



PROGRAM
of the

*One Hundred Thirty-Third
Annual Meeting*

**AMERICAN
OTOLOGICAL SOCIETY, INC.**

**May 13-14
2000**

**Orlando World Center Marriott
Orlando, Florida**

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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 13, 2000

REGISTRATION - 12 Noon

BUSINESS MEETING - 12:30 p.m.

ROOM: Palms Ballroom-Sago
(Restricted to Members)

Minutes of the Annual Meeting 1999

Introduction of New Members

Election of Nominating Committee

Report of the Secretary-Treasurer

Report of the Editor-Librarian

SCIENTIFIC PROGRAM - 1:00 p.m.

ROOM: Palms Ballroom-Sago
(Open to Non-Members)

Presidential Remarks

C. Gary Jackson, M.D.

Introduction of the Guest of Honor

Derald E. Brackmann, M.D.

Remarks by Guest of Honor

Presidential Citation

William B. Williams III

NOTES

MIDDLE EAR/MASTOID

1. 1:20 p.m. **Feline Immunodeficiency Virus-Mediated Gene Therapy of Middle Ear Mucosa Cells**
Hamid R. Djalilian, MD*
Yasuhiro Tsuboi, MD
Wesley Obritsch
Jizhen Lin, MD

2. 1:30 p.m. **Analysis of the Dysfunctional Eustachian Tube by Video Endoscopy**
Dennis S. Poe, MD*
Ashraf A. Halawa, MBBch MS
Osama A. Razek, MBBch MS

3. 1:40 p.m. **Laser Stapedotomy with Conservation of the Stapedial Tendon**
Rodney C. Perkins, MD*

4. 1:50 p.m. **Current Use of Implants in Middle Ear Surgery**
Robert A. Goldenberg, MD*
John R. Emmett, MD FACS

- 2:00 p.m. **DISCUSSION**

5. 2:10 p.m. **Vibratory Sample Magnetometry of Stapes Prostheses and Manufacturing Materials**
Mark J. Syms, MD*
Derrick W. Peterman, PhD

***Speaker**

NOTES

6. 2:20 p.m. **Middle Ear Prosthesis Displacement in High Strength Magnetic Fields**
Michelle D. Williams, MS4*
Patrick J. Antonelli, MD FACS
Lorna Williams, MD

7. 2:30 p.m. **Prognostic Factors in Ossiculoplasty: A Statistical Staging System**
John L. Dornhoffer, MD*
Edward K. Gardner, MD

2:40 p.m. **DISCUSSION**

2:50 p.m. **INTERMISSION**

3:10 p.m. **PANEL: Cholesteatoma Surgery: Canal Wall Up/Canal Wall Down Revisited**

Moderator:

Bruce J. Gantz, MD**

Panelists:

Paul R. Lambert, MD

Joseph B. Nadol, Jr., MD

Simon C. Parisier, MD

8. 3:50 p.m. **Anterior Subannular T-Tube for Prolonged Middle Ear Ventilation During Tympanoplasty: Long Term Follow-Up**
Ravindhra G. Elluru, MD PhD*
Reena Dhanda, MD
Joel A. Goebel, MD FACS
J.Gail Neely, MD FACS

*Speaker

**Moderator

NOTES

9. 4:00 p.m. **Delayed Facial Palsy After Stapedectomy**
Xianxi Ge, MD*
John J. Shea, Jr., MD
10. 4:10 p.m. **Incidence of Facial Nerve Dehiscence at Surgery for Cholesteatoma**
Samuel H. Selesnick, MD FACS*
Alastair G. Lynn-Macrae, MS

4:20 p.m. **DISCUSSION**

MENIERE'S DISEASE

11. 4:30 p.m. **A Meta-Analysis of Hearing Results in Intratympanic Gentamicin Therapy**
Michelle L. Facer, DO*
Colin L. W. Driscoll, MD
Stephen G. Harner, MD
George W. Facer MD
Charles W. Beatty, MD
Thomas J. McDonald, MD
12. 4:40 p.m. **Quality of Life Assessment of Patients with Meniere's Disease**
John P. Anderson, PhD
Jeffrey P. Harris, MD PhD*
13. 4:50 p.m. **The Waning Role of Vestibular Nerve Section and Labyrinthectomy for Intractable Meniere's Disease**
Anis A. Ahmadi, BS*
Patrick J. Antonelli, MD
George T. Singleton, MD

*Speaker

NOTES

5:00 p.m. **DISCUSSION**

5:15 p.m. **GROUP PHOTOGRAPH**
MEMBERS OF THE AMERICAN
OTOLOGICAL SOCIETY, INC.
(Location to be announced.)

