PROGRAM
of the

One Hundred Thirtieth
Annual Meeting

AMERICAN OTOLOGICAL SOCIETY, INC.

May 10-11,
1997

Scottsdale Princess Hotel
Scottsdale, Arizona

OFFICERS
JULY 1, 1996 - JUNE 30, 1997

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The American Otological Society is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.

This Continuing Medical Education offering meets the criteria for eight (8) credit hours in Category One (1) of the Physician's Recognition Award of the American Medical Association.

SATURDAY, MAY 10, 1997

REGISTRATION - 7 a.m.

BUSINESS MEETING - 7 a.m.
ROOM: SALONS F AND G
(Restricted to Members)

Minutes of the Annual Meeting 1996

Introduction of New Members

Election of Nominating Committee

Report of the Secretary-Treasurer

Report of the Editor-Librarian

SCIENTIFIC PROGRAM - 7:30 a.m.
ROOM: SALONS F AND G
(Open to Non-Members)

Remarks by the President
Joseph C. Farmer, Jr., M.D.

Remarks by the Guest of Honor
Mansfield F.W. Smith, M.D.

Presidential Citation
Research Triangle Institute,
Center for Auditory Prosthesis Research
Blake Wilson, B.S.E.E., Dewey T. Lawson, Ph.D.,
Charles C. Finley, Ph.D., Mariangeli Zerbi, M.S.

COCHLEAR IMPLANTS

1. 7:46 a.m. Within-Patient Comparisons Among Processing Strategies for Cochlear Implants
Dewey T. Lawson, Ph.D.
Blake S. Wilson, B.S.E.E.*
(by invitation)
Mariangeli Zerbi, M.S.
Patricia A. Roush, M.A.
Chris van den Honert, Ph.D.
Charles C. Finley, Ph.D.
Debara L. Tucci, M.D.
Joseph C. Farmer, M.D.

2. 7:54 a.m. Bilateral Cochlear Implants Controlled By A Single Speech Processor
Dewey T. Lawson, Ph.D.*
(by invitation)
Blake S. Wilson, B.S.E.E.
Mariangeli Zerbi, M.S.
Chris van de Honert, Ph.D.
Charles C. Finley, Ph.D.
Joseph C. Farmer, Jr., M.D.
John T. McElveen, Jr., M.D.
Patricia A Roush, M.A.

3. 8:02 a.m. Performance with the new Cochlear 20+2L Lateral Wall Cochlear Implant
Paul R. Kileny, Ph.D.*
Steven A. Telian, M.D.
Terry A. Zwolan, Ph.D.
Angelique K. Boerst, M

***speaker**

4. 8:10 a.m. The Clarion Multi-StrategyCochlear Implant: Surgical Technique, Complications, and Results
Anil K. Lalwani, M.D.*
(by invitation)
Jannine B. Larky, M.D.
Karen Kwast, M.A.
Robert A. Schindler, M.D.

5. 8:18 a.m. Cochlear Implantation After Labyrinthectomy
George W. Facer, M.D.*
Robert H. Brey, Ph.D.
Ann Peterson, M.D.

8:26 a.m. **DISCUSSION**

PEDIATRIC COCHLEAR IMPLANTS

6. 8:33 a.m. Language Acquisition in Prelingually Deaf Children with Cochlear Implants
Richard T. Miyamoto, M.D.*
Mario A. Svirsky, Ph.D.
Amy M. Robbins, M.S.
Karen Iler Kirk, Ph.D.

7. 8:41 a.m. Long Term Results Regarding Socialization, Rehabilitation, and Education in Children with Cochlear Implants
M. Suzanne Hasenstab, Ph.D.
Wesley D. Vander Ark, M.D.*
(by invitation)
Shawn K. Kastetter, M.D.
Jon E. Isaacson, M.D.

***speaker**

8. 8:49 a.m. Expanding Criteria for Pediatric Cochlear Implantation
Susan B. Waltzman, Ph.D.*
(by invitation)
Noel L. Cohen, M.D.

9. 8:57 a.m. Speech Recognition Performance of Older Children with Implants
Mary Joe Osberger, Ph.D.*
(by invitation)
Sue Zimmerman-Phillips, M.S.
Lisa Geier, M.S.
Mary Barker, M.A.

9:05 a.m. **DISCUSSION**

OTOSCLEROSIS, STAPES FUNCTION AND SURGERY

10. 9:11 a.m. Gene Association Studies in Otosclerosis
Michael J. McKenna, M.D.*
(by invitation)
Arthur Kristiansen, M.S.
Mary L. Bartley, R.N.
Jonathan L. Haines, Ph.D.

11. 9:19 a.m. Stapes Movement: Complex Rather Than Piston-Like
Kurt E. Heiland, M.D.*
(by invitation)
Richard L. Goode, M.D.
Alex M. Huber, M.D.

***speaker**

12. 9:27 a.m. Early Post-Laser Stapedotomy Hearing Thresholds
Patrick J. Antonelli, M.D.*
(by invitation)
Gerard J. Gianoli, M.D.
Michael J. LaRouere, M.D.
Larry B. Lundy, M.D.
Jack M. Kartush, M.D.

13. 9:35 a.m. Laser Stapedotomy Minus Prosthesis
Herbert Silverstein, M.D.*

14. 9:43 a.m. Forty Years of Stapes Surgery
John J. Shea, Jr., M.D.*

9:51 a.m. **DISCUSSION**

9:58 a.m. **Intermission**

***speaker**

OTOTOXICITY AND CHOLESTEATOMA

15. 10:14 a.m. The Protective Aspects of Brain Derived Neurotrophic Factor (BDNF) During Gentamicin Ototoxicity
Ivan Lopez, Ph.D.*
(by invitation)
Vicente Honrubia, M.D.
Seung Chul Lee, M.D.
Gang Li, M.D.
Karl Beykirch, M.S.
Paul Mycevich, Ph.D.

16. 10:22 a.m. Effect of Protective Agents Against Cisplatin Ototoxicity
Leonard P. Rybak, M.D., Ph.D.*
Satu M. Somani, Ph.D.

17. 10:30 a.m. Cholesteatoma: A Molecular and Cellular Puzzle
Anthony P. Albino, Ph.D.*
(by invitation)
Simon C. Parisier, M.D.

18. 10:38 a.m. Cytotoxicity of Cytokeratin Monoclonal Antibodies Against Keratinocytes—A Possible Therapeutic Adjunct For Cholesteatoma?
Moises A. Arriaga, M.D.*
(by invitation)
Patti Dixon

10:46 a.m. **DISCUSSION**

19. 10:52 a.m. Intratympanic Gentamicin for the Treatment of Meniere's Disease
Dennis S. Poe, M.D.*
Tarek F. Youssef, M.D.

20. 11:00 a.m. The Role of Endolymphatic Mastoid Shunt Surgery in the Managed Care Era
Myles L. Pensak, M.D.*
Rick A. Freidman, M.D., Ph.D.

21. 11:08 a.m. The Acute Effects of Hemodialysis On the Inner Ear
Jeffrey J. Dyer, M.D.*
(by invitation)
Barry Strasnick, M.D.
John T. Jacobson, Ph.D.
Claire A. Jacobson, M.S.

22. 11:16 a.m. Autoimmune Sensorineural Hearing Loss: Clinical Characteristics
Ralph A. Nelson, M.D.*
Donald Robertson, M.D.
M. Jennifer Derebery, M.D.
Karen I. Berliner, Ph.D.

23. 11:24 a.m. Long-Term Treatment Outcomes in Autoimmune Sensorineural Hearing Loss
M. Jennifer Derebery, M.D.*
(by invitation)
Donald Robertson, M.D.
Ralph A. Nelson, M.D.
Karen I. Berliner, Ph.D.

11:52 a.m. **DISCUSSION**

***speaker**

24. 11:39 a.m. Facial Nerve Injury in Congenital Aural Atresia Surgery
Robert A. Jahrsdoerfer, M.D.*
Paul R. Lambert, M.D.

25. 11:47 a.m. Facial Nerve Surgery in the 19th and 20th Centuries: The Controversy Between Crossover Anastomosis and Nerve Repair
Saurabh B. Shah, M.D.*
(by invitation)
Robert K. Jackler, M.D.

26. 11:55 a.m. Ultrastructural Findings of a Facial Nerve Schwannoma
Dennis G. Pappas, Jr., M.D.*
(by invitation)
Suzanne Chen, Ph.D.
Noel L. Cohen, M.D.
Paul E. Hammerschlag, M.D.
Laura Downey, M.D.

12:03 p.m. **DISCUSSION**

12:08 p.m. **GROUP PHOTOGRAPH**
MEMBERS OF THE AMERICAN OTOLOGICAL SOCIETY, INC.
(Location to be announced.)

***speaker**

SUNDAY, MAY 11, 1997

REGISTRATION - 12 Noon

BUSINESS MEETING - 12:30 p.m.
ROOM: SALONS F AND G
(Restricted to Members)

REPORTS 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
Head and Neck Surgery

Report of the Audit Committee

Report of the Nominating Committee

Report of Communications

Unfinished Business

New Business

SCIENTIFIC PROGRAM - 1:00 p.m.
ROOM: SALONS F AND G
(Open to Non-Members)

27. 1:00 p.m. Otalgia: An Isolated Symptom of Malignant Infratemporal Fossa Tumors
John P. Leonetti, M.D.*
John Li, M.D.
Peter G. Smith, M.D., Ph.D.

28. 1:08 p.m. Clinical Acumen and Vestibular Schwannoma
David A. Moffat, B.Sc., M.A.*

29. 1:16 p.m. Acoustic Neuromas Presenting With Normal or Symmetrical Hearing: Clinical Features Which Lead to Tumor Discovery
Lawrence R. Lustig, M.D.*
(by invitation)
Sasha Rifkin, B.S.
Robert K. Jackler, M.D.

30. 1:24 p.m. Management of Nonacoustic Cranial Nerve Neuromata
Ian S. Storper, M.D.*
(by invitation)
Alexander Gorup, M.D.
Jeffrey N. Bruce, M.D.
Michael Sisti, M.D.

31. 1:32 p.m. Temporal Bone and Lateral Skull Base Malignancy: Experience and Results with 81 Patients
Spiros Manolidis, M.D.*
(by invitation)
C. Gary Jackson, M.D.
Peter G. Von Doersten, M.D.
Michael E. Glasscock, III, M.D.
Dennis G. Pappas, Jr., M.D.
James L. Netterville, M.D.

1:40 p.m. **DISCUSSION**

***speaker**

TEMPORAL BONE HISTOPATHOLOGY, CRANIAL ANATOMY PLUS EUSTACHIAN TUBE AND AUDITORY FUNCTION

32. 1:47 p.m. Relative Prevalence of Disorders Of Hearing or Balance Using Histologic Diagnostic Criteria: A Temporal Bone Histopathologic Study
Robert I. Kohut, M.D.*
Jai H. Ryu, Ph.D.
Raul Hinojosa, M.D.
George Howard, Dr. PH.

33. 1:55 p.m. Cranial Anatomy and Otitis Media: A Cadaver Study
N. Wendell Todd, M.D.*

34. 2:03 p.m. Cochlear Function After Division Of the Lateral Semicircular Canal Using the Argon Laser and Microdrill
Josef E. Gurian, M.D.*
(by invitation)
J. Douglas Green, Jr., M.D.
David A. Fabry, Ph.D.
George W. Facer, M.D.

35. 2:11 p.m. Outcomes Research in Conductive Hearing Loss: Development of a New Hearing Status Instrument
Michael G. Stewart, M.D.*
(by invitation)
Herman A. Jenkins, M.D.
Newton J. Coker, M.D.
Jamers F. Jerger, Ph.D.
Louise H. Loiselle, M.S.

***speaker**

36. 2:19 p.m. Long-Term Results with the Titanium Bone Anchored Hearing Aid (BAHA): the U.S. Experience
Jack Wazen, M.D.*
Michele Caruso
Anders Tjellstrom, M.D., Ph.D.

37. 2:27 p.m. Teflon Paste Injections for the Treatment of Abnormally Patent Eustachian Tube: Current Technique And Long-Term Results
Jack L. Pulec, M.D.*

2:35 p.m. **DISCUSSION**

2:42 p.m. **INTERMISSION**

PEDIATRIC OTOLOGY

38. 3:12 p.m. Spontaneous Otoacoustic Emissions In the Early Neonate
Sean K. Kastetter, M.A.*
(by invitation)
Kerri A. Rudin, M. Ed.

39. 3:20 p.m. The Effect of Topical Ciprofloxacin On Postoperative Otorrhea Following Tympanostomy Tube Insertion
Terrence E. Zipfel, M.D.*
(by invitation)
David F. Street, M.D.
Jeff Wulffman, M.D.
Ajit Tipirneni, B.S.
Lin Frey, Ph.D.
W. Edward Wood, M.D.
William S. Gibson, M.D.

***speaker**

40. 3:28 p.m. Long-Term Impact of Ventilation Tubes
Stephen G. Harner, M.D.*
Charles W. Beatty, M.D.
George W. Facer, M.D.
Thomas J. McDonald, M.D.

41. 3:36 p.m. Pediatric Tympanoplasty of Iatrogenic Perforations from Ventilation Tube Insertion
Gabriel O. Te, M.D.*
(by invitation)
Franklin M. Rizer, M.D.
Arnold G. Schuring, M.D.

3:44 p.m. **DISCUSSION**

VESTIBULAR PHYSIOLOGY AND DYSFUNCTION

42. 3:50 p.m. A Novel Psychophysical Illusion Resulting From Interaction Between Horizontal Vestibular and Vertical Pursuit Stimulation
Vicente Honrubia, M.D.*
Alan Greenfield, Ph.D.

43. 3:58 p.m. Vestibular Decruitment, Hyperactivity And Rebound Caloric Nystagmus
Arvind Kumar, M.D.*
Aftab Patni

***speaker**

44. 4:06 p.m. Vestibular and Auditory Function Abnormalities In Silicone Breast Implant Patients
F.O. Black, M.D.*
(by invitation)
David B. Hawkins, Ph.D.

