-surgical scar tissue as graft material for revision tympanoplasty operations.
Study design: Retrospective case review.
Setting: Tertiary referral center
Patients: Thirty-five patients who underwent revision tympanoplasty with or without mastoidectomy procedures and 36 patients undergoing primary surgeries who had all the data necessary for the study and a minimum follow-up of 6 months. The mean follow-up period was 12 months (range, 6 to18 months). Mean age, perforation size, cholesteatoma presence, time required for harvesting, and adjunctive mastoidectomies were similar between the two groups.
Intervention(s): The patients undergoing revision tympanoplasty had graft material harvested from the subcutaneous scar tissue. In the control group temporalis fascia graft was used as graft tissue.
Main outcome measure(s): The rate of perforation closure and post-operative hearing change was measured.
Results: In the scar tissue tympanoplasty, 32 (91%) of 35 patients had successful closure of the TM perforation, whereas in the control group, the success rate was 92% ($p>0.05$). Mean post-operative pure tone average improvement was 21dB in the scar tissue tympanoplasty group and 18dB in the control group ($p>0.05$).
Conclusions: Subcutaneous scar tissue is as successful in perforation closure and hearing improvement as temporalis fascia graft. The use of subcutaneous scar tissue graft is advantageous to other graft materials used in revision tympanoplasty operations in that it can be harvested through the same incision, does not add to the operative time, and does not carry the cost or risk of acellular dermis.

Role of Prophylactic Antibiotics in Reducing Postoperative Infection Rates in Mastoid and Middle Ear Surgery: Implications of the JCAHO Requirement for Postoperative Infection Rate Reporting

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OBJECTIVE: The use of prophylactic preoperative antibiotics in mastoid and middle ear surgery has been controversial. In light of equivocal prospective studies and new JCAHO requirements for reporting of postoperative infection rates, we expect an increase in use of perioperative antibiotics in otologic surgery. Study goals are: first, to report postoperative infection rates as a function of surgery duration, ASA rating, and preoperative infection status; second, by stratifying patients in the above categories preoperatively, to identify patient populations at high risk of postoperative infection.
STUDY DESIGN: Retrospective chart review
SETTING: Tertiary referral hospital
PATIENTS: The most recent 144 patients who underwent middle ear and mastoid surgery at our institution were included in the chart review. Patients with incomplete records, or those without follow-up appointments, were excluded.
INTERVENTIONS: Patients who undergo otologic surgery at our institution do not routinely receive preoperative prophylactic antibiotics. Postoperatively, most patients receive prophylactic oral cephalosporins and antibiotic eardrops.
MAIN OUTCOME MEASURES: The postoperative infection rates are reported as a function of the following variables: presence or absence of preoperative infection, duration of operation, type of operation, and ASA rating.
RESULTS: Results indicate a low overall incidence of postoperative infection, despite the decision to routinely forego preoperative antibiotics.
CONCLUSION: This is the first study to report otologic postoperative infection rates as a function of duration of surgery and ASA rating, a reporting format now required by JCAHO. Postoperative infection rates were low in most categories. Number of patients in some categories was insufficient to draw valid conclusions. Further study is needed in this area.

Distribution of Low Frequency Cochlear Nerve Fibers in the Auditory Nerve. Temporal Bone Findings and Clinical Implications

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Fred H Linthicum Jr., MD; Manuel Don, PhD

Hypothesis:
Low frequency cochlear nerve fibers travel on the outer surface of the auditory nerve adjacent to vestibular nerve fibers in the distal part of the IAC.

Background:
There is a misconception that low frequency cochlear nerve fibers travel within the core of the cochlear nerve surrounded by high frequency nerve fibers.

Methods:
Analyzed temporal bones with total loss of upper spiral ganglion cells due to different etiologies (n=6) and traced the corresponding fibers into the distal IAC. Counted spiral ganglion cells for each segment of the cochlea (I-IV) according to Ott and al. and measured the amount of degenerated nerve.

Results:
There was near total degeneration of the upper spiral ganglion cells in these bones. Corresponding low frequency cochlear nerve fibers traveled on the outer surface of the cochlear nerve adjacent to vestibular nerve fibers in the distal part of the IAC.