NOTES

SUNDAY, MAY 14, 2000

REGISTRATION - 7:00 a.m.

BUSINESS MEETING - 7:00 a.m.

ROOM: Palms Ballroom - Sago

(Restricted to Members)

REPORT OF THE:

- A. Board of Trustees of the Research Fund
- B. American Board of Otolaryngology
- C. Award of Merit Committee
- D. American College of Surgeons
- E. American Academy of Otolaryngology
Head and Neck Surgery

Report of the Audit Committee

Report of the Nominating Committee

Report of Communications

Unfinished Business

New Business

SCIENTIFIC PROGRAM - 7:30 a.m.

ROOM: Palms Ballroom-Sago

(Open to Non-Members)

NOTES

IMPLANTABLE DEVICES

14. 7:30 a.m. **Implantation of the Severely Malformed Cochlea**
Andrew J. Fishman, MD*
J. Thomas Roland, MD
George Alexiades, MD
Noel L. Cohen, MD
15. 7:40 a.m. **The Management of Far-Advanced Otosclerosis in the Era of Cochlear Implantation**
Michael J. Ruckenstein, MD MSc FACS*
Kristine O. Rafter, MA
Douglas C. Bigelow, MD
16. 7:50 a.m. **Is Cochlear Implantation Possible After Acoustic Tumor Removal?**
Aziz Belal, MD*
17. 8:00 a.m. **Adult Cochlear Implant Patient Performance with New Electrode Technology**
Terry Zwolan, PhD*
Paul R. Kileny, PhD
Sharon Smith, MS
Dawna Mills, MS
- 8:10 a.m. **DISCUSSION**

***Speaker**

NOTES

18. 8:20 a.m. **Hearing Rehabilitation Using the BAHA™-Bone Anchored Hearing Aid: Results in 35 Patients**

Lawrence R. Lustig, MD*
H. Alex Arts, MD
Derald E. Brackmann, MD
Timothy B. Maloney, MD
Cliff A. Megerian, MD
Gary F. Moore, MD
Karen M. Moore, MA
Thomas E. O'Connor, MA CCC-A
William Potsic, MD
Jay T. Rubinstein, MD PhD
S. Srirredy, MA
Charles A. Syms III, MD
George Takahashi, PhD
David M. Vernick, MD
Phillip A. Wackym, MD
John K. Niparko, MD

19. 8:30 a.m. **Surgical Techniques for Implanting the Vibrant Soundbridge Middle Ear Hearing Device**

Alec Fitzgerald O'Connor, FRCS*

TUMORS

20. 8:40 a.m. **Update on Conservative Management of Patients with Acoustic Neuromas**

Dick L. Hoistad, MD*
George A. Melnik, MD
Bulent Mamikoglu, MD
Cathleen A. O'Connor, MS
Richard J. Wiet, MD FACS

*Speaker

NOTES

21. 8:50 a.m. **Comparison of KI-67 and C-FOS Staining Pattern in Glomus Jugulare and Glomus Tympanicum**
Mohammad.Mujtaba, MD*
Thomas J. Roland, MD
Dennis G. Pappas, MD
Dean E. Hilman, PhD

9:00 a.m. **DISCUSSION**

9:10 a.m. **PANEL: The Acoustic Tumor Management Conundrum**

Moderator:

D. Bradley Welling, MD**

Panelists:

Derald E. Brackmann, MD

John C. Flickinger, MD

Kevin X. McKennan, MD

9:50 a.m. **INTERMISSION**

HEARING LOSS/INNER EAR

22. 10:10 a.m. **Etanercept Therapy for Immune-Mediated Cochleovestibular Disorders. Preliminary Results in a Pilot Study**
Hyon K. Choi, MD MPH
Dennis S. Poe, MD
Mahboob U Rahman, MD PhD*

***Speaker**

****Moderator**

NOTES

23. 10:20 a.m. **Risk Factors for Hearing Loss in Neonates**
Stilianos E. Kountakis, MD PhD*
John Skoulas, MD
Diane Phillips, MS CCC-A4
C. Y. Joseph Chang
24. 10:30 a.m. **Lidocaine Perfusion of the Inner Ear
Plus IV Lidocaine for Tinnitus**
John J. Shea, Jr., MD*
Xianxi Ge, MD
25. 10:40 a.m. **Role of Imaging in the Clinical Diagnosis
of Inner Ear Disorders**
Arvind Kumar, MD
Mahmood Mahfee, MD
Scott W. DiVenere, MD*
Han Soo Bae, BS
- 10:50 a.m. **DISCUSSION**

HISTOPATHOLOGY/VESTIBULAR DISORDERS/ ANATOMY

26. 11:00 a.m. **An Interactive Three-Dimensional
Computer Model of the Temporal Bone**
Masayuki Inouye, MD*
Joseph Roberson, MD
Kevin Montgomery, PhD
Michael Stephanides, MD

***Speaker**

27. 11:10 a.m. **Histopathology of Residual and Recurrent Conductive Hearing Loss Following Stapedectomy**
Joseph B. Nadol, Jr., MD*
28. 11:20 a.m. **Histologic Studies of the Posterior Stapedio-Vestibular Joint in Otosclerosis**
Saumil N. Merchant, MD*
Armagan Incesulu, MD
Robert J. Glynn, ScD
Joseph B Nadol, Jr., MD
29. 11:30 a.m. **A Comparison of ENG Results with Posturography Findings from the BalanceTrak 500**
Manali Amin, MD*
Marian Girardi, MA
Horst R. Konrad, MD
Larry F. Hughes, PhD
30. 11:40 a.m. **A Vestibular Phenotype for Waardenburg's Syndrome?**
F. O. Black, MD FACS*
S. C. Pesznecker, RN
K. Allen, MS, CCC-A
Claire Gianna, PhD

11:50 a.m. **DISCUSSION**

12:00 p.m. **Introduction of New President**
A. Julianna Gulya, MD

ADJOURNMENT

***Speaker**

**ABSTRACT DEADLINE FOR COSM 2001
IS OCTOBER 15, 2000
Email – segossard@aol.com for abstract form**

NOTES

NAMES AND ADDRESS OF PRIMARY AUTHORS

John P. Anderson, Ph.D.
USCD Medical Center
200 W. Arbor Drive 8895
San Diego, CA 92103

Patrick J. Antonelli, M.D., FACS
University of Florida
Dept. of Oto-Health Science Center
Box 100264, JHMHC
Gainesville, FL 32610-0264

Aziz Belal, M.D.
37 Syria Street, Rouchdy
Alexandria, Egypt

F. O. Black, M.D.
Dept. of Neurotology Research
P. O. Box 3950
1225 NE 2nd Ave., Ste 303
Portland, OR 97208-3950

John L. Dornhoffer, M.D.
University of AR for Medical Sciences
Dept. of Otolaryngology
4301 West Markham Slot 543
Little Rock, AR 72205

Ravindhra G. Elluru, M.D., Ph.D.
Washington University
Dept. of Otolaryngology
660 South Euclid Ave.
Campus Box 8115
St. Louis, MO 63110

Michelle L. Facer, D.O.
Dept. of Otolaryngology
Mayo Clinic
200 First Street S.W.
Rochester, MN 55902

NAMES AND ADDRESS OF PRIMARY AUTHORS

Andrew J. Fishman, M.D.
Dept. of Otolaryngology
NYU Medical Center
550 First Avenue
New York, NY 10016