45. 4:14 p.m. Disabling Paroxysmal Positional Vertigo
J. Douglas Green, Jr., M.D.*
(by invitation)

4:22 p.m. **DISCUSSION**

EXTERNAL EAR CANAL, MIDDLE EAR AND MASTOID SURGERY

46. 4:28 p.m. Surgical Treatment of Acquired External Auditory Canal Atresia
Samuel H. Selesnick, M.D.*
(by invitation)
Tuyet-Phuong K. Nguyen, B.S.

47. 4:36 p.m. Irradiated Rib Cartilage Graft For Tympanic Membrane Reconstruction
Douglas L. Schulte, M.D .*
(by invitation)
Colin L.W. Driscoll, M.D.
Thomas J. McDonald, M.D.
George W. Facer, M.D.
Charles W. Beatty, M.D.

***speaker**

48. 4:44 p.m. Endoscopic Medial Graft Tympanoplasty
Muaaz Tarabichi, M.D.*
(by invitation)

49. 4:52 p.m. A Randomized Blinded Study of Canal Wall Up vs. Canal Wall Down Mastoidectomy to Determine the Differences in Viewing Middle Ear Anatomy and Pathology
Gregory F. Hulka, M.D.*
(by invitation)
John T. McElveen, Jr., M.D.

50. 5:00 p.m. Reversible Canal Wall Down Mastoidectomy: An Alternative to Intact Canal Wall and Canal Wall Down Mastoidectomy Procedures
John T. McElveen, Jr., M.D.*
(by invitation)
Gregory F. Hulka, M.D.

5:08 p.m. **DISCUSSION**

5:15 p.m. **Introduction of New President**
Charles M. Luetje, M.D.

ADJOURNMENT

***speaker**

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1995	D. Thane Cody, M.D.
1996	F. Blair Simmons, M.D.

GUESTS OF HONOR (1974-1995)

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of the

ONE HUNDRED THIRTIETH ANNUAL MEETING

AMERICAN OTOLOGICAL SOCIETY, INC.

May 10-11, 1997

Scottsdale Princess Hotel
Scottsdale, Arizona

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1.

WITHIN-PATIENT COMPARISONS AMONG PROCESSING STRATEGIES FOR COCHLEAR IMPLANTS

Dewey T. Lawson, Ph.D., Blake S. Wilson, B.S.E.E.,
Mariangeli Zerbi, M.S., Patricia A. Roush, M.A.,
Chris van den Honert, Ph.D., Charles C. Finley, Ph.D.,
Debara L. Tucci, M.D., Joseph C. Farmer, Jr., M.D.

Studies have been completed with five of seven subjects implanted with a percutaneous research version of the standard Nucleus 22 electrode array. Each subject enjoyed good to excellent performance with her everyday processor (a monopolar version of the standard clinical SPEAK strategy) in terms of the cochlear implant population as a whole. Percutaneous access to the implanted electrodes allowed laboratory comparisons with a variety of alternative processing strategies, based on identification of medial consonant sounds, isolated words, and words in sentences. All tests were conducted in a hearing alone condition, with no feedback as to correct or incorrect responses. Both male and female voices were included in the medial consonant tests. Results will be presented comparing the performance of (1) particular continuous interleaved sampling (CIS) processors, (2) "n-of-m" designs, in which a total of m frequency bands are analyzed but only the n electrodes corresponding to the n highest energy bands are stimulated on a given processing cycle, and (3) the SPEAK strategy. The effects of stimulation rate, overall analyzed frequency range, and number of processing channels will be discussed.

OBJECTIVES:

1. To describe the study in general and one specific part of it in more detail.
2. To present specific results for that part.
3. To discuss the significance of those results.

* Research funded by the National Institutes of Health. Cochlear Corporation underwrote cost of implant devices, associated clinical costs, and the travel and subsistence expenses subjects while participating in these studies.

BILATERAL COCHLEAR IMPLANTS CONTROLLED BY A SINGLE SPEECH PROCESSOR*

Dewey T. Lawson, Ph.D. , Blake S. Wilson, B.S.E.E.,
Mariangeli Zerbi, M.S., Chris van den Honert, Ph.D.,
Charles C. Finley, Ph.D., Joseph C. Farmer, M.D.,
John T. McElveen, Jr., M.D., Patricia A. Roush, M.A.

A patient rendered profoundly deaf by Listeria rhomboencephalitis, with partial insertion of a Nucleus 22 electrode array and radiographic evidence of rapid bilateral ossification, received a second cochlear implant in the other ear, where full insertion was achieved. The patient routinely uses a pair of independent clinical MSP processors with her two implants. Laboratory studies have been undertaken to assess potential benefits of placing stimulation of the electrodes in both ears under the control of a single continuous interleaved sampling (CIS) processor. Among such potential benefits are: the ability to double the effective stimulation rate limit imposed by the Nucleus transcutaneous link for a given number of CIS channels, access to additional independent channels of stimulation, and the ability to convey direction of sound incidence. All 24 useable BP+1 electrode assignments (16 left ear, 8 right ear) were included in common studies of pitch discrimination and pitchranking. Three bilateral pairs of such assignments were identified as capable of supporting interaural comparisons with no perceptable difference in pitch. Interaural time delay studies using 50 ms bursts of 80 us/phase pulses at 480 pulses/s will be presented, demonstrating the ability of this subject to identify the ear receiving the earlier onset for delays extending down to less than 150 us. Other studies to be presented will include interaural amplitude difference experiments, and comparisons of medial consonant identification results using CIS processors with various stimulation rates and with channels assigned to various unilateral and bilateral sets of electrodes. The latter conditions will include both comparisons involving the full tonotopic range of the deeper insertion and comparisons involving only the range common to both implanted arrays. Results for a series of two-channel processors will explore relative performance for channels differing in both ear and perceived pitch, for channels differing in ear but not pitch, and for channels differing in pitch but not ear.

OBJECTIVES:
1. To summarize the patient's status and history.
2. To outline potential benefits of control of both implants by a single processor.
3. To present results of one or two specific experiments.

*Research funded by the National Institutes of Health

PERFORMANCE WITH THE NEW COCHLEAR 20+2L LATERAL WALL COCHLEAR IMPLANT*

Paul R. Kileny, Ph.D., Steven A. Telian, M.D.,
Terry A. Szolan, Ph.D. Angelique K. Boerst, M.A.

The cochlear 20+2L lateral wall cochlear implant represents a modification of the standard mini22, bipolar cochlear implant. In addition to the intrascalar electrode array, the 20+2L has two additional extra-cochlear electrodes: a plate ground electrode mounted on the lateral surface of the receiver in contact with the temporalis muscle, and an apical, transcochlear wall, titanium encased ball electrode in contact with the endosteum of the apical turn. The apical lateral wall electrode is positioned inferior to the tensor tympani muscle just anterior to Jacobson's nerve. This electrode is accommodated by a second cochleostomy created in the otic capsule, deep enough to expose the endosteum of the apical turn. The 20+2L implant may be activated in both the standard bipolar modes of stimulation as well as in two different monopolar modes, one referenced to the receiver-mounted plate electrode, the other one to the apical lateral wall electrode.

To date, nine patients have been implanted with this new device. Five different electrode configurations are used in each patient using a balanced, randomized introsubject design. The electrode configurations are: standard bipolar +1, two monopolar configurations using the apical electrode, one involving 10 the other 20 active electrodes; and two monopolar configurations using the receiver-mounted plate electrode, one with 10 , the other with 20 active electrodes. In all cases, monopolar thresholds and comfort levels are substantially lower than their bipolar stimulation counterparts. In terms of speech perception, early results indicate that in some cases a monopolar condition results in improved speech perception. In none of the subjects investigated to date did the twenty-channel monopolar configurations result in a reduction of speech perception scores. In general, the twenty-channel monopolar conditions resulted in superior performance when compared to the ten-channel monopolar conditions. Subjectively, some patients prefer the sound quality associated with monopolar stimulation. To date, there have been no adverse effects associated with the surgical procedure or with any of the stimulation modes available with the 20+2L lateral wall cochlear implant.

OBJECTIVES:

1. To provide information about a new cochlear implant with a titanium-anchored apical lateral cochlear wall electrode in addition to the scala tympani electrode array and a receiver-mounted ground electrode.
2. To provide information regarding threshold and comfort level differences between two monopolar and a standard bipolar stimulation mode.
3. To provide information regarding speech and phoneme recognition with different monopolar and bipolar modes of stimulation.

* Supported in part by NIH Grant #5 RO1 DC 01851-02

THE CLARION MULTI-STRATEGY COCHLEAR IMPLANT: SURGICAL TECHNIQUE, COMPLICATIONS, AND RESULTS

Anil K. Lalwani, M.D., Jannine B. Larky, M.A., C.C.C/A. ,
Karen Kwast, M.D., C.C.C./A., Robert A. Schindler, M.D.

In August, 1996, the Clarion Multi-Strategy Cochlear Implant received FDA market approval for use in post-lingually deafened adults. Introduced in 1991, this device presented significant advances in electrode design, speed of the internal processing unit, and speech processing strategies, and incorporated two-way telemetry to assess device function. Further, the Clarion cochlear implant offers options in stimulation mode, waveform, and temporal distribution of the signal, unavailable in previous generation cochlear implants.

One of the first centers to implant the Clarion device, our institution is currently the largest Clarion cochlear implant center in the United States with a total of 41 adult users. Of these, three had their previous non-functioning cochlear implant explanted and replaced with the Clarion device. In all but one case full electrode insertion was obtained. Surgical technique is similar to that of other implants but is modified to accommodate some of the unique features of the Clarion device such as the curvilinear electrode array: a more generous facial recess and a larger cochleostomy is required for the use of the specially designed electrode inserter. Surgical complications were minimal and included two instances of delayed onset facial palsy resolved with steroid therapy, and one reseating of internal cochlear stimulator due to migration. No patient has experienced device extrusion, device malfunction, wound infection or dehiscence or flap-related problems. Significant improvement in speech understanding was observed in the majority of adult implant recipients within the first six months of device use. Specifically, at six months, scores on CID Sentences (implant alone) improved from a pre-operative mean of 8% to a mean of 70% and scores on the NU-6 monosyllabic word test increased from a pre-operative mean of 3% (range 0 to 20%) to a mean of 34% (range 0 to 80%). More than three quarters (77%) of the adults were able to understand 50% of the sentences over the telephone, and half were able to understand 80% of the sentence material.

In summary, our institutional experience with Clarion Multi-Strategy Cochlear Implant demonstrates minimal surgical morbidity and significant improvement on all open-set test measures of sentence and word recognition.

OBJECTIVES:

1. To highlight the unique aspects of and the differences in the surgical technique compared with other implants such as the requirement of a more generous facial recess, larger cochleostomy, and the use of an electrode introducer.
2. To discuss the surgical complications associated with the Clarion Multi-Strategy Cochlear Implant.
3. To discuss the rehabilitative outcome with the Clarion Multi-Strategy Cochlear Implant.

5.

COCHLEAR IMPLANTATION AFTER LABYRINTHECTOMY

George W. Facer, M.D., Robert H. Brey, Ph.D. Ann Peterson, M.D.

Several reports have shown that patients who have had a previous transmastoid labyrinthectomy can be electrically stimulated by transtympanic promontory technique. It has not been demonstrated that a patient with a previous transmastoid labyrinthectomy will be able to perform with a cochlear implant. A patient who underwent a previous complete transmastoid labyrinthectomy and had an absence of measurable cochlear function bilaterally will be presented. The use of intraoperative electrical auditory brainstem response will be emphasized and the postoperative results with a cochlear implant will be discussed.

OBJECTIVES:

1. To be able to discuss the indications for cochlear implantation.
2. To be familiar with and discuss evaluation and testing prior to cochlear implantation.
3. To be aware of and discuss the intraoperative evaluation of a cochlear implant patient.

LANGUAGE ACQUISITION IN PRELINGUALLY DEAF CHILDREN WITH COCHLEAR IMPLANTS*

Richard T. Miyamoto, M.D., Mario A. Svirsky, Ph.D.,
Amy M. Robbins, M.S., Karen Iler Kirk, Ph.D.

Language acquisition is one of the most important outcome measures for cochlear implantantion of prelingually deaf children. However, quantifying the added benefit provided by a cochlear implant over the language gains expected from maturation is difficult. In order to address this issue, language skills were assessed in two groups of prelingually-deafened children using the Reynell Developmental Language Scales (RDLS). A control group of 89 unimplanted deaf subjects were analyzed cross-sectionally to establish the language progress that would be expected as a result of maturation. Chronological age was plotted against language age and the r2 of the regression was 0.53 which is statistically significant. The slope was 0.42 which is equivalent to approximately five month's language growth over a one year period. Mean longitudinal language scores for 23 prelingually deaf children who received cochlear implants was then calculated. The language growth in the implanted children exceeded the language growth of deaf children without implants. Although the implanted children were initially behind in their language skills, their rate of acquisition of language was comparable to normal hearing children. During this study the children with cochlear implants did not reach a plateau indicating that continued longitudinal studies are needed. The language data will also be compared to speech perception and speech production data.

OBJECTIVES:

1. To describe the measurement of language acquisition as an an outcome measure in prelingually deaf children with cochlear implants.
2. To describe the method of estimating language growth expected as a result of maturation.
3. To present language results in a population of cochlear implant recipients who have been followed longitudinally.

*Supported by NIH-NIDCD

LONG TERM RESULTS REGARDING SOCIALIZATION, REHABILITATION, AND EDUCATION IN CHILDREN WITH COCHLEAR IMPLANTS

M. Suzanne Hasenstab, Ph.D., F.A.A.A., Wesley D. Vander Ark, M.D.
Shawn K. Kastetter, M.A., C.C.C..A., Jon E. Isaacson, M.D.

Cochlear implants have been shown to be an effective rehabilitative option for both adults and children with profound sensory neural hearing loss. The impact and effect of these implants have been studied over the past 30 years with multiple technological advances and new generations of implants. The main objective has been to help individuals who are profoundly deaf to function more easily in society. The 1995 NIH Consensus Conference Statement on Cochlear Implants states that the impact of implants on adults has been excellent with less dependency and loneliness and improved social integration. However, no large series has been done to look at the social, educational, and rehabilitative effect of these implants on children.