Conclusion:
These findings explain low frequency SNHL in 10% of patients with acoustic neuromas and have clinical relevance in the diagnosis of these retrocochlear lesions by Stacked auditory brainstem responses.

Selective Gene Expression Profiling in Supporting Cells from the Inner Ear of the Rat

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Paul Popper

Hypothesis: The role of supporting cells and hair cell precursors can be evaluated selectively using laser capture microdissection and global gene expression profiling techniques.
Background: Multiple studies demonstrated hair cell regeneration in the vertebrate vestibular sensory epithelia. However, little is known about the gene expression patterns of supporting cells and hair cell precursors. We recently reported a method for selective acquisition of RNA from individual cell populations from the inner ear sensory epithelia using laser capture microdissection.
Methods: We have performed expression profiling of RNA microcaptured from the supporting cell and hair cell populations using a rat microarray chip containing 29,842 probes with unique UniGene identities.
Results: There were 11,008 individual genes present with good quality flags. The analysis demonstrated 1556 genes expressed in supporting cells and 3615 in hair cells only. Within the supporting cell only genes 167 are well annotated. Among these we identified genes involved in cell cycle regulation and proliferation, consistent with the presence of hair cell precursors or stem cells within the supporting cell population. Other genes of interest identified are involved in development and neurogenesis, calcium homeostasis and metabolism, signal transduction, cell surface receptors and cytoskeletal proteins.
Conclusion: We present the first selective analysis of the supporting cell transcriptome. This study identified genes involved in cell proliferation, and provides a deeper understanding of the role of supporting cells. Furthermore, some of the identified genes may be used as supporting cell markers.

Hyperbaric Oxygen Therapy for Sudden Sensorineural Hearing Loss: A Prospective Trial of Patients Failing Steroid and Antiviral Treatment

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Objective: To investigate the safety and efficacy of Hyperbaric Oxygen Therapy (HBOT) in adult patients with sudden sensorineural hearing loss (SSNHL) who fail standard of care steroid and antiviral therapy.

Study Design: A prospective cohort study.

Setting: An urban tertiary care referral center.

Patients: Nine adult patients presenting with SSNHL from December 2002 through February 2004. Patients with acute onset SSNHL of >30dB in 3 contiguous frequencies who failed to show audiometric improvement after 2 weeks of systemic steroids and antivirals were enrolled.

Interventions: Study patients received HBOT at 2.0 atmospheres for 90 minutes while breathing 100% oxygen under a clear plastic hood in the chamber. Treatments were administered daily for 10 days over a 2 week period.

Main Outcome Measures: Pre- and post-HBOT mean hearing gains measured in decibels for pute-tone audiometry at 0.5, 1, 2, 3, 4KHz for bone and additional 8KHz for air; pure-tone averages for air and bone; speech reception thresholds; and speech discrimination levels. Patient reported subjective recovery rates (complete, substantial, partial, not improved) were recorded.

Results: One patient had substantial improvement, 1 patient had partial improvement, 7 patients had no improvement in their bone line thresholds. Two patients had complications of serous otitis media requiring myringotomy and pressure equalizing tube placement. No other compications were observed.

Conclusions: Secondary HBOT after failure of systemic steroid and antiviral therapy is not associated with hearing gains in patients with SSNHL.

Etanercept Treatment for AIED: Results of a Randomized, Double-Blind, Placebo-Controlled Study

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Stanley Cohen, MD; Michael Weisman, MD
Angela Shoup, PhD

Purpose: Recent animal data supports the role of TNF-α in inner ear inflammation and a recent open label trial of etanercept suggested potential treatment benefit in AIED. Therefore, we conducted a pilot placebo controlled trial of etanercept in AIED patients.