Xianxi Ge, M.D.
6133 Poplar Pike
Memphis, TN 38119

Marian Girardi, M.A.
SIU School of Medicine-Division of Otolaryngology
P. O. Box 19662
Springfield, IL 62794-9662

Robert A. Goldenberg, M.D.
111 W. First St., Suite 600
Dayton, OH 45402

Dick L. Hoistad, M.D.
1000 Central, Suite 610
Evanston, IL 60201

Masayuki Inouye, M.D.
Dept. of Otolaryngology
Stanford University Hospital
300 Pasteur Drive
Stanford, CA 94305

Stilianos E. Kountakis, M.D., Ph.D.
University of Virginia Medical Center
P. O. Box 1008
Charlottesville, VA 22906-008

Arvind Kumar, M.D.
Eye & Ear Infirmary
1855 W. Taylor
Chicago, IL 60612

NAMES AND ADDRESS OF PRIMARY AUTHORS

Jizhen Lin, M.D.
Box 396 UMHC
420 S. E. Delaware St.
Minneapolis, MN 55455

Lawrence R. Lustig, M.D.
Dept. of Otolaryngology-HNS
Johns Hopkins University
JHOC 6th Fl, 601 North Caroline St.
Baltimore, MD 21287-0910

Saumil N. Merchant, M.D.
Dept. of Otolaryngology
Massachusetts Eye & Ear Infirmary
243 Charles Street
Boston, MA 02114-3096

Mohammad.Mujtaba, M.D.
Dept. of Otolaryngology-TH-513
NYU Medical Center
550 First Avenue
New York, NY 10016

Joseph B. Nadol, Jr., M.D.
Massachusetts Eye & Ear Infirmary
234 Charles Street
Boston, MA 02114-3096

Alec Fitzgerald O'Connor, FRCS
Auditory Implant Centre
St. Thomas' Hospital NHS Trust
Lambeth Palace Road
London, SE1 7EH

Rodney C. Perkins, M.D.
California Ear Institute at Stanford
801 Welch Road
Palo Alto, CA 94304

NAMES AND ADDRESS OF PRIMARY AUTHORS

Dennis S. Poe, M.D.
Zero Emerson Place, Suite 2C
Boston, MA 02114

Mahboob U Rahman, M.D., Ph.D.
Arthritis Association
Massachusetts General Hospital
15 Parkman St.
Boston, MA 02114

Michael J. Ruckenstein, M.D.
University of Pennsylvania
Dept. of Otorhinolaryngology-HNS
3400 Spruce Street
Philadelphia, PA 19104

Samuel H. Selesnick, M.D.
Weill Medical College
Dept. of Otorhinolaryngology-HNS
5 Ravdin, 520 E. 70th St.
New York, NY 10021

John J. Shea, Jr., M.D.
6133 Poplar Pike
Memphis, TN 38119

Mark J. Syms, M.D.
Otolaryngology-HNS
Tripler Regional Medical Center
Honolulu, HI 96859-5000

Terry Zwolan, Ph.D.
University of Michigan
Cochlear Implant Program
475 Market Place, Bldg 1, Ste. A
Ann Arbor, MI 48108

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1995	Robert A. Jahrsdoerfer, MD
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1999	Gregory J. Matz, MD

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1987-1992	Robert I. Kohut, MD
1992-1997	Gregory J. Matz, MD
1997-	Horst R. Konrad, MD

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

****Active Members**

Warren Y. Adkins, M.D. (1987)
171 Ashley Ave., Charleston, SC 29425

Peter W. Alberti, M.D. (1982)
10 Deer Park Crescent
Toronto, Ontario, Canada M4V 2C2

Sean R. Althaus, M.D. (1987)
5201 Norris Canyon Rd. #230
San Ramon, CA 94583-5405