Through the cooperation of Cochlear Corporation, we mailed a survey of 25 questions to parents of 3,000 children implanted with the Nucleus 22 channel implant over the past 10 years at centers in the United States and Canada. The questionnaire addressed the educational level, rehabilitative services, and socialization of these children in their environment after implantation. Descriptive analysis was performed on the collected data to elucidate the impact the cochlear implant has on the lives of patients who received them and to help guide future rehabilitative efforts.

OBJECTIVES:

1. To review the literature concerning socialization, rehabilitation, and education of children who have had cochlear implants over the last 10 years.
2. To present information regarding follow up services, socialization, and educational outcomes of pediatric cochlear implant patients based on the results of a national survey.
3. To draw conclusions to help guide rehabilitative services and social integration of children who receive cochlear implants.

8.

EXPANDING CRITERIA FOR PEDIATRIC COCHLEAR IMPLANTATION*

Susan B. Waltzman, Ph.D., Noel L. Cohen, M.D.

In 1990 the FDA approved the use of the Nucleus multichannel cochlear implant for children age 2 years and older, who derived no substantial benefit from amplification. The only children approved for implantation below the age of two, for this device and subsequent multichannel devices, were those who were deafened due to meningitis and had actual or impending obstruction of the cochlea by labyrinthitis obliterans. The primary concerns prohibiting implantation below the age of two were based on several concerns: a questionable ability to establish definitive ear specific information confirming a bilateral profound sensorineural hearing loss, an insufficient length of time to demonstrate lack of progress with conventional sensory aids and possible surgical complications related to skull size and future growth. Recently, the high level of performance achieved by some young implantees, increased surgical experience and audiological diagnostic techniques have caused clinicians to re-evaluate the lower age limit for implantation. The purpose of this study was to determine the viability of implanting children below the age of two years and to assess their postoperative performance.

Ten profoundly deaf children between the ages of 16 and 23 months were implanted with the Nucleus multichanel cochlear prosthesis. Eight children were congenitally deaf and two children were deafened due to meningitis. The nature and extent of the hearing loss was confirmed with ear specific behavioral audiograms and/or frequency specific auditory evoked potentials obtained bilaterally. All subjects had trial periods with appropriate amplification associated with habilitation. The length of implant usage ranges from 3 mos-5yrs. In addition to audiograms obtained under earphones, auditory evoked potentials, and sound field audiograms with and without amplification, the following tests were administered preoperatively and postoperatively: ESP, NU-CHIPS, GASP words and sentences, PBK words and phonemes and Common Phrases. A score of 0% was assigned when the test was not administered due to a subject's inability to comprehend the task. Statistical analyses were performed to determine differences between preoperative and postoperative performance in all areas of auditory skills.

Results indicate significant improvement for mean scores on all closed and open-set speech perception measures. Upon inspection, the individual data appear to reveal a trend towards more rapid progression of auditory skills than have been noted with older subjects. Similarly, and not unexpectedly, the emergence of baseline receptive and expressive language skills is evidenced earlier in this age group. Surgical complications have been rare, minor and fewer in number than in older children.

Although these results are very promising, caution must be exercised in terms of blanket recommendations regarding the implantation of children below two years of age. Criteria for implantation should include the ability to obtain ear and frequency specific information and a cochlear implant team experienced in all facets of implantation in children including assessment, surgery, programming and habilitation.

OBJECTIVES:

1. To determine the viability of implanting children below two years of age.
2. To determine the level, nature and progression of the postoperative performance and compare them to older children.
3. To examine the nature and extent of the surgical complications.

* Supported by NIH NIDCD# 55P50DC00178 and the Oberkotter Foundation.

SPEECH RECOGNITION PERFORMANCE OF OLDER CHILDREN WITH IMPLANTS

Mary Jo Osberger, Ph.D., Sue Zimmerman-Phillips, M.S.,
Lisa Geier, M.S., Mary Barker, M.A.

Although the current trend is to implant children at younger ages, older children are still referred for implants. This study examined the speech recognition skills of 25 prelingually deafened children, implanted between the ages of 5 and 15, with the CLARION Multi-Strategy cochlear implant. Ten of the subjects were implanted after age 9. Tests of closed- and open-set speech recognition were administered to the subjects preoperatively while wearing hearing aids and at 3- and 6-months postoperatively while using the Continuous Interleaved Sampler (CIS) strategy in their processors. The mean score on the ESP Monosyllable Word Identification test improved from 22% preoperatively to 56% at the 3-month postoperative interval, and to 70% at the 6-month post-operative interval. Three-months postoperatively, 57% of the subjects demonstrated substantial open-set speech recognition abilities (i.e., score _50% on GASP Words). Six-months postoperatively, 68% of them demonstrated substantial open-set speech recognition on the GASP Words. On the most difficult test in the battery, the PB-K test, consisting of phonetically balanced monosyllable words, 50% of the children demonstrated some open-set speech recognition (i.e., score _ 4%) after 3-months of implant use, and 67% of them demonstrated open-set speech recognition on the PB-K test after 6-months of implant use. These results suggest that older children, including prelingually deafened adolescents, can derive substantial benefit from the current implant technology. Previous conclusions regarding the performance of children implanted at older ages need to be re-examined in light of the technology that was available at that time. As implant technology continues to improve, there is a need to re-examine and modify existing candidacy criteria.

OBJECTIVES:

1. To present speech perception data for children implanted with Clarion Implant between ages 5-15.
2. To examine changes in performance over time.
3. To discuss results relative to changing implant criteria.

10.

GENE ASSOCIATION STUDIES IN OTOSCLEROSIS*

Michael J. McKenna, M.D., Arthur Kristiansen, M.D.,
Mary L. Bartley, R.N., Jonathan L. Haines, Ph.D.

Otosclerosis is among the most common causes of acquired hearing loss in the general population. There is a well-established genetic predisposition with approximately fifty percent of cases occurring in individuals with other known affected family members. However, the nature of the genetic etiology is complex and has not been well-defined. For complex diseases a combination of statistical and molecular genetic techniques can be used as tools to find the underlying genes. We have instituted a comprehensive effort to identify and collect families with multiple affected members in an attempt to identify the gene or genes involved in the development of otosclerosis. Ultimately, once an adequate number of informative pedigrees has been obtained, a random linkage analysis will be conducted.

While our family ascertainment continues, we are focusing on examination of specific candidate genes for statistical association with otosclerosis. To date we have examined COL 1A1, COL 1A2, and COL 2A1. In each case, we tested approximately 75 independent cases and 75 controls for polymorphisms within the genes. There were no statistically significant differences in allele frequencies between the cases and controls for COL 1A2 or COL 2A1. However, we did find an initial interesting result with COL 1A1. We tested a two allele PCRable RFLP. In controls, the allele frequencies were: 1=0.14, 2=0.86. In the individuals with clinical otosclerosis, the frequencies were 1=0.23, 2=0.77. The chi-square test was significant (p=.01). We thus genotyped two additional PCRable RFLPs in this gene. The second polymorphism was also significantly different (Otosclerosis: 1=0.77, 2=0.23: Controls 1=0.88, 2=0.12: P=0.001) as was the third (Otosclerosis: 1=0.44, 2=0.56,: Controls 1=0.27, 2=0.73, P=0.001). We are currently examining the data for haplotype frequencies between three polymorphisms. These data suggest a role for COL 1A1 in otosclerosis.

OBJECTIVES:

1. To review pathologic factors involved in the development of otosclerosis.
2. To present new data on molecular genetic analysis of otosclerosis.
3. To review evidence for COL 1A1 gene and its' role in the development of otosclerosis.

*Supported by NIH grant #K08 DC00065

STAPES MOVEMENT: COMPLEX RATHER THAN PISTON-LIKE

Kurt E. Heiland, M.D., Richard Goode, M.D., Alex M. Huber, M.D.

It is assumed that the human stapes moves like a piston. This study was designed to determine whether stapes movement is piston-like or complex. The human ossicular chain has a great deal of inefficiency. Knowledge regarding possible wasted movement at the level of the stapes footplate would be useful in middle ear reconstruction for chronic ear disease.

Using ten freshly harvested human cadaver temporal bones, three targets were placed on the stapes footplate through an extended hypotympanotomy. The targets were 0.5mm pieces of reflective adhesive material positioned on the long axis of the footplate at the anterior crus, central footplate and posterior crus. They were tracked over the frequency range of 200Hz to 10,000Hz using a sound generating program and a sophisticated laser Doppler vibrometer measuring system. This measuring system is well described in the literature as a useful and accurate device for the study of middle ear mechanics. Displacement and phase of three targets on the footplate were plotted against frequency at a 90dB sound pressure level input at the eardrum. A 486 personal computer calculated overall footplate displacement as well as the rocking movement of the footplate long axis over the 360 degree phase shift of representative cycles.

Stapes movement is clearly complex. At lower frequencies piston-like movement exceeds rocking; however, rocking movement increases with frequency. At 6,000Hz ricjubg nivenebt overcomes in and out translational displacement. Rocking movement is considered a relatively inefficient movement. The clinical application of this data is in ossicular replacement prosthesis design to better stabilize the stapes, minimize rocking and maximize piston-like movement. This would aid the otologist in closing the air bone gap through more effective transfer of acoustic energy to the cochlea and will be discussed in the paper.

OBJECTIVES:

1. To demonstrate that human stapes movement is complex rather than piston-like.
2. To propose that rocking stapes movement is part of a protective mechanism in the middle ear to prevent acoustic trauma.
3. To apply this new knowledge regarding stapes movement to the design of better ossicular replacement prostheses.

12.

EARLY POST-LASER STAPEDOTOMY HEARING THRESHOLDS

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Hypothesis: Laser stapedotomy may routinely depress auditory thresholds in the immediate postoperative period.

Background: Auditory testing is not routinely performed within 4 to 6 weeks after stapedotomy, because hearing acuity is thought to be transiently depressed. In rare circumstances, post-surgical auditory and vestibular complaints may lead one to test hearing. The early postoperative effects of CO_2 and KTP lasers, which are now routinely used to perform stapedotomies have not been reported. The purpose of this report is to present normative data for auditory thresholds within 2 weeks of laser stapedotomy.

Methods: Audiometry was performed using standard techniques preoperatively, $\leq$ 14 days and > 30 days postoperatively. Five surgeons enrolled patients at 3 academic centers.

Results: Thirty-six patients were enrolled. Nine cases were revision procedures. The CO_2 laser was used in 24 procedures and the KTP laser was used in 12. Bone conduction pure tone averages and speech discrimination scores did not worsen during the early postoperative period. Bone conduction at 4000 Hz dropped slightly within the first week (-6.7 dB, $p = 0.019$) but recovered thereafter. Bone conduction at 1000 Hz actually improved within the first week postoperatively (+6.2 dB, $p = 0.021$). Improvement in air conduction thresholds (and air-bone gap) were not appreciated until the late (>30 days postoperatively) audiogram. The results for CO_2 and KTP laser-treated groups were not significantly different.

Conclusions: Cochlear function is not significantly depressed in the early postoperative period following laser (CO_2 or KTP) stapedotomy. Degradation of bone conduction scores or speech discrimination within the first 2 weeks after stapedotomy may indicate a departure from the normal postoperative course.

OBJECTIVES:

1. To evaluate hearing in ears recently treated with laser stapedotomy.
2. To compare the effects of KTP and CO2 laser stapedotomy on early postoperative hearing.
3. To review the clinical implications of the early postoperative audiometric data.

13.

LASER STAPEDOTOMY MINUS PROSTHESIS

Herbert Silverstein, M.D.

The stapes mobilization procedure as described by Rosen in 1952 was abandoned primarily because of frequent refixation of the stapes footplate resulting in recurrent conductive hearing loss. Stapedotomy or stapedectomy with the placement of a prosthesis has become the primary surgical treatment for otosclerosis throughout the world.

Meyers showed in a temporal bone study that a fractured footplate that was not involved with otosclerosis heals by fibrous union across the fracture line and remains mobile. In light of this finding, it was felt that in cases where the otosclerotic focus was confined to the fissula antefenestru, the otosclerotic focus could be isolated and the stapes could be mobilized using the laser.

Using an Argon laser with a hand-held probe, the anterior crus of the stapes is cut and the footplate is bisected in a linear fashion across its anterior portion. This allows the posterior portion o f the stapes to become completely mobile. If the stapes does not become mobile, the stapedotomy can be enlarged and a prosthesis placed in the usual manner. Patients understand that there is a chance the stapes may come refixed in the future and a stapedotomy with prosthesis will be required.

Initial results of twelve patients have been excellent. Eight patients demonstrated complete closure of air-bone gap, four patients had closure of air-bone gap to within 10 dB. In this report, the technique and results of stapedotomy minus prosthesis over a 1.5 year period is presented.

OBJECTIVES:

1. To show that when there is minimal stapes fixation secondary to localized otosclerosis at the fissula antefenestrum, the laser can be used to mobilize the stapes without the use of a prosthesis.
2. To show that hearing results are comparable to conventional stapes procedures without the associated risks of using a prosthesis.
3. To show in a seven year post-operative histologic temporal bone study that a fractured footplate not involved by otosclerosis heals by fibrous union.

14.

FORTY YEARS OF STAPES SURGERY

John J. Shea, Jr., M.D.

This report will detail my results performing 14,449 stapedectomy operations during the forty years since the first stapedectomy. For this report, 100 or more patients were selected at random from each of the forty years, for a total of 5,444 operations.

Primary stapedectomy was performed on 4137 (76%) ears and revision on 1307 (24%) ears. The most commonly used prosthesis was the original Teflon piston, in 3192 (58.6%) operations. The oval window was sealed by vein in 2972 (54.6%) ears, by the lining membrane of the middle ear in 1375 (25.3%) ears, by gelfoam in 478 (8.8%) ears, by perivenous loose connective tissue in 396 (7.3%) ears and by other material in 223 (4.1%) ears. The entire footplate was removed in 1575 (29.2%), and half or less of the footplate in 3812 (70.8%).