Methods: 20 AIED patients were enrolled in a 12 week blinded placebo (PLA) controlled randomized clinical trial of etanercept (ETA) 25 mg s.c. twice weekly. History of AIED and a previous documented response to high dose corticosteroids was required for enrollment. Pts. received treatment for 8 weeks with a 4 week follow-up off treatment. Serial audiograms were obtained along with evaluation of auditory acuity, tinnitus and vertigo severity by VAS(0-100), and hearing disability as measured by a validated questionnaire (PIPHL). The primary study endpoint was an improvement in pure tone threshold (PTA) of 10Db in two consecutive frequencies and/or improvement in speech discrimination of >12% at week 8.

Results: 17 subjects (8 ETA, 9 PLA)completed the trial. 1 ETA and 2 PLA subjects achieved the primary endpoint (P> 0 .999). 1 ETA and 1 PLA pt demonstrated improved in auditory acuity, vertigo severity by VAS and hearing disability. These 2 pts also met the primary endpoint. No safety issues were observed.

Conclusion: The results of this pilot trial demonstrate that etanercept 25 mg twice weekly for 8 weeks was no better than placebo for treatment of AIED in this patient population.

Corticosteroids are Otoprotective for Hair Cells and Stimulate Neuritogenesis by Auditory Neurons While Inhibiting Fibroblastic Outgrowth In Vitro

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Marek Polak, PhD; Alexis Furze, BS
Deanna Kralick; Carolyn Garnham, PhD
Thomas J. Balkany, MD

Hypothesis: Corticosteroids protect hair cells from oxidative stress-induced loss and promote neuritogenesis while inhibiting the outgrowth of fibroblasts in vitro.
Background: Both systemic and round window membrane applied corticosteroids have been successfully used to treat some patients with sudden idiopathic sensorineural hearing loss. Dexamethasone has also been shown to be protective against sound trauma in an animal model. Triamcinolone acetonide has been applied into the scala tympani of cochlear implant patients as part of a soft surgery approach for patients with residual hearing.
Methods: Organotypic cultures of P-4 organ of Corti and spiral ganglion explants were the in vitro test systems. A naturally occurring ototoxin produced by oxidative stress (i.e. 4-hydroxy-2,3-nonenal; HNE) was the ototoxic challenge for hair cells. Hair cell counts were done on phalloidin stained explants and spiral ganglion neuritic outgrowth was detected by anti-neurofilament staining. Neuritic and fibroblast outgrowth was measured by image analysis. The corticosteroids tested on ganglion explants were: triamcinolone acetonide; dexamethasone; and methylprednisolone.
Results: Triamcinolone acetonide protected auditory hair cells in the organ of Corti explants from damage and loss caused by exposure to toxic levels of HNE. Both triamcinolone acetonide and dexamethasone stimulated neuritic outgrowth and prohibited fibroblastic outgrowth from the spiral ganglion mini-explants.
Conclusion: Triamcinolone acetonide is not ototoxic and is otoprotective against oxidative stress damage to hair cells. Both triamcinolone acetonide and dexamethasone stimulate a neuritogenesis response from auditory neurons and inhibit outgrowth of fibroblasts. The results of this in vitro study support the use of corticosteroids during cochlear implantation.

Development of a Human Endolymphatic Sac Epithelial Cell Line and Aquaporin-2 Regulation

PI: Kiweon Cha, Ph.D.

A human endolymphatic sac epithelial cell line (HEI-HESEC-1) was established by the use of E6/E7 gene products of the human papilloma virus. The HEI-HESEC-1 has remained morphologically and phenotypically stable, even after 50 passages. Average doubling time of the HEI-HESEC-1was 42.2 hours compared to 54.3 for primary endolymphatic sac epithelial cells. The immortalized cells show positive staining with anti-cytokeratin antibodies (a marker for epithelial cells) and ZO-1 (tight junction marker). Transmission electron microscopy showed tight junction complex desmosome. Chromosomal analysis indicates that the cell line is diploid and derived from male human epithelial cells. Together, our results suggest that the cell line originated from endolymphatic sac epithelial cells from a male human and was successfully immortalized by the E6/E7 genes of human papilloma virus type 16. The creation of this cell line thus provides a new tool for the study of the normal cell biology and the pathological processes associated with the epithelial cells of the endolymphatic sac possibly in Meniere's disease. The HEI-HESEC-1 will also be useful in the search for new drug and biological agents involved in disease treatment.