Ronald G. Amedee, M.D. (1995)
1430 Tulane Ave., New Orleans, LA 70112

Edward Applebaum, M.D. (1985)
1855 W. Taylor St., Chicago, IL 60612

Richard W. Babin, M.D. (1993)
1830 Hwy. 51 So., Covington, TN 38019

Thomas J. Balkany, M.D. (1991)
PO Box 016960-D48, Miami, FL 33101

David M. Barrs, M.D. (1997)
3404 Wake Forest Rd., Ste. 303, Raleigh, NC 27609

Loren J. Bartels, M.D. (1992)
4 Columbia Dr., Ste. 610, Tampa, FL 33606

Charles W. Beatty, M.D. (1995)
200 First St. SW, Rochester, MN 55905

F. Owen Black, M.D. (1983)
1225 NE 2nd Ave (97232), PO Box 3950
Portland, OR 97208-3950

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Brian Blakley, M.D. (1996)
Rm GB 421- 820 Sherbrook St., Winnipeg
Manitoba, Canada R3A 1R9

Charles D. Bluestone, M.D. (1977)
3705 Fifth Ave., Pittsburgh, PA 15213

Derald E. Brackmann, M.D. (1979)
2100 W. Third St., 1st Floor
Los Angeles, CA 90057

B. Hill Britton, M.D. (1978)
PO Box 26901, Oklahoma City, OK 73190

Patrick Brookhouser, M.D. (1988)
555 N. 30th St., Omaha, NE 68131

Rinaldo F. Canalis, M.D. (1991)
457-15th St., Santa Monica, CA 90402

Robert W. Cantrell, M.D. (1979)
University of Virginia MSC, Box 179
Charlottesville, VA 22908

Richard A. Chole, M.D. (1984)
517 S. Euclid, Box 8115, St. Louis, MO 63110

Jack D. Clemis, M.D. (1976)
734 LaVergne Ave., Wilmette, IL 60091

Noel L. Cohen, M.D. (1985)
530 First Ave., New York, NY 10016

Newton J. Coker, M.D. (1991)
6550 Fannin St., St. 2001, Houston, TX 77030

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

C. Phillip Daspit, M.D. (1995)

222 W. Thomas Rd., Ste. 114
Phoenix, AZ 85013

Vijay S. Dayal, M.D. (1975)

5841 S. Maryland Ave., Chicago, IL 60637

Antonio De la Cruz, M.D. (1991)

2100 W. Third St. 1st Fl, Los Angeles, CA 90057

John R.E. Dickins, M.D. (1991)

10201 Kanis Rd., Little Rock, AR 72205

Robert A. Dobie (1985)

NIH/NIDCD, EPS, MSC - 7180
6210 Executive Blvd, Ste 400C
Bethesda, MD 20892-7180

Larry G. Duckert, M.D. (1988)

Dept. of Otolaryngology, PO Box 357923
Seattle, WA 98195

Thomas L. Eby, M.D. (1995)

1501 5th Ave. S., Birmingham, AL 35233

Avrim Eden, M.D. (1988)

151 E. Palisade Ave., Apt. E-1
Englewood, NJ 07631

John R. Emmett, M.D. (1990)

6133 Poplar Pike at Ridgeway, Memphis, TN 38119

George W. Facer, M.D. (1994)

200 First St., S.W., Rochester, MN 55905

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Joseph C. Farmer, Jr., M.D. (1984)
Duke University Medical Ctr. Box 3805
Durham, NC 27710

Jay B. Farrior, III, M.D. (1990)
509 Bay St., Tampa, FL 33606

John M. Fredrickson, M.D. (1978)
517 S. Euclid, Box 8115, St. Louis, MO 63110

Bruce J. Gantz, M.D. (1987)
200 Hawkins Dr., Iowa City, IA 52242

L. Gale Gardner, Jr., M.D. (1983)
899 Madison Ave., Ste. 602A, Memphis, TN 38103

George A. Gates, M.D. (1987)
Dept. of Otolaryngology, PO Box 356515
Seattle, WA 98195

Joel A. Goebel, M.D. (1995)
517 S. Euclid Ave., Box 8115, St. Louis, MO 63110

Robert A. Goldenberg, M.D. (1989)
111 W. First St., Ste 600, Dayton, OH 45402

Richard L. Goode, M.D. (1990)
300 Pasteur Dr. R135, Stanford, CA 94305

Marcos V. Goycoolea, M.D. (1992)
Pedro Lira Urquieta 11154, Lo Barnechea
Santiago, CHILE