Using 500, 1000 and 2000 Hz, the criteria of success were defined as an air-bone gap closure to 10 dB or less, and no decline in the postoperative discrimination score of > 10%. In the primary stapedectomy group, success was achieved in 95.1% of ears with a follow-up for 1 year, in 94.7% of ears followed for 1-5 years, 89.9% for 6-10 years, 79.8% for 11-20 years, 74.1% for 21-30 years, and 62.5% for > 30 years. In the revision group, success was obtained in 71.1% of ears followed for 1 year, in 62.4% for 1-5 years, and in 59.4% for 1-36 years. The success rate using vein as the oval window seal was 87.8%, using lining membrane of the middle ear was 89.7%, using perivenous loose connective tissue was 88.7% and using gelfoam was 80.3%. The causes of delayed conductive hearing loss were dislocation of the prosthesis in 41.5% of ears, eversion of the lining membrane of the vestibule, with or without erosion of the lower incus in 26.3% of ears, bony and/or fibrous closure of the oval window in 15.7% of ears, epitympanic fixation of the incus and/or malleus in 14.3% of ears, and other causes in 2.2%. Complications included complete sensorineural hearing loss in 34 (0.6%) ears, perilymph leak in 14 (0.25%) ears, tympanic membrane perforation in 10 (0.18%) ears, and temporary facial nerve paralysis in 4 (0.07%) ears.

Over time, gradual decline in cochlear function occurs in about 30% of patients, who still retain closure of the air-bone gap, due to invasion of the cochlea by the otosclerotic focus. This is sensorineural hearing loss in excess of that to be expected with age.

Better results, with almost no complications, have been achieved in recent years with better audiometry, anesthesia, and removal of the posterior half of the footplate with the hand-held argon laser probe, vein graft oval window seal and platinum Teflon cup piston.

OBJECTIVES:

1. To present the results with stapedectomy in a large series of patients with various techniques during the last forty years.
2. To present the technique I now use as giving the best results achieved during this 40-year experience.
3. To explain the causes of failure and complications and the best ways to avoid them.

15.

THE PROTECTIVE ASPECTS OF BRAIN DERIVED NEUROTROPHIC FACTOR (BDNF) DURING GENTAMICIN OTOTOXICITY*

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Karl Beykirch, M.S., Paul Mycevich, Ph.D.

The question was investigated in vivo for the first time, of whether BDNF influences the spontaneous process of hair cell regeneration following gentamicin (GM) ototoxicity. For this purpose, a study was made on five experimental groups of animals, using the chinchilla as the model.

EXPERIMENTAL GROUPS: Group I - The normal number of type I and II hair cells were counted in the normal horizontal semicircular canal crista using the disector method (N=5). For other groups, dosages were consistent, i.e., 0.05mg of GM and 1ug of BDNF. Group II-GM was applied intraotically to induce ototoxicity. Counts of hair cells were performed following hair cell damage and recovery at four different times post treatment of 1,2,4 and 8 weeks with three animals each time. Two additional groups of animals were treated and evaluated as in Group II after treatment with GM and BDNF. Group III-GM and BDNF were applied simultaneously. Group IV-GM was applied first, followed one week later by BDNF. Morphological observation and quantification of hair cells were made for each treatment condition as in Groups I and II. Group V-The effect of BDNF alone was evaluated in another group (N=4) at three weeks post treatment.

RESULTS: The effect of GM on the animals in Group II resulted in complete loss of type I hair cells (normal = 3174+/-145) and loss of type II hair cells to 15% of normal at one week post treatment (normal=2725=+/-296). The recovery began after two weeks. It reached 85% of normal for type II hair cells but only 3% for type I hair cells at four weeks post treatment. In Group III, the simultaneous treatment with BDNF prevented the ototoxic effect of GM on type II hair cells and diminished the effect in type I hair cells (23% of normal) at one week post treatment. There was a delay in the ototoxic effect with 22% type II hair cell loss at two weeks post treatment. In Group IV, the treatment with BDNF one week after GM, accelerated the rate of recovery of both type I and II hair cells. At two weeks post treatment, the number of type II hair cells was 81%of normal vs. Only 5% without BDNF. The final level of recovery was also greater (104% of normal). In Group V, treatment with BDNF alone did not influence the number of hair cells.

CONCLUSION: The trophic factor BDNF minimizes the ototoxic effect of GM. There are two possible mechanisms: I) prevention of GM ototoxicity as observed in Group III, and ii) accelerated regeneration as observed in Group IV. In spite of complete destruction of hair cells from GM one week post treatment, there was accelerated recovery to 81% of type II hair cells at two weeks due to the treatment of BDNF. The estimated rate of recovery was approximately 257 hair cells per day.

OBJECTIVES:

1. To document the phenomenon of vestibular hair cell regeneration after gentamicin ototoxicity in mammals.
2. To demonstrate the effect of brain derived neurotrophic factor (BDNF) on regeneration process of vestibular hair cells.
3. To demonstrate the potential therapeutic role of trophins to prevent or repair hair cell damage.

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16.

EFFECT OF PROTECTIVE AGENTS AGAINST CISPLATIN OTOTOXICITY*

Leonard P. Rybak, M.D., Ph.D., Satu M. Somani, Ph.D.

Cisplatin is an important antineoplastic agent which has been proven effective against head and neck tumors, testicular and ovarian carcinomas and a variety of other malignant neoplasms. Although one major dose-limiting side effect, nephrotoxicity, can be minimized by hydration, administering mannitol and other protective agents, ototoxicity continues to be a significant side effect. The present study was designed to compare the relative efficacy of three protective agents against cisplatin ototoxicity in the rat. Forty-nine male Wistar rats 250-350g received an intraperitoneal infusion of 16 mg/kg of cisplatin. Group I received no protective agent. Group II was treated with diethyldithiocarbamate (DDTC) 600 mg/kg subcutaneously one hour after cisplatin. Group II was administered 4-methylthiobenzoic acid (MTBA) 250mg/kg thirty minutes before cisplatin. Group IV animals were given ebselen 16 mg/kg i.p. one hour before cisplatin. Auditory brainstem responses (ABRs) were elicited before and 72 hours after treatment. ABR thresholds were determined using 100 microsecond clicks and 10 millisecond tone bursts at 4,8,16 and 32 kHz, delivered with an insert microphone. Group I animals had significant elevations of ABR thresholds (30-40dB) compared to pretreatment values. Animals in Groups II-IV had significantly lower ABR threshold shifts of less than 10 dB. Cochleas were removed and extracts of the tissues were analyzed for glutathione (GSH), activities of antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase, and glutathione reductase), and malondialdhyde (MDA). Cisplatin treated animals had significant reduction of the cochlear GSH content accompanied by an elevation of MDA and alteration of antioxidant enzyme activities. These changes were attenuated in Groups II-IV. These findings suggest that cisplatin ototoxicity is related to lipid peroxidation, and that the use of protective agents prevents lipid peroxidation by sparing the antioxidant system in the cochlea. These results suggest that the clinical use of protective agents could effectively prevent damage to the inner ear of patients treated with cisplatin, provided that the antitumor effect is not altered.

OBJECTIVES:

1. To demonstrate the role of the antioxidant system in experimental cisplatin ototoxicity.
2. To show the efficacy of several protective agents against cisplatin ototoxicity.
3. To suggest the clinical utility of potential protective agents in ameliorating hearing loss from cisplatin.

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CHOLESTEATOMA: A MOLECULAR AND CELLULAR PUZZLE

Anthony P. Albino, Ph.D., Simon C. Parisier, M.D.

Cholesteatomas can result from several specific insults: (I) negative middle ear pressure or inadequate ventilation, (ii) ingrowth of keratinizing epithelium at the margin of a perforation, (iii) invagination of the tympanic membrane in the form of a retraction pocket, and possibly (iv) metaplasia of the middle ear mucosa or tympanic membrane epithelium. However, the specific biological programs induced by these insults, as well as the molecular and cellular defects that result in the clinical hallmarks of acquired and congenital cholesteatomas, are unknown. The focus of our ongoing research is to determine the existence of defects in the normal biology, biochemistry, and genetic complement of the major cellular constituents comprising a cholesteatoma (i.e., fibroblasts and keratinocytes). This knowledge will be critical in answering a number of important questions for which we have as yet no satisfactory answers. For example: (1) What are the specific molecular and cellular defects that explain each clinical feature of cholesteatomas (i.e., invasion, migration, uncoordinated proliferation, altered differentiation, aggressiveness, and recidivism)?; (2) Are the different types of cholesteatomas (i.e., acquired, congenital, and recidivistic) also different at the molecular and cellular levels?; and (3) How can this knowledge be useful in a clinical setting?

Prior to resolving the molecular basis for the pathogenesis of cholesteatomas, it is important to first present plausible models that could explain how a cholesteatoma becomes invasive, migratory, hyperproliferative, aggressive, and recidivistic. Although these biological phenomena can be treated as individual events in the discussion of a model system, several of these traits are probably inseparably linked *in vivo*. There are at least four possible molecularmodels of cholesteatoma pathogenesis: (1) low-grade squamous neoplasia; (2) defective wound healing;; (3) pathologic collision of the host inflammatory response, middle ear epithelium, and a bacterial infection; and (4) unknown idiopathic process.

Our analysis to date supports several suppositions concerning the pathobiology of cholesteatomas. First, cholesteatoma epithelium behaves more like a wound healing process than a neoplasia. The available evidence to date does not indicate that cholesteatomas have inherent genetic instability, a critical feature of all malignant lesions. Second, the induction of hyperproliferative cells in all layers of the cholesteatoma epidermis implicates a potential idiopathic response to both internal events as well as external stimuli in the form of cytokines released by infiltrating inflammatory cells. Third, the presence of bacteria may provide a critical link between the cholesteatoma and the host which prevents the cholesteatoma epithelium from terminating specific differentiation programs and return to a quiescent state in which it becomes minimally proliferative, nonmigratory, and noninvasive. Fourth, none of our data suggests that there are any obvious molecular or cellular differences between the various types of cholesteatomas, i.e., primary and secondary acquired, recidivistic, and congenital. Continued research should delineate the precise molecular and cellular dysfunctions involved in the pathogenesis of cholesteatomas and how this knowledge can be useful in the clinical management of cholesteatomas.

OBJECTIVES:

1. To discuss the molecular and cellular defects that may result in the clinical features of cholesteatomas: invasion, migration, uncoordinated proliferation, altered differentiation, aggressiveness, and recidivism.
2. To discuss our hypothesis that cholesteatoma epithelium behaves more like a wound healing process than a neoplastic one.
3. To discuss data that suggest there are no obvious molecular or cellular differences between the various types of cholesteatomas, i.e., primary and secondary acquired, recidivistic, and congenital.

18.

CYTOTOXICITY OF CYTOKERATIN MONOCLONAL ANTIBODIES AGAINST KERATINOCYTES--A POSSIBLE THERAPEUTIC ADJUNCT FOR CHOLESTEATOMA?

Moises A. Arriaga, M.D., Patti Dixon

Despite elegant surgical procedures for cholesteatoma, residual disease is an important clinical problem. Although gross cholesteatoma removal is usually feasible, microscopic foci of residual keratinocytes may develop into clinically significant disease. This study was designed to evaluate the keratinocyte cytotosicity of monoclonal antibodies directed against cytokeratin subtypes relatively unique to cholesteatoma.

Keratinocytes, skin fibroblasts, and endothelial were trypsinized, counted and seeded in 96 well plates. Cells were exposed to mouse monoclonal antibody to cytokeratin 10 at dilutions of 1:10, 1:25, 1:50, 1:100 and 1:200 with 4 to 6 replicates. After 24,48, 72 and 96 hour incubation, cells that had been pulsed with 3H-thymidine were harvested. Cellular DNA was processed for quantification of 3H-thymidine incorporation with a beta counter. Cells exposed to antibody are reported as percent inhibition relative to controls.

Inhibition ranged from 88.9% for the 1:10 concentration to 14.9% for 1:200. This effect was significantly more pronounced than the effect on skin fibroglasts and endothelial cells. These results suggest that monoclonal antibodies have in vitro cytotoxicity against keratin subtypes. Additional investigation should be pursued with a goal to developing a clinically useful biological adjunct for cholesteatoma management.

OBJECTIVES:

1. To discuss theoretic basis of biological adjunct for cholesteatoma treatment.
2. To present experimental data of cytotoxicity of keratinocytes by monoclonal antibodies to cytokeratin.
3. To discuss research direction for developing clinically useful biological adjuncts.

19.

INTRATYMPANIC GENTAMICIN FOR THE TREATMENT OF MENIERE'S DISEASE

Dennis S. Poe, M.D., Tarek F. Youseff, M.D.

Numerous different protocols using gentamicin sulfate injections have been used with varying success in the control of vertigo spells in Meniere's Disease. Reports of significant hearing loss remain a major disadvantage. We have treated a total number of 123 Meniere's cases with introtympanic gentamicin using four separate protocols, including insertion of soaked gelfoam pledgets through a myringotomy, or transtympanic injections and varying the medication dwell time from 30 to 60 minutes. We selected as optimal, a protocol that injected a concentration of 30 mg/ml through an anesthetized tympanic membrane to fill the posterior mesotympanum and kept the patient supine for 45 minutes. A second injection would be planned for approximately one week later and subsequent doses would be given only in the event of new vertigo spells, attempting to titrate the dose and minimize hearing loss.

48 patients treated under this later protocol between July, 1993, to December, 1995, are now eligible for reporting under the 1995 criteria of the Committee on Hearing and Equilibrium Guidelines for Meniere's disease. The number of injections ranged from 1-6, depending on patient response, 8% received one injection, 2 injections - 54%, 3 injections - 6%, 4 injections - 13%, and 6 injections - 19%. 27 patients (56%) had complete relief of vertigo spells, 13 (27%) had substantial recovery, 3(6%) had insignificant improvement, 4(8%) were treatment failures, and one (2%) was worse. Hearing results analysis was performed on 45 patients, excluding three for pre-treatment anacusis. 28 patients (62%) had no change or hearing improved, 10 (22%) had an average threshold shift of 10-20 dB, 5(11%) had a threshold shift between 21-40 dB, one (2%) had a threshold shift greater than 40 dB, and one (2%) developed anacusis.