Specific Aim #1: ***To fully characterize the immortalized ES cell line, HEI-HESEC-1,*** is going to be accomplished and draft manuscript has been prepared for the patent application and publication. However, anchorage dependent growth and tumorigenicity experiments need to be done to complete manuscript. It has taken a total 7 months rather than 4 months for characterization due to eradication of cytokeratin non-producing cells using magnetic beads (Dynal) coated with antibody against pan-cytokeratin. This problem has already been described in our "potential problems and alternatives". We were able to solve this problem successfully and made HEI-HESEC-1 cell line available.

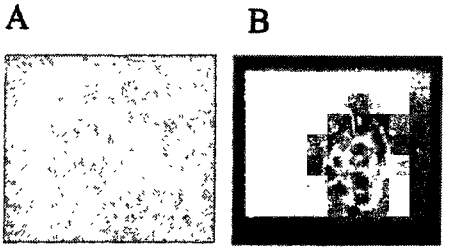
Despite these temporary delays, this project has advanced on three critical fronts.

a. Human endolymphatic sac epithelial cell line (HEI-HESEC-1, Fig. 1) was established by the use of E6/E7 gene products of the human papilloma virus.

b. The cell line keeps epithelial cell marker and tight junction markers – cytokeratin, ZO-1, desmosome. (Fig. 1 for ZO-1)

c. Established cell line is being used for **Specific Aim #2 – *application to Aquaporin 2 regulation.***

Fig. 1 A. Phase-contrast light micrograph of HEI-HESEC-1 cell line showing polygonal, cobblestone-like appearance. **B.** ZO-1 staining of HEI-HESEC-1 cell line shows tight junction in hexagonal formation at the top of the dome formation



Efficacy of Corticosteroids and Antiviral Therapy in Acute Vestibular Neuritis: A Prospective, Randomized, Placebo-controlled Trial

PI: Joel A. Goebel, MD

The goal of this study is to recruit thirty patients through the Barnes-Jewish Hospital Emergency Department with acute vestibular neuritis of less than 24 hours duration. At the present time, all ED personnel (faculty, residents and staff) and pharmacy staff have been briefed on the protocol and examination criteria. Dr. Rebecca Arant has served as the liaison from the ED to facilitate patients through the initial evaluation and drug administration.

Due to a delay in receiving the active valacyclovir and placebo in late November, we applied for a six month no cost extension to the grant. As a result of the delay, we have not enrolled an active patient to date although we have evaluated and eliminated four candidates due to prior history of vertigo or atypical examination findings. We expect that over the next twelve months we will enroll an average of three patients per month to reach our target goal of thirty subjects. If necessary, we will eliminate the criteria of prior vertigo if subjects had not received corticosteroids and/or antiviral therapy for the prior attack. In contrast to the findings of Strupp et al, we feel strongly that is important to retain the less than 24 hour criteria for vertigo to address the efficacy of antiviral therapy. (1) If necessary, we may also consider expanding to additional ED within the region to expand our referral base.

Reference:

1. Strupp M, Zingler VC, Arbusow V, Niklas D, Maag KP, Dieterich M, Bense S, Theil D, Jahn K, Brandt T. Methylprednisolone, Valacyclovir or the Combination for Vestibular Neuritis N Engl J Med 351:4, 28-35, 2004.

Effects of Elevated Potassium on Spiral Ganglion Neurite Growth and Maintenance

PI: Marlan R. Hansen
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The effect of elevated extracellular potassium ($[K^+]_o$) on spiral ganglion neurons (SGNs) and afferent cochlear innervation carries critical implications for Ménière's disease. We have begun exploring the effects of elevated $[K^+]_o$ on spiral ganglion neurites. The aims of our studies were to: (1) define the effects of elevated $[K^+]_o$ on SGN neurite growth and maintenance and (2) determine the requirement of Ca^{2+}/calmodulin dependent kinase II (CaMKII) and/or protein kinase A (PKA) activity for the inhibition of neurite growth by elevated $[K^+]_o$.

Elevated $[K^+]_o$ inhibits SGN neurite growth and results in loss of peripheral afferent fibers in cochlear explants. To determine the effects of elevated $[K^+]_o$ on SGN neurite growth, dissociated spiral ganglion cultures were maintained in neurotrophin 3 (NT-3) in the presence of 5.4 mM K^+ (5K), 30 mM K^+ (30K), or 80 mM K^+ (80K). After 48 hours (h), the cultures were fixed and immunostained with anti-neurofilament 200 (NF200) antibody and neurite length was determined. We found that SGNs maintained in elevated $[K^+]_o$ have significantly reduced neurite lengths compared with SGNs in 5K. The extent of neurite inhibition by depolarization varied directly with $[K^+]_o$; SGNs in 80K had shorter neurites than those in 30K.

To investigate the effects of elevated $[K^+]_o$ on neurites that have already formed we used a cochlear explant preparation, which maintains the relationship of the SGNs with hair, supporting, and glial cells. Cochlear explants were exposed to 80K for 24 h, fixed, and immunolabeled with anti-NF200 antibody. Depolarization with 80K for 24 h results in blebbing and loss of the peripheral neurites. Treatment of explants in 80K with the L-type voltage sensitive Ca^{2+}-channel blocker, verapamil (40 □M) (VPL) prevented the blebbing and loss of SGN neurites while treatment with NT3 failed to prevent neurite degeneration. Explants that had been exposed to 80K for 24 h and maintained in 5K for an additional 72 h (96 h total) showed a near complete loss of peripheral processes.

CaMKII and PKA are not required for the inhibition of neurite growth by elevated $[K^+]_o$.

CaMKII and PKA are activity dependent kinases that promote SGN survival, are required for the survival promoting effects of elevated $[K^+]_o$, and inhibit SGN neurite growth. We transfected cultured SGNs with GFP-AIP or GPKI, small peptides fused with green fluorescent protein (GFP) that are specific and effective CaMKII and PKA inhibitors, respectively.

Neither inhibitory peptide prevented the inhibition of neurite growth by elevated $[K^+]_o$. These results were confirmed using KN-62 and RpcAMPS, pharmacologic CaMK and PKA inhibitors. These results demonstrate that elevated $[K^+]_o$ recruits different signals to inhibit SGN neurite growth than those that are required to promote survival.

Calpain activity is partially required for the inhibition of SGN neurite growth by elevated $[K^+]_o$.

Calpain is a Ca^{2+}-activated protease that mediates growth cone inhibition by repulsive cues in spinal cord neurons. We hypothesized that calpain mediates the effect of elevated $[K^+]_o$ on SGN neurite growth. To test this, we treated spiral ganglion cultures with calpeptin (10 □M), a highly specific calpain inhibitor. Calpeptin partially prevented the inhibition of neurite growth by 30K, suggesting that calpain is required, at least in part, for the inhibition of neurite growth by elevated $[K^+]_o$. Ongoing studies seek to further define the consequences of calpain activity on SGN neurite growth and maintenance.

The results of these studies hold important implications for patients with Ménière's disease. For example, retraction or loss of neurites by exposure to elevated $[K^+]_o$ may reduce the density of afferent fibers innervating the organ of Corti. Manipulation of the signals activated by elevated $[K^+]_o$ could limit the potentially damaging consequences on neurites. To the extent that membrane depolarization mimics electrical stimulation, these studies also offer insights into the consequences of high rates of electrical stimulation on cochlear innervation and into cochlear development as formation of functional neuronal circuits requires limiting axonal and dendritic growth to appropriate targets. The mechanisms restricting SGNs to their appropriate targets is unknown. Activity-dependent signals mediated by calpain may play a role in SGN neurogenesis.