The overall rate of substantial relief of vertigo was 83% with significant hearing loss in 15%. The relief of vertigo was not as high as other published series but the rate of hearing loss was substantially better. We recommend titrated intratympanic injections as one of the options available to patients with Meniere's disease that have failed to respond adequately to aggressive medical management.

OBJECTIVES:

1. To establish the efficacy for intratympanic Gentamicin on relief of Meniere's vertigo spells.
2. To establish the effect of intratympanic Gentamicin on hearing loss.
3. To discuss the inverse relationship of vertigo treatment and secondary hearing loss to optimize therapy.

20.

THE ROLE OF ENDOLYMPHATIC MASTOID SHUNT SURGERY IN THE MANAGED CARE ERA

Myles L. Pensak, M.D., Rick A. Freidman, M.D., Ph.D.

The management of Meniere's disease remains controversial with few procedures engendering as much debate amongst otologists as the decompression or shunting of the endolymphatic sac. Moreover, in a managed care environment wherein outcomes measurement, cost effectiveness, and procedural efficacy must be demonstrated, the surgeon can no longer rely on anecdotal or empirical observation regarding the efficiency of a treatment paradigm.

This report reviews the control of vertigo obtained in 96 patients undergoing endolymphatic mastoid shunt surgery with a minimal follow-up of 5 years. All patients in this series either refused destructive procedures or did not meet clinical or electrophysiologic criteria for vestibular nerve section or labyrinthectomy. Employing an anatomic classification system patients with a Type I endolymphatic sac achieved 68% control of vertigo, those with a Type II endolymphatic sac had a 92% control rate and patients with a Type III endolymphatic sac achieved 78% relief. No Type IV sacs were identified. Based upon an assessment of outcome variables the authors conclude that there remains a definite role for endolymphatic shunt surgery in the contemporary approach to patients with Meniere's disease.

OBJECTIVES:

1. To review, from a historic context, the controversy surrounding Endolymphatic mastoid sac surgery.
2. To identify outcomes criteria that can be standardized amongst patients and treatment protocols.
3. To provide data that supports the role of EMS in contemporary management strategies.

21.

THE ACUTE EFFECTS OF HEMODIALYSIS ON THE INNER EAR

Jeffrey J. Dyer, M.D., Barry Strasnick, M.D.,
John T. Jacobson, Ph.D., Claire A. Jacobson, M.S.

Considerable controversy exists in the literature regarding the sensitivity of the cochlear and retrocochlear structures to local hemodynamic change. Over the past two decades, patients undergoing long-term hemodialysis have been noted to suffer a 15 to 40 percent incidence of permanent sensorineural hearing loss. A prospective study was therefore undertaken to determine whether the hemodynamic stress of dialysis would lead to acute inner ear manifestations as measured by auditory brainstem response. Forty-five subjects (88 ears) were examined for latency shifts produced acutely during and after dialysis. Twenty of eighty-eight ears (23%) were noted to exhibit significant latency shifts during a single dialysis session, 44% of whom were noted to undergo at least partial recovery within minutes after discontinuation of hemodialysis. No significant difference in acute recovery was observed between the short-term and long-term dialysis patients, nor were significant differences noted when patients were subclassified based on serum electrolyte and hematocrit values. These findings suggest that repeated, acute hemodynamic insult may contribute to insidious hearing loss in this patient population, regardless of how adept the cochlear pathways are to hemodialysis. Further study appears warranted to evaluate the long-term sequelae of such hemodynamic variation in the inner ear.

OBJECTIVES:

1) To familiarize the audience with the controversy regarding the sensitivity of the inner ear to acute hemodynamic variation.
2) To review the results of our prospective study in defining a population at risk for sensorineural hearing loss.
3) To emphasize the importance for further study (e.g., examining long-term sequelae in these patients) and long-term patient follow-up.

22.

AUTOIMMUNE SENSORINEURAL HEARING LOSS: CLINICAL CHARACTERISTICS

Ralph A. Nelson, M.D., Donald Robertson, M.D.,
M. Jennifer Derebery, M.D., Karen I. Berliner, Ph.D.

Patients whose eventual diagnosis is autoimmune sensorineural hearing loss (AISNHL) often present with a variable picture. The diagnosis of autoimmune loss may not be made until months or even years after presentation. We reviewed charts of 93 patients we diagnosed with AISNHL presenting to a tertiary care otologic practice. The symptoms especially at presentation were more varied than expected and did not mirror the classical bilateral rapidly progressive course usually applied to AISNHL. There were also a surprising number of overlapping otologic diagnoses as well as a high number of other autoimmune diseases.

Although clinical suspicion was the primary basis for diagnosis in 52.7% of cases where this could be determined from the charts, nonspecific screening laboratory tests were often positive.

A larger sample of patients is currently being reviewed, and analyses of changes over time in the characteristics of patients who receive this diagnosis and the time to diagnosis will be presented.

OBJECTIVES:

1. To present the clinical symptoms and audiological findings suggestive of patients ultimatelydiagnosed with autoimmune sensorineural hearing loss.
2. To review which nonspecific laboratory tests were most useful in establishing the diagnosis of autoimmune sensorineural hearing loss.
3. To attempt to establish a natural history of this disease by analysis of the pattern of progression of hearing loss from the time of initial presentation.

LONG-TERM TREATMENT OUTCOMES IN AUTOIMMUNE SENSORINEURAL HEARING LOSS

M. Jennifer Derebery, M.D., Donald Robertson, M.D.
Ralph A. Nelson, M.D., Karen I. Berliner, Ph.D.

The diagnosis of autoimmune sensorineural hearing loss (AISNHL) has been historically made by the clinical history of rapidly progressive sensorineural hearing loss, often bilateral, which may be accompanied by vestibular symptoms. While some patients have recently been found to have autoantibodies to a particular antigenic epitope (heat shock protein 70), the diagnosis has been most frequently made by the presenting history and a clinical response to treatment by immunosuppressive drugs and regimens including steroids, cyclophosphamide, methotrexate, azothioprine and plasmapheresis, all of which have a potential of significant side effects. Without a known, reliable diagnostic test, the physician must at times choose between possible improvement in a potentially treatable cause of progressive sensorineural hearing loss versus the known toxicity of immunosuppressive agents.

We reviewed records of 93 patients diagnosed with autoimmune sensorineural hearing loss. The 61 females and 32 males ranged in age from 5.5 to 78.7 years, with a mean age of 46.9 years. Steroids were used for treatment in 89.2% of the cases, and 29% (84.4% of those with data available) had multiple courses. The majority (51.9%) of those treated with steroids had an initial course of 14 days and some (26.9%) had longer courses. Of those where it can be ascertained, 95% were on steroid maintenance for some period. Complications of steroids were known to have occurred in 11.8% of the entire group of patients, although only one was considered major. Minor complications occurred in 8 patients. Cataracts occurred in one patient as did bone fracture. Other complications occurred in two patients.

Fifteen percent of the cases received cytoxan, and one of these experienced intolerance or complication. Other treatments included Imuran. Plasmapheresis (5.4%), gammaglobulin (1.1%), vasodilators (52.7%), diuretics (8.6%), and other medications (11.8%) were also used. Additionally, some patients also had allergy treatment, including desensitization (7.5%) and diet (26.9%). Nearly 11% of patients underwent otologic surgery.

A larger sample of patients is currently being reviewed, and an analysis of both the long-term response to different treatment modalities, as well as the subsequent late development of side effects will be presented.

While the treatments used for AISNHL are not benign, long-term follow-up does reveal a rather low incidence of the development of side effects.

OBJECTIVES:

1. To encourage more aggressive therapy of AISNHL.
2. To show relative worth of treatment protocols.
3. To show that long-term therapy is effect ive and worthwhile.

24.

FACIAL NERVE INJURY IN CONGENITAL AURAL ATRESIA SURGERY

Robert A. Jahrsdoerfer, M.D., Paul R. Lambert, M.D.

The two most serious complications of congenital aural atresia surgery are facial nerve injury and increased hearing loss. Preoperatively, the facial nerve is the single most important concern that parents have for their child. In congenital aural atresia, the facial nerve is typically out of position in 25-30% of cases. This displacement usually involves a sharp bend at the second genu with the nerve crossing the middle ear at the level of the round window to exit into the temporomandibular joint.

In over 2,000 patients evaluated for a congenital ear malformation, we have encountered a facial nerve paralysis/paresis in 10 cases. Seven patients from over nine hundred patients operated were surgical complications of ours, while three patients had their atresia surgery elsewhere with immediate onset facial nerve paralysis. Two of these three patients subsequently underwent revision surgery by us.

The facial nerve is at risk not only from drilling the new ear canal, but also from the intial skin incision, dissecting in the temporomandibular joint, transposing the nerve in the middle ear, and from undermining the preauricular soft tissue to allign the new ear canal with the new meatus. Only in one case was the nerve inadvertently transected. This required a cable graft. In the other nine cases, recovery of facial nerve function was spontaneous and complete.

We present recommendations on how to best avoid a displaced facial nerve in congenital atresia. We also note those conditions in which the facial nerve is particularly vulnerable to injury. Discriminate, but not routine, use of facial nerve monitoring is emphasized.

OBJECTIVES:

1. To alert otologic surgeons to the fact that the facial nerve may be cut in the initial skin incision.
2. To outline anatomic areas in atresia surgery where the facial nerve is particularly vulnerable to injury.
3. To note conditions under which the facial nerve is at increased risk, i.e., cholesteatoma.

FACIAL NERVE SURGERY IN THE 19'TH AND EARLY 20'TH CENTURIES: THE CONTROVERSY BETWEEN CROSSOVER ANASTOMOSIS AND NERVE REPAIR

Saurabh B. Shah, M.D., Robert K. Jackler, M.D.

The historical aspects of facial nerve (FN) anatomy and of Bell's palsy have long been favorite topics of otological historians. However, little attention has been paid to the evolution of FN surgery, a subject with a remarkably rich and engaging history. In the early 13'th century, Roland, an Italian surgeon, used a red hot iron to coapt severed nerve endings. In the 17'th century, Ferrara, another italian, sutured injured nerves with tortoise tendon dipped in hot red wine. It was not until the late 19'th century that a peripheral nerve suture became a subject of serious scientific study. Although it is ironic, the course of events suggests that the evolution of facial nerve repair was greatly stimulated by the development of the modern mastoid operation. While the simple mastoid operation practiced by Wilde (1853) and others carried little risk of FN injury, more adventuresome procedures such as radical mastoidectomy (Kessel, 1885) carried a much greater risk. The abundance of iatrogenic palsies during this era undoubtedly did much to motivate surgeons to seek a better means of restoring facial animation. Most surgeons would be surprised to learn that crossover anastomoses pre-dated direct nerve repair by nearly half of a century. In 1879, the German surgeon Drobnik performed the first facial-spinal accessory anastomosis. Over the next 2 decades numerous articles were written (most notably by Sir Charles Balance and Harvey Cushing) on crossovers between the FN and cranial nerves IX, X, XI, and XII. While a few tentative attempts at reapproximating severed Fns took place in the first 2 decades of this century, it was not until 1925 when an actual suture repair of an intratemporal injury was undertaken. This feat was first accomplished by the famous hand surgeon Sterling Bunnel and, shortly thereafter, by the otolaryngologist Robert Martin. The evolution of FN surgery in the days predating the operating microscope is a rich tapestry of colorful personalities and clashing egos which saw promising advances relegated to obscurity, and some previously obscure techniques become progressively more promising.

OBJECTIVES:

1. To review the early history of direct facial nerve repair.
2. To review the early history of facial nerve crossover anastomoses.
3. To discuss the roots of the controversy concerning #1 & #2 in context of the personalities involved, the evolution of the surgical technology, and the development of the modern mastoid operation.

26.

ULTRASTRUCTURAL FINDINGS OF A FACIAL NERVE SCHWANNOMA

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The morphologic and histopathologic features of facial nerve schwannomas (neurilemomas) are indistinguishable from schwannomas of eighth nerve origin. Yet, the incidence of facial schwannomas is rare in comparison. The distinction of eighth nerve schwann cell vulnerability versus seventh nerve schwann cell resistance to neoplastic change can be debated. We present the ultrastructural evaluation of an intratemporal facial nerve schwannoma resected following the development of rapid paralysis. Ultrastructural comparison with 13 acoustic neuromas indicates characteristic differences of both intracellular and extracellular organization. Notable findings included: cell to cell interaction exhibiting a higher concentration of hemidesmosomes in the facial schwannoma case; a notable difference in glycogen particle content; and the identification of cellular division.

OBJECTIVES:

1. To document the ultrastructural characteristics of Facial Schwannomas
2. To compare these findings with ultrastructural findings in Acoustic neuromas.
3. To further associate the agressive nature of these lesions with the pediatric age group.

OTALGIA: AN ISOLATED SYMPTOM OF MALIGNANT INFRATEMPORAL FOSSA TUMORS

John P. Leonetti, M.D., John Li, M.D. Peter G. Smith, M.D., Ph.D.

Six hundred and fifteen patients were seen between 7/88 and 7/96 with otalgia in a normal appearing ear. A complete head and neck examination with selected radiographic studies identified 18 patients with malignant infratemporal fossa tumors including 10 patients with adenoid cystic carcinoma, 4 patients with adenocarcinoma, 2 patients with squamous cell carcinoma, and 2 patients with osteogenic sarcoma. The period between the onset of otalgia and tumor diagnosis ranged from 4 months to 21 months (average = 7.5 mo.). All 18 patients had received a variety of prior medical and/or surgical treatment for their ear pain.

A methodology is offered for the evaluation of patients presenting with otalgia in a normal appearing ear. Our experience with 18 patients with malignant infratemporal fossa tumors with otalgia as the initial presenting symptom will be shared in order to emphasize the difficulty of early tumor detection in this relatively "silent" anatomic location.

OBJECTIVES:

1. To discuss the sensory innervation of the ear with particular emphasis on related infratemporal fossa anatomy.
2. To discuss an evaluation strategy for the assessment of patients with otalgia in a normal appearing ear.
3. To review a series of 18 patients with malignant tumors of the infratemporal fossa with otalgia as the only initial presenting symptom.

28.

CLINICAL ACUMEN AND VESTIBULAR SCHWANNOMA

David A. Moffat, B.Sc, M.S., F.R.C.S.

Whilst many patients with vestibular schwannoma present with the typical history of sensorineural hearing loss, tinnitus and imbalance, a number will have only one of these symptoms and signs of an expanding cerebello-pontine angle tumour ensue. There are a significant number of patients who present atypically with mastoid aching, benign paroxysmal positional vertigo, headache or facial numbness, with minimal audiological or vestibular signs and symptoms. These patients might not be investigated by a clinician who felt that unilateral sensorineural hearing loss was a prerequisite for investigation.

This paper describes the incidence of such presenting symptoms in a series of 400 cases of vestibular schwannoma. It will also discuss the value of a good neuro-otological examination of the patient in alerting the physician with good clinical acumen to the possibility of the presence of vestibular schwannoma. The series of patients discussed has been managed with a team approach to the diagnosis and management of this condition, comprising an Otologist, a Neurosurgeon, an Audiological Scientist and a Neuroradiologist. The benefits of this in the identification of atypical presentations will be described and discussed.

OBJECTIVES:

1. To describe atypical presentations of this condition.
2. To review signs and symptoms that trigger investigation.
3. To discuss a multidisciplinary approach to this condition.

ACOUSTIC NEUROMAS PRESENTING WITH NORMAL OR SYMMETRICAL HEARING: CLINICAL FEATURES WHICH LEAD TO TUMOR DISCOVERY

Lawrence R. Lustig, M.D., Sasha Rifkin, B.S., Robert K. Jackler, M.D.

Acoustic neuroma (vestibular schwannoma) most commonly present as an asymmetrical or unilateral sensorineural hearing loss, preferentially involving the higher frequencies in its early stages. A small percentage of patients, however, will present with normal pure-tone audiometry. In these selective cases, it would be useful for the clinician to know of other common presenting features, if any which are associated with the patient with normal audiometry and an undetected acoustic neuroma. In pursuit of this goal, a retrospective review of 545 patients with acoustic neuroma was undertaken to determine presenting symptoms, signs, and factors which led to the diagnosis in this unique group of patients with acoustic neuroma. A total of 28 patients (5%) were identified who had normal or symmetrical pure-tone audiograms between 500 hz and 4000hz. The average difference in speech reception threshold was 3.2db and the average difference in speech detection score was 2.6%. The most common presenting symptoms which led to the diagnosis of the acoustic neuroma were dysequilibrium/vertigo (11 cases), cranial nerve V and VII abnormalities (10 cases), routine screening for families with NF-2 (5 cases), asymmetric tinnitus (4 cases), headaches (4 cases), unilateral subjective hearing difficulty (4 cases), and incidental finding during evaluation for another problem (2 cases). The average tumor size was 19mm, with 4 cases presenting with 30mm or larger sized tumors. 19 patients had a hearing preservation procedure (middle fossa or suboccipital), 11 of whom had useful hearing postoperatively. Thus, despite normal audiometry, patients presenting with imbalance or vertigo, Vth or VIIth cranial nerve deficits, or unilateral hearing complaints may warrant further evaluation to rule out the possibility of an acoustic neuroma or other retrocochlear lesion. In order to seek an explanation for this phenomenon, the incidence of various tumor characteristics (e.g., the size of the cerebellopontine angle component, depth of penetration into the internal auditory canal, and degree of porous erosion) are discussed and compared with the entire acoustic neuroma population.

OBJECTIVES:

1. To describe the circumstances which led to the diagnosis of patients with normal puretone audiograms.
2. To identify additional presenting symptoms and signs in patients with normal puretone audiograms which may lead to the diagnosis of acoustic neuroma.
3. To correllate the occurrence of normal or symmetrical audiometry with tumor features such as size, depth of internal auditory canal penetration, degree of porous erosion, and length of clinical presentation, and compare this to the overall acoustic neuroma population.

MANAGEMENT OF NONACOUSTIC CRANIAL NERVE NEUROMATA

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Objective: While there is an extensive body of literature which is devoted to diagnosis and treatment of eighth cranial nerve tumors, there have been no published studies on nonacoustic cranial nerve neuromata of the cerebellopontine angle and skull base. It was therefore our purpose to review our experience with diagnosis and management of these tumors. For each type of cranial neuroma, a management strategy is discussed.

Methods: A retrospective review of the charts of all patients at our institution with the diagnosis of nonacoustic neuroma from the fifth to twelfth cranial nerves, between the years 1980-1995 was undertaken. Presenting symptoms, diagnostic techniques, and treatment, including surgery, observation, and irradiation are discussed for each lesion.

Results: A total of six cranial nerves were involved in this review of ten cases. These included four cases of fifth nerve neuroma, one case of sixth nerve neuroma, two cases of seventh nerve neuroma, and one case each of tenth, eleventh, and twelfth cranial nerve neuroma. All but two patients eventually underwent surgery. One patient with trigeminal neuroma neuroma was too ill to undergo craniotomy; the patient with abducens neuroma in the cavernous sinus is asymptomatic and being observed.

Conclusions: A structured plan for diagnosis and management exists for nonacoustic cranial nerve neuromata. By adhering to this plan, a diagnosis will be established most expeditiously and the proper mode of therapy will be selected.

OBJECTIVES:

1. To familiarize the observer with the presenting signs and symptoms of six different types of nonacoustic cranial nerve neuromata.
2. To formulate a management plan, including the proper surgical approach, for each different type of tumor.
3. To present the first case of sixth cranial nerve neuroma in the otolaryngology literature.

TEMPORAL BONE AND LATERAL SKULL BASE MALIGNANCY: EXPERIENCE AND RESULTS WITH 81 PATIENTS

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Temporal bone and lateral skull base malignancy is a rare entity which continues to challenge cranial base surgeons. It is difficult to apply oncologic principles to resection in this region. Loss of function and disfigurement often accompany high mortality after such procedures.

We have retrospectively examined our experience with 317 lateral skull base lesions. Of these, 81 patients were managed for malignancy. Epithelial tumors predominate: 26 squamous cell carcinomas, 10 adenocarcinomas, 7 adenoid cystic carcinomas, 4 acinic cell carcinomas, 3 carcinomas ex pleomorphic adenomas and 4 basal cell carcinomas. The list of tumors of mesenchymal origin numbered 8 sarcomas, 5 malignant glomus tumors, 3 hemangiopericytomas, 2 malignant neuromas, 6 chordomas and 3 CNS tumors. The mean age was 48.5 and with a range of 5 to 83 years. There were 42 males and 39 females.

All patients underwent surgery. Our mean follow-up time was 54 months with a range of 1 to 180 months. Forty-three patients were alive without evidence of recurrent disease, 6 were living with disease, 25 were dead of disease and 3 dead of other causes. Four were lost to follow-up.

Descriptive statistics, histopathology, outcome, factors predictive of outcome and complications are assiduously assayed.

OBJECTIVES:

1. To define relative incidence and epidemiologic characteristics.
2. To identify prognostic features useful in defining outcome.
3. To seek contemporary survival statistics and outcome data for this pathology.

RELATIVE PREVALENCE OF DISORDERS OF HEARING OR BALANCE USING HISTOLOGIC DIAGNOSTIC CRITERIA: A TEMPORAL BONE HISTOPATHOLOGIC STUDY*

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Although prevalences of disorders of hearing or balance have been studied using clinical diagnostic criteria, few studies of this type employed histologic diagnostic criteria. The purpose of this study is to determine histologically the relative prevalence of several disorders of the ear which have defined histologic manifestations.

Temporal bone specimens from two hundred consecutive autopsies were prepared for histologic evaluation for this purpose. In that causes of death are generally unrelated to hearing or balance, the specimens as far as practical and possible represent a cross section of society, adjustable if necessary by estimating strata specific prevalence rates.

The disorders considered were: otosclerosis, (which was also used to statistically verify comparability of the specimen sample), vestibular neuritis, hydrops, acoustic neuroma, and labyrinth capsule patencies related to perilymph fistulas. The relative prevalence of some of these disorders using histologic criteria differ from those prevalences suggested using clinical criteria and for others there was little difference.

These results suggest that either the clinical diagnostic criteria needs refinement or that the histologic diagnostic criteria are not exact. In that the former is more likely, ROC (Receiver Operations Characteristics) statistical methods may be useful using traditional temporal bone collections for histopathologic study thereby enabling more accurate clinical abilities.

OBJECTIVES:

1. To distinguish between clinical and histopathologic diagnoses.
2. To indicate the relative prevalence of specific disorders of hearing or balance based on histopathologic diagnosis.
3. To indicate the need for clinical diagnostic criteria refinement using temporal bone histopathologic methods.

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and the Research Fund of the American Otological Society.

33.

CRANIAL ANATOMY AND OTITIS MEDIA: A CADAVER STUDY*

N. Wendell Todd, M.D.

Background: The eustachian tube is regarded as en etiologic factor for otitis media. Though anatomical eustachian differences are suggested, few scientifically rigorous studies have been reported.

Materials: Thirty-five adult cadaver crania, of which none had evidence of clinical otitis media.

Methods: Multiple (32) linear and angular measurements were done. Prior otitis media was assessed by two indicators: small mastoid pneumatization seen radiographically, and abnormal tympanic membranes at photographic tympanoscopy. Each measurement and each categorization was done twice, independently. The average of the two measurements was used for each comparison. Only consistent categorizations were used for comparison.

Results: Relatively short eustachian tubes were found to associate with the indicators of childhood otitis: $r = .39$, $P < .05$. A relatively short distance from mid-sella to staphylion was also associated with otitis. No angular relation of either the bony or cartilaginous eustachian tube correlated with the otitis indicators. Bilateral symmetry of pneumatization and tympanoscopic categorization, and of the various linear and angular measurements, was apparent.

Conclusion: Short eustachian tubes correlate with indicators of childhood otitis media. Longer eustachian tubes may be more protective of the middle ear.

OBJECTIVES:

1. To offer a rigorous anatomic study adhering to scientific methods.
2. To discuss cranial bony morphologic differences as related to otitis media.
3. To place these findings in historical context.

* Supported by Lions Lighthouse.

34.

COCHLEAR FUNCTION AFTER DIVISION OF THE LATERAL SEMICIRCULAR CANAL USING THE ARGON LASER AND MICRODRILL

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Prior reports have suggested that the semicircular canals can be divided without damaging cochlear function. We determined to find out if the technique used to divide the semicircular canal was critical to hearing preservation. We hypothesized that the argon laser could be used to seal the membranous labyrinth in a less traumatic fashion and thereby better preserve cochlear function. Twenty adult chinchillas were randomly separated into one of three groups. In each group, the horizontal semicircular canal was divided using one of three methods: argon laser, microdrill, or a combination of argon laser and microdrill. Hearing was assessed using serial threshold auditory brainstem response (ABR) testing preoperatively, intraoperatively, and postoperatively over a two week period. Preoperative ABR thresholds were within 10dB in all twenty chinchillas. Intraoperative and perioperative ABR thresholds fluctuated widely within 30dB of preoperative levels regardless of the surgical technique. By two weeks postoperatively, 95% of the ABR thresholds had returned to within 20dB of the preoperative levels in all three groups. Temporal bone histology was reviewed from representative animals for each group and demonstrated that semicircular canal division had been accomplished. This preliminary study suggests that the lateral semicircular canal can be divided by either the argon laser or the microdrill with minimal change in cochlear function.

OBJECTIVES:

1. To discuss the effects of dividing the horizontal semicircular canal.
2. To discuss the techniques of dividing the membranous labyrinth using the argon laser, the microdrill, or a combination of the argon laser and the microdrill.
3. To discuss the histologic changes noted with division of the membranous labyrinth.

OUTCOMES RESEARCH IN CONDUCTIVE HEARING LOSS: DEVELOPMENT OF A NEW HEARING STATUS INSTRUMENT

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Assessment of clinical outcomes after medical and surgical treatment is becoming increasingly important in the managed care era. Without valid outcomes data, decisions on appropriate treatment may be based only on cost. We have developed and validated a disease-specific hearing status instrument for use in outcomes research on conductive hearing loss: the Hearing Satisfaction Scale (HSS). The HSS expands upon other instruments which measure hearing status, and may be used after treatment of CHL with either hearing aids, surgery, or both. The HSS contains 2 subscales which assess (1) emotional effects and (2) social/situational effects of hearing loss.

We retrospectively surveyed 45 patients with CHL treated with surgery or a hearing aid. We used a health-related quality of life instrument (the SF-36), two previously-validated instruments for hearing loss (the Hearing Handicap Inventory, the Abbreviated Profile of Hearing Aid Benefit), and clinical and audiometric data to validate the HSS> Test-retest reliability of the HSS was high ($r=0.82$), confirming the stability of HSS scores in the absence of changes in clinical status. Internal consistency reliability was high for both HSS subscales (Cronbach's $a=0.83$ and 0.71). Content validity was adequate because inter-item to scale correlations aaere significant ($0.40 < r < 0.77$; $p < 0.009$ for all items). Construct and criterion validities were also high for subscale and individual item scores. Individual items on overall hearing satisfaction had good correlations with both audiometric data ($r=0.45$; $p=0.02$) and results from other questionnaires ($r=0.57$;$p=0.001$). The social/situational subscale correlated well with SF-36 subscale data ($r=0.54$;$p < 0.001$) and other questionnaires ($r=0.67$; $p < 0.001$). Discriminant validity from other hearing-status instruments was also achieved with individual items on the HSS.

The HSS is a valid, reliable instrument which is self-administered, easy to complete, and measures hearing-specific outcomes in CHL. In outcomes research on CHL, the HSS should be administered prospectively in combination with a health-related quality of life instrument. Prospective data collection is currently underway to determine the sensitivity of this instrument to clinical change.

OBJECTIVES:

1. To report on the status of outcomes and quality of life research for conductive hearing loss.
2. To describe the development and validation of a new hearing status instrument for use in outcomes research on conductive hearing loss.
3. To discuss the use of Hearing Satisfaction Scale for outcomes research on conductive hearing loss.

36.