Restoration of Cochlear Function by Cell Transplantation

PI: Leonard P. Rybak, MD, PhD

The specific aims of the first year of the award of 7/01/04 were (1) to acquire viable cochlear cells from the spiral ligament of normal rat, (2) transplant them into the same region, and evaluate the effect on cochlear function and hearing by measuring brainstem evoked response (ABR), endocochlear potential (EP), and migration of transplanted cells (3) repeat aim 2 using rats that have cisplatin-impaired cochlear damage. Significant progress has been made in aims 1 and 2. Specifically, surgical methods have been developed that allow recovery of viable cells from the cochlear lateral wall. Specifically, using anesthetized rats, a post-auricular incision was made in the skin, and the soft tissues bluntly retracted to expose the auditory bulla. The bulla was opened to expose the cochlea, and an aperture was made in the bone overlying the lateral wall of the first turn. Cochlear tissue from donors was harvested from this area. An examination of these cells suggested that they have the characteristics of spiral ligament fibrocytes. Recipients underwent the same surgical procedure, tissue was removed and replaced with donor cells. Several synthetic compounds were tested to seal the bulla and minimize loss of endolymph. These included bone wax and acrylic glue (n-butyl cyanoacrylate). However, adipose tissue proved to be the most effective and was well tolerated. Although these harvested cells were successfully implanted and the bone sealed with glue or lipid, cochlear function and hearing was not detectable and did not recover within eight weeks of the surgery. Since the submission of this proposal, there have been a number of reports of transplants of stem cells into the cochlea. Studies are underway to measure the ability of the transplanted cochlear cells to participate in the movement towards the margin of the stria vascularis. Studies invovling the third aim have not started.

Genetic Analysis of Meniere's Disease

PI: Jeffery T. Vrabec, MD
Raye Lynn Alford, PhD

Background: There are numerous theories of pathogenesis for Meniere's disease (MD), though none have gained universal acceptance. Clinical and histopathological evidence are usually given in support of these theories, though the molecular mechanisms of the disorder remain obscure. A number of features of MD implicate genetic contributions to disease development. MD is primarily a disease of Caucasians, familial cases represent approximately 10% of all cases, and the sibling risk is 10 fold greater than that of the general population. More efficient techniques for genetic analysis provide a new opportunity for deciphering the underlying physiology of this disease.

Millions of single nucleotide polymorphisms (SNPs) have been mapped across the entire human genome. These markers can be used to compare population samples for genotype differences, either using SNPs dispersed across the entire genome or concentrated in specific genes. For any given SNP, variance of allele frequency between a test population and controls could indicate adjacent variation in genetic sequence.

While the discovery of a genetic link to disease is eagerly anticipated by both scientists and patients alike, enthusiasm must be contained until conclusive evidence is attained. DFNA9 is a familial form of progressive cochleovestibular dysfunction due to mutation in *COCH*. The finding of some affected individuals with vertigo episodes prompted one group to propose a link between *COCH* mutations and MD. This two part study aims to investigate the prevalence of *COCH* mutations in sporadic MD cases and perform a case control association study of candidate genes selected for potential role in disease development.

Methods: Candidate gene selection was based on existing theories of MD pathogenesis. Individual SNP assays were chosen based on existing haplotype block data for the gene of interest. All patients met criteria for definite MD according to AAO-HNS guidelines. Controls were matched for ethnicity, but have unknown history of otologic disease. Genotype and allele frequency differences between the two groups were compared via contingency tables with correction for multiple tests. In the second portion of the study, 20 patients and 11 controls were selected for sequencing of the coding regions of *COCH*.

Results: A total of 59 SNPs in 34 candidate genes have been investigated to date. Efforts remain in progress for several additional candidate genes. The genes selected may be broadly classified into those associated with herpes simplex virus entry or reactivation, those associated with inflammatory signaling, and those associated with familial or sporadic migraine. SNPs showing tentative associations in an initial survey were repeated in a second population sample, though results are not complete at this time.

In the second portion of the study, none of the known *COCH* mutations were identified in MD patients or controls. No novel mutations were detected either.

Conclusions: Our investigation demonstrates a lack of association between *COCH* and sporadic cases of MD in a Caucasian American population. The candidate genes investigated to date also do not show a confirmed association with MD, due to lack of statistical power. The list of potential candidate genes for any given theory of pathogenesis is quite large. Thus, it is difficult to disprove a theory by reporting negative results as the relevant gene may not have been studied. The collection of a repository of patient DNA allowed by this grant provides a means to confirm the future observations of others regarding the genetics of Meniere's disease.

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