LONG-TERM RESULTS WITH THE TITANIUM BONE ANCHORED HEARING AID (BAHA): THE U.S. EXPERIENCE

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An analysis of the long term results of twenty nine (29) patients implanted with the titanium bone anchored hearing aid was carried out through a review of office charts and questionnaires. All patients were implanted between 1984 and 1987 in 4 U.S. centers, with a follow up period of 9 - 12 years.

The evaluation included the 4 basic categories of: 1) satisfaction with the amplification and auditory characteristics, 2) complication rate, 3) effect on tinnitus, vertigo, and the contralateral ear, and 4) appearance , ease of use, and comfort.

Eighty percent of the patients are still using their implants daily, with minimal complications limited to skin irritation. No major complications or osteomyelitis were encountered.

The results of the study, and the medical and audiological indications are presented.

OBJECTIVES:

1. To analyze the long term results of the multi-center study of 29 patients implanted between 1984-1987.
2. To review the medical and audiological indications for the device.
3. To describe the surgical technique of the implantation and the long term care.

TEFLON PASTE INJECTION FOR THE TREATMENT OF ABNORMALLY PATENT EUSTACHIAN TUBE: CURRENT TECHNIQUE AND LONG TERM RESULTS***

Jack L. Pulec, M.D.

The symptom of autophony, hearing one's own breathing and voice because the eustachian tube is abnormally open, can be an extremely disturbing symptom. Treatment by injection of Teflon paste into the levator palatini muscle anterior to the pharyngeal orifice of the tube is an effective treatment. A technique for the accurate placement of the injection has evolved. The treatment will be described and the results in 316 cases followed from 1 to 30 years will be given. Physiologic closure producing normal function can be obtained in the majority of patients.

OBJECTIVES:

1. To review the symptoms, scope and implications of the abnormally eustachian tube.
2. To describe the current technique for the injection of teflon paste.
3. To present the long-term results of treatment using teflon injection for abnormally patent eustachian tube.

***EDITOR'S NOTE: The use of teflon paste for injection into the nasal pharynx has not been approved by the F.D.A.

SPONTANEOUS OTOACOUSTIC EMISSIONS IN THE EARLY NEONATE

Sean K. Kastetter, M.A., C.C.C.-A, Kerri A. Rudin, M.Ed.

There is general acceptance that Spontaneous Otoacoustic Emissions (SOAE) generators emanate from structures within the cochlea. Furthermore, studies have shown that SOAEs occur in approximately 40-60% of normal adult ears with a similar occurrence in children. The focus of this study was twofold. Our first objective was to identify the incidence of SOAEs in early neonates (< 72 hours of age). The second purpose was to examine and compare SOAE prevalence to Transient Evoked Otoacoustic Emissions (TEOAE) amplitude. SOAEs were recorded from 85 newborns which yielded a total of 165 ears. Subjects were 41 females (81 ears) and 49 males (84 ears). Subject ages ranged from 6-70hrs (mean= 28hrs) for females and 8-55hrs (mean= 24hrs) for males. All infants were selected at random from the Well Baby Nursery (WBN). The neonates presented no known risk factors for hearing loss.

Infants were tested with TEOAEs prior to SOAE testing. The standard WBN pass criteria for TEOAE is >3dB signal to noise at 3 of 4 frequencies 1.6kHz, 2.4kHz, 3.2kHz, 4.0kHz with individual frequency whole wave reproducibility of >70%. SOAE responses were considered present with a 5dB signal to noise floor and at least one peak in the 1kHz-5kHz frequency range. Overall, SOAE responses occurred in 64% of all infants. SOAE responses were present for at least one ear more often in females (78%) than in males (52%). Examining individual ear results of the 165 ears tested, SOAEs were present in 56% of all ears with 70% of the female ears and 44% of the male ears showing SOAE responses.

Comparison of SOAEs to TEOAE amplitude revealed a trend toward increased SOAE presence with increasing average TEOAE amplitude. Average TEOAE response amplitude was catagorized as $\leq$5dB, $\leq$10dB, $\leq$15dB, $\leq$20dB, >20dB signal response relative to the noise floor. No SOAEs were recorded when the average TEOAE was 5dB or less. SOAEs were present in 33% of all subjects when TEOAE average amplitude was 6-10dB. TEOAE responses of 11- 15dB yielded SOAE responses in 50% of all ears. Incidence of SOAE presence was noted to be markedly greater with TEOAE amplitudes of >15dB with 73% of the ears showing SOAEs and 93% of all ears showing SOAEs when TEOAE amplitude is >20dB. These data suggest a greater incidence of SOAEs than previously reported in the neonatal population. This research also suggests there is a relationship between TEOAE amplitude and SOAE prevalence.

OBJECTIVES:

1. To compare average Transient Evoked Otoacoustic Emission response amplitude with Spontaneous Otoacoustic Emission prevalence.
2. To discuss the incidence of Spontaneous Otoacoustic Emissions in the early newborn (72 hrs).
3. To identify gender differences related to Spontaneous Otoacoustic Emissions in the newborn.

THE EFFECT OF TOPICAL CIPROFLOXACIN ON POSTOPERATIVE OTORRHEA FOLLOWING TYMPANOSTOMY TUBE INSERTION

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W. Edward Wood, M.D., William S. Gibson, M.D.

Posttympanostomy otorrhea is one of the most common complications following tympanostomy tube insertion. A randomized clinical trial with 147 patients who underwent bilateral myringotomy with tympanostomy tube insertion was conducted. Our aim in this study was to investigate the efficacy of topical ciprofloxacin in the prevention of early postoperative otorrhea following tympanostomy tube insertion. Factors such as age, sex, the presence of middle ear effusions, types of middle ear effusions, and bleeding were also evaluated for possible relationship with postoperative otorrhea. For each patient, one ear was randomly assigned to receive topical ciprofloxacin while the other served as an untreated control. The middle ear space of treated ears was filled with topical ciprofloxacin solution after myringotomy was performed. Patients were evaluated at two weeks following surgery to assess for presence of otorrhea. A significantly lower incidence of postoperative otorrhea ($p=.033$) was observed in ciprofloxacin treated ears as compared to untreated ears (4.1% vs. 9.5%, respectively). Bleeding at the time of surgery was associated with increased development of otorrhea among untreated ears. Subjects with absent, serous, and purulent effusions had lower otorrhea rates with ciprofloxacin treatment. The rate of otorrhea in subjects with mucoid middle ear effusions was similar with or without treatment. We conclude that the use of topical ciprofloxacin solution at the time of tympanostomy tube insertion is an effective prophylaxis for the prevention of otorrhea in the early postoperative period.

OBJECTIVES:

1) To investigate the efficacy of topical ciprofloxacin solution in the prevention of early postoperative otorrhea following tympanostomy tube insertion.
2) To determine if factors such as age, sex, the presence of effusion, and the presence of bleeding at the time of tympanostomy tube insertion are related to the development of posttympanostomy otorrhea.
3) To determine if the type of middle ear effusion present at the time of tympanostomy tube insertion (serous, mucoid, or purulent) is predictive of increased risk of posttympanostomy otorrhea.

40.

LONG TERM IMPACT OF VENTILATION TUBES

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Acute otitis media and otitis media with effusion are two of the most common medical problems among children. Management of these problems is the source of vigorous debate among various medical disciplines. One view is that these are self limited problems which need minimal therapy and will resolve without sequelae. Some feel that aggressive therapy will actually cause more problems than the disease and that the therapy is not cost effective. The other view is that aggressive therapy prevents complications, improves the quality of life for the parent and the patient, and reduces the overall cost of medical care. The initial management of these two diseases with antibiotics and tincture of time is fairly well accepted. The introduction of myringotomy, ventilation tubes, and/or adenoidectomy is more controversial.

Ventilation tubes have been inserted over the past 40 years to: reduce the incidence of acute otitis media, improve hearing by removal of the fluid and to prevent complications such as adhesive otitis media and cholesteatoma. The first two goals are reasonably well accepted. The prevention of long term problems such as adhesive otitis media, ossicular destruction and cholesteatoma are not as clear cut.

This study will review a series of 230 children, 10-years-old and younger , who underwent myringotomy and insertion of ventilation tubes during 1981 at one institution. The study will look at: basic demographics, indications for surgery, procedure(s) performed, and the type of tube inserted. Short term complications such as otorrhea, tympanic membrane perforation and the need to reinsert tubes will be documented. The need for more aggressive procedures will be reviewed, specifically tympanoplasty and/or mastoidectomy. Audiometric data will be evaluated. This is a retrospective study and most of the information will be compiled from the medical record. For those patients who have moved or have not returned for follow-up contact will be made by letter or phone.

OBJECTIVES:

1. To study a group of children who had ventilation tubes inserted 15 years previously.
2. To examine the question of whether ventilation tubes prevent the evolution of adhesive otitis media and/or cholesteatoma.
3. To look at the short and long term benefits and complications of ventilation tubes.

PEDIATRIC TYMPANOPLASTY OF IATROGENIC PERFORATIONS FROM VENTILATION TUBE INSERTION

Gabriel O. Te, M.D., Franklin M. Rizer, M.D., Arnold G. Schuring, M.D.

Children are prone to serous otitis media because of immature Eustachian tube function. These infections are easily treated by antibiotics and the insertion of ventilation tubes. However, their recurrent nature frequently mean prolonged maintenance on ventilation tubes or their repeated insertions giving rise to persisten tympanic membrane perforations.

Although a considerable number of tympanoplasties are done in children, controversy surrounds this issue. Few studies have been done on children despite the fact that most perforations occur in childhood. Opinions differ regarding the indications, patient selection, surgical technique, timing of surgery and predictive factors for success.

This study focuses on a subset of 98 pediatric tympanoplasties wherein perforations were iatrogenically caused by the insertion of ventilation tubes for serous otitis media. The objectives of this study were to examine tympanoplasty outcome in the setting of recurrent serous otitis media and underlying Eustachian tube dysfunction and to determine whether there is an optimal age for tympanoplasty.

Tympanoplasty outcome was evaluated in terms of drum healing, hearing and complications. There was a graft take-rate of 94.9% (93 cases) after a follow-up of 1.4 years. Reperforations occurred in 5.1% (5 cases) after a follow-up of 0.82 years. The air-bone gap was completely closed in 57.1% (56 cases), closed to within 10 dB in 82.6% (81 cases), and to within 15 dB in 91.8% (90 cases). In 8.2% (8 cases), the air-bone gap was greater than 15 dB. However, no dead ears resulted. Complications included 2 infections, 1 hearing loss and a case with recurrent serous otitis media. Furthermore, age at surgery did not influence success rates.

We, therefore, conclude that repair of persistent perforations following ventilation tube insertion for recurrent serous otitis media can be successfully performed regardless of age and eustachian tube function at the time of surgery.

OBJECTIVES:

1. To determine drum healing after tympanoplasty of iatrogenic perforations in the setting of recurrent serous otitis media and Eustachian tube dysfunction.
2. To determine hearing results after tympanoplasty of iatrogenic perforations in the setting of recurrent serous otitis media and Eustachian tube dysfunction.
3. To determine complications after tympanoplasty of iatrogenic perforations in the setting of recurrent serous otitis midea and Eustachian tube dysfunction.
4. To determine the influence of age at surgery on tympanoplasty outcome.

42.

A NOVEL PSYCHOPHYSICAL ILLUSION RESULTING FROM INTERACTION BETWEEN HORIZONTAL VESTIBULAR AND VERTICAL PURSUIT STIMULATION*

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The hypothesis was tested that the perception of an object's motion is made in relation to an internal reference center (IRC) under influence of vestibular receptors. Six subjects were instructed to track a vertically moving visual target (VT) while being rotated in the yaw plane at 14, 28 and 42°/s. All stimuli had a frequency of 0.2 Hz. Eye movements were monitored by EOG electrodes. During visual-vestibular interaction, all subjects perceived a VT moving obliquely while eye movement remained vertical. The subject then tilted the VT trajectory until vertical was perceived. At this time, the eye had an oblique trajectory. Horizontal eye velocities from interactive tests were plotted versus corresponding results from rotation in the dark without VT at the same stimuli. A strong positive relationship was found between interactive eye movements and eye movements in darkness (slope=0.96, r=0.84, n=18). Results support the hypothesis of an egocentric sense of orientation whereby velocity of external objects is evaluated in relation to an IRC dependent on the VOR state. This illusion may lead to new techniques for clinical evaluation of vestibular patients.

OBJECTIVES:

1. To demonstrate how combined psychophysical and electrooculographic data can be used to study vestibular function.
2. To illustrate a new vestibular illusion unrecognized until now.
3. To illustrate how vestibular stimulation or damage alters the perception of self motion or the motion of objects.

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VESTIBULAR DECRUITMENT, HYPERACTIVITY AND REBOUND CALORIC NYSTAGMUS

Arvind Kumar, M.D., Aftab Patni

In the monothermal caloric test, each ear is irrigated with 10 ml and 100 ml of water, both at 20°C in 5 seconds and 20 seconds respectively. The induced nystagmus is analyzed by counting the number of beats in each 5 second interval and the 2 consecutive intervals in which the frequencies are the highest are added and this *culmination frequency* represents the sensitivity of the endorgan in numerical terms. Using this technique of caloric stimulation, we have noted 3 signs which correlate with lesions of the brainstem and/or cerebellum: 1) *Vestibular decruitment (VD):* When the strong stimulus response (100 ml) is divided by the weak stimulus response (10 ml) a ratio is obtained. The normal range of ratios is 1.2 - 3.5 and a ratio of 1.1 or less is called *vestibular decruitment.* Such a finding has not been noted in 93 normal subjects tested by two different investigators in our laboratory. 2) *Hyperactive responses(HR):* - For many years, we have regarded a response as hyperactive when the culmination frequency value is 3 SD greater than the mean values calculated for the 10 ml and 100 ml stimuli responses in normal subjects; 3) *Rebound caloric nystagmus(RCN):* This is a reversal of the primary phase nystagmus after it has ended and occurs when the plane of the lateral semicircular canal is changed from vertical to horizontal. This finding has also not been observed in normal subjects.

The purpose of this retrospective study was to evaluate the sensitivity and specificity of these three abnormalities for lesions of the brainstem and cerebellum (posterior neuro-axis or PNA). For purposes of this study we sought the final diagnosis determined by MRI scan report from 2800 patient records entered into our computer files since 1988. The caloric test results of this group of 104 patients with well defined MRI abnormalities of the PNA, were analyzed with respect to VD, HR, and RCN. To test the specificity of the monothermal caloric test with respect to VD, HR and RCN, we tested 18 normal subjects. The vestibular evaluation of all patients and normal subjects was done in the sitting position and eye movements were recorded by the binocular infrared oculographic technique.

The results from the normal subjects showed that VD, HR or RCN does not occur in normals. In the patient group, 5 different types of MRI abnormalities had been diagnosed. There were 67 patients with type I Chiari malformation, 18 patients with well defined infarct of the PNA, 22 patients with cerebellar or brainstem atrophy, and 5 patients had multiple sclerosis. There were 2 patients with miscellaneous lesions. In this group, VD alone occurred in 88 out of 104 patients, giving a sensitivity of 85%. HR alone occurred in 6 patients and RCN alone occurred in 4 patients. If all these three signs are taken together as indicators of a PNA lesion, the sensitivity of the monothermal caloric test is 95%. Since none of our normal subjects showed any of these signs, the specificity could be regarded as 100%. We therefore conclude that the monothermal caloric test is a useful test for diagnosing PNA lesions.

OBJECTIVES:

1. To review the monothermal caloric test technique and values which define abnormalities of vestibular decruitment and hyperactivity and their clinical significance.
2. To statistically demonstrate the high sensitivity of these abnormalities to brainstem/cerebellar lesions.
3. To statistically demonstrate the high specificity of these test results and the overall diagnostic advantages of the Torok Monothermal Caloric test.

VESTIBULAR AND AUDITORY FUNCTION ABNORMALITIES IN SILICONE BREAST IMPLANT PATIENTS*

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A syndrome of joint pain, fatigue, and sicca is now widely recognized in patients with silicone breat implants (SBI). Some also complain of dizziness, balance disorders, and hearing loss. Auditory and vestibular function tests were obtained from 19 women with ruptured silicone breast implants and results compared with a matched, asymptomatic SBI control group and a published, age-matched normal data base. Sixty-seven percent of SBI subjects (SBIS) had abnormal positional nystagmus (32% of normals), 6% had abnormal Hallpike tests (2% of normals), and dynamic posturography sensory organization tests were abnormal in 100% (17% of normals). Vestibulo-ocular reflex function was comparable to that of normals. Sensorineural hearing loss was documented in 39% of SBIS (24% of normals). Based upon these findings, immune response to silicone compounds appears to be associated with pathologic changes in vestibular and auditory function.

OBJECTIVES:

1. To determine if the prevalence of vestibular and auditory abnormalities in a) symptomatic, b) asymptomatic breast implant differs from c)a normal population.
2. To characterize, quantitatively, the abnormalities in the symptomatic and asymptomatic control group.
3. To compare abnormal findings with other types of immune inner ear disorders, e.g. Cogan's syndrome and Delayed Endolymphatic Hydrops.

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45.

DISABLING PAROXYSMAL POSITIONAL VERTIGO

J. Douglas Green, Jr., M.D., David B. Hawkins,

Benign paroxysmal positional vertigo (BPPV) represents a common form of vertigo familiar to most otolaryngologists. We have recently recognized a subgroup of four individuals with BPPV who experience a particularly violent variety which we have called disabling paroxysmal positional vertigo (DPPV). DPPV is different from BPPV in that the affected individuals are severely limited or disabled as a result of their symptoms. These symptoms last for several years without the spontaneous remission periods that are observed in many cases of BPPV. Autonomic symptoms such as nausea and vomiting are frequent with DPPV, making compliance with rehabilitation such as habituation exercises or physical therapy poor. Most importantly, DPPV may be easily confused with disabling positional vertigo caused by microvascular compression of the eight cranial nerve. A patient with DPPV might be unnecessarily subjected to craniotomy and microvascular decompression of the eighth cranial nerve if not properly recognized. Treatment for disabling positional paroxysmal vertigo is similar to that of benign positional paroxysmal vertigo with patients responding favorably to the canalith repositioning procedure (CRP) as described by Epley. Multiple trials with the CRP are frequently required.

OBJECTIVES:

1. To describe a new variant of benign paroxysmal positional vertigo which we have termed disabling paroxysmal positional vertigo along with its treatment.
2. To differentiate disabling paroxysmal positional vertigo from disabling positional vertigo caused by microvascular compression of the eighth cranial nerve.
3. To present illustrative cases of disabling paroxysmal positional vertigo.

SURGICAL TREATMENT OF ACQUIRED EXTERNAL AUDITORY CANAL ATRESIA

Samuel H. Selesnick, M.D., Tuyet-Phong K. Nguyen, B.S.

Acquired atresia of the external auditory canal (EAC) is an underrepresented clinical entity for which surgical treatment is challenging. An important cause of conductive hearing loss, acquired atresia can result in other significant and sometimes irreversible complications if left untreated. Cholesteatoma formation secondary to squamous epithelial entrapment, for example, can cause extensive local erosion, resulting in sensorineural hearing loss, vertigo, and facial paralysis.

Complications of EAC surgery, such as recurrence of atresia, have led investigators to experiment with a variety of incisions, techniques, and grafts. The methods employed in the repair of acquired external auditory canal atresia (AEACA) have included the excision of fibrous tissue and a combination of one or more of the following procedures: meatoplasty, wide canalplasty, mastoidectomy, tympanoplasty, and reconstruction of the defect with skin grafts or flaps. Advantages and disadvantages accompany both the use of flaps and that of skin grafts, but superiority of either remains to be determined.

Six cases of acquired atresia of the EAC were treated in a period of three years. These patients were unusual in that they presented with AEACA secondary to trauma and prior surgery, not as a result of chronic infection, which is far more common in the literature. This series of patients demonstrates the slow progression of AEACA. In most cases, the patients presented for an evaluation after an average of 14 years subsequent to the insult to the ear canal. The absence of pain and the innocuous nature of early symptoms make early presentation to a skilled observer less likely. This inevitably adds to the difficulty of surgical treatment to achieve a successful outcome.

Al six patients in this series presented with conductive hearing loss and some with symptoms of otalgia and otorrhea. Complications seen in one patient included sensorineural hearing loss and facial nerve paralysis due to erosion of the cholesteatoma into the inner ear and Fallopian canal.

The patients in this series were treated with excision of the atresia, meatoplasty, canalplasty, and, in most cases, a split thickness skin graft (STSG) to the area denuded of epithelium. One patient required a mastoidectomy to facilitate removal of the cholesteatoma. The post-operative course of each patient has been uneventful, with the exception of one who developed a mild restenosis three months after the surgery. This patient's treatment differed from that of the rest of the patients in that it did not include reconstruction of the canal with a STSG, possibly suggesting the importance of the graft in preventing recurrence of the atresia. No other complications were noted. Hearing improvement was significant and will be presented. These results suggest that surgery is a necessary and effective treatment of AEACA.

OBJECTIVES:

1. To present and discuss variations in pre-operative clinical findings, surgical treatment, and results of surgeryin six patients who underwent repair of acquired atresia of the external auditory canal.
2. To summarize data and discuss treatment options presented in the literature on acquired external auditory canal atresia.
3. To emphasize the importance and effectiveness of surgical treatment in acquired atresia of the auditory canal.

IRRADIATED RIB CARTILAGE GRAFT FOR TYMPANIC MEMBRANE RECONSTRUCTION

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Reconstruction of the tympanic membrane in advanced ear disease has presented a challenge to the otologist since the early works of Zollner and Wullstein in the 1950's. Initial tympanoplasties utilized skin grafts, which were soon discarded in favor of thinner canal skin. More recent works have been done primarily with temporalis fascia grafts. However, with current techniques eustachian tube dysfunction cannot be improved and , therefore, progressive graft retraction often occurs. Allograft cartilage harvested from the tragus or concha has proven to be useful in preventing the progressive retraction.

An alternative to conchal and tragal cartilage in tympanoplasty is homologous irradiated rib graft. Irradiated rib can be used in any situation the otologist would have formerly used allograft cartilage. The advantages of irradiated rib graft are numerous. First, the rib cartilage can be molded easily and quickly into the desired size and thickness. Second, ancillary staff can prepare multiple specimens for potential use as the surgery progresses, thus saving anesthesia time. Third, the patient undergoes no separate incision and harvest, thus avoiding the attendant complications and inconveniences and further reducing surgical time. Fourth, irradiated rib graft is available in practically unlimited quantities. The disadvantages of homograft material versus autologous graft material are only theoretical and have not been borne out in multiple studies.

We will present the result of the use of homograft irradiated rib graft material in the reconstruction of the tympanic membrane in 30 patients. The audiologic results will be discussed. The graft take rate and complications will be presented. We have found irradiated rib to be effective in preventing tympanic membrane retraction. There has been no evidence of clinically significant resorption or extrusion. Hearing results are comparable to tympanoplasties performed with allograft cartilage grafts.

OBJECTIVES:

1. To demonstrate effectiveness of irradiated rib cartilage graft in preventing tympanic membrane retraction.
2. To present data demonstrating the ability to achieve excellent hearing results.
3. To provide an alternative to allograft cartilage grafts.

48.

ENDOSCOPIC MEDIAL GRAFT TYMPANOPLASTY

Muaaz Tarabichi, M.D.

Sixty-four medial graft transcanal tympanoplasty procedures were performed using an endoscope instead of the microscope to perform all surgical tasks. Preoperative microscopic evaluation revealed anterial perforation and/or overhanging anterior ear canal wall with partial visualization of the perforation in 35 ears (54%). There were 45 type I tympanoplasty procedures and 19 procedures which involved ossicular reconstruction. Closure of perforation was evident in 59 ears (92%). Postoperative audiometric results showed air-bone gap <20dB (avg. Of 500, 1000, 2000 Hz) in all patients who underwent type I tympanoplasty with closure of perforation; and in 12 out of 19 (63%) procedures involving ossicular reconstruction. These results were compared with 50 consecutive microscopic procedures performed previously by the same surgeon which included 21 postauricular procedures (42%) and an overall success rate of 88%. The endoscope offered the following advantages: 1) A wide angle view of the whole tympanic ring which allowed better manipulation of the graft and reduced the need for continuos repositioning of the patient or the microscope. 2) Extending the operative field of transcanal procedures into structures which are usually hidden from the microscope (anterior perforation, posterior retraction pocket, facial recess and hypotympanum). These advantages translated into a better surgical technique and reduced the need for postauricular procedures in our patients when compared to a historical group.

OBJECTIVES:

1. To discuss technique of endoscopic tympanoplasty.
2. To discuss results of endoscopic tympanoplasty.
3. To discuss advantages and disadvantages of endoscopic technique.

A RANDOMIZED BLINDED STUDY OF CANAL WALL UP VS. CANAL WALL DOWN MASTOIDECTOMY TO DETERMINE THE DIFFERENCE IN VIEWING MIDDLE EAR ANATOMY AND PATHOLOGY

Gregory F. Hulka, M.D., John T. McElveen, Jr., M.D.

A significant amount of literature is available retrospectively describing the experiences of individuals and otology groups in terms of the advantages and disadvantages of canal wall up vs. canal wall down procedures for middle ear pathology. In the interest of objectively supporting (or contradicting) the literature, we have studied the differences in access to various locations of the temporal bone in a randomized blinded study comparing these two surgical approaches. While 7.8 temporal bones would allow for a power of 80% assuming a standard deviation of 1.0, 95% confidence interval, t=0.05, and a difference of 0.75 observations measured between groups, twelve are used to additionally check for variances in observations between sessions in this study. All bones are viewed in two dissections: canal wall up and canal wall down. The canal walls are intially removed in a method described in this study. Following removal, those requiring replacement for the study have this done in a method utilizing native posterior bony canal also described in this study. Four points are marked on each temporal bone. Three different colors are used in a random order to eliminate observer expectation and bias. The four points marked include eustachian tube orifice, facial recess, Prussak's space, and epitympanum. Temporal bones are presented to an expert otologist in a randomized fashion at two different sessions, seven days apart. For the first session, six bones are presented canal wall up and six canal wall down. At the second session, five bones from each group are reversed in terms of canal wall up or down. Two from each group are left the same to check for variance of observance between sessions. Each temporal bone is placed in a temporal bone bowl allowing for rotation and repositioning approximating that in the operating room. For each temporal bone, the observer is asked to fill in a questionnaire describing his observations of location and color of markers. Statistical analysis performed includes evaluation of the differences in visible access between the two surgical procedures overall, by indivdual site, by color of marker, as well as per session of observation.

OBJECTIVES:

1. To objectively describe the differences in visualization of middle ear anatomy achieved with canal wall up vs. canal wall down mastoidectomy.
2. To demonstrate a reliable model for comparative study of the middle ear anatomy in a temporal bone.
3. To describe a technique for reliably reversing a canal wall down procedure.

50.

REVERSIBLE CANAL WALL DOWN MASTOIDECTOMY: AN ALTERNATIVE TO INTACT CANAL WALL AND CANAL WALL DOWN MASTOIDECTOMY PROCEDURES

John T. McElveen, Jr., M.D., Gregory F. Hulka, M.D.

"Canal wall down" mastoidectomy remains a mainstay in the management of chronic ear disease. Although effective in exposing and exteriorizing cholesteatoma, the patient is left with a mastoid cavity requiring long-term care. In order to avoid the limitations of canal wall down surgery, yet maintain the exposure provided by this approach, we have developed a completely "reversible" canal wall down mastoidectomy technique. Although it is premature to compare the effectiveness of this approach with other mastoidectomy procedures, the preliminary data confirms the feasibility of this approach in all but the most constricted mastoid cavities. The surgical steps and instrumentation involved in performing this approach are described and the technique illustrated in a video taped demonstration.

OBJECTIVES:

1. To demonstrate new technique for chronic ear surgery.
2. To demonstrate the advantage of this technique over standard mastoidectomy procedures.
3. To discuss potential application of this technique for otologic pathology, and explain limitations.

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