Malcolm D. Graham, M.D. (1979)
4700 Waters Ave., Box 23665, Savannah, GA 31404

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

A. Julianna Gulya, M.D. (1991)
1558 N. Colonial Terrace
Arlington, VA 22209

Thomas J. Haberkamp, M.D. (1997)
6726 N. Wildwood Ave., Chicago, IL 60646

Lee A. Harker, M.D. (1987)
555 N. 30th St., Omaha, NE 68131

Stephen G. Harner, M.D. (1987)
200 First St., S.W., Rochester, MN 55905

Jeffrey P. Harris, M.D., Ph.D. (1988)
200 W. Arbor Dr. 8895, San Diego, CA 92103

Cecil W.J. Hart, M.D. (1992)
2160 S. First Ave., Bldg 105-Rm 1870
Maywood, IL 60153

Barry E. Hirsch, M.D. (1996)
200 Lothrop St., Ste. 500, Pittsburgh, PA 15213

Ronald A. Hoffman, M.D. (1992)
1430 Second Ave., Ste. 110, New York, NY 10021

John W. House, M.D. (1984)
2100 W. Third St., Los Angeles, CA 90057

Gordon B. Hughes, M.D. (1987)
9500 Euclid Ave. A-71, Cleveland, OH 44195

Robert K. Jackler, M.D. (1992)
400 Parnassus Ave. A-730, San Francisco, CA 94143

Carol A. Jackson, M.D. (1994)
361 Hospital Rd., Ste. 325, Newport Beach, CA

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

C. Gary Jackson, M.D. (1990)
300 20th Ave. N., Ste. 502, Nashville, TN 37203

Anthony Jahn, M.D. (1992)
556 Eagle Rock Ave., Roseland, NJ 07068

Robert A. Jahrsdoerfer, M.D. (1982)
University of Virginia Med. Ctr., Box 430
Charlottesville, VA 22908

Herman A. Jenkins, M.D. (1987)
6550 Fannin St., Ste. 1727, Houston, TX 77030

Timothy K. Jung, M.D. (1990)
3975 Jackson St., Ste. 202
Riverside, CA 92503

Donald B. Kamerer, M.D. (1988)
200 Lothrop St., Ste. 500, Pittsburgh, PA 15213

Jack D. Kartush, M.D. (1991)
27555 Middlebelt Rd., Farmington Hills, MI 48334

Athanasios Katsarkas, M.D. (1991)
Royal Victoria Hospital #E 4.48,687 Pine Ave. W
Montreal, Qc, CANADA H3A 1A1

Sam E. Kinney, M.D. (1981)
9500 Euclid Ave., Cleveland, OH 44195-5034

Horst R. Konrad, M.D. (1991)
SIU-PO Box 19662, Springfield, IL 62794-9662

Arvind Kumar, M.D. (1993)
1855 W. Taylor St., Chicago, IL 60612

Anil K. Lalwani, M.D. (1999)
400 Parnassus Ave., A730, San Francisco, CA 94143

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Paul R. Lambert, M.D. (1995)
University of Virginia Med. Ctr.Box 430
Charlottesville, VA 22908

K. J. Lee, M.D. (1997)
98 York St., New Haven, CT 06511

John P. Leonetti, M.D. (1995)
2160 S. First Ave., Bldg 105-Rm 1870, Maywood, IL 60153

S. George Lesinski, M.D. (1993)
10550 Montgomery Rd. #34, Cincinnati, OH 45242

Samuel C. Levine, M.D. (1999)
Box 396,420 Delaware St., Minneapolis, MN 55455

Roger C. Lindeman, M.D. (1987)
1100 Ninth Ave. - #900, Seattle, WA 98101

Charles M. Luetje, M.D. (1991)
3100 Broadway, Ste. 509, Kansas City, MO 64111

Charles A. Mangham, Jr., M.D. (1987)
600 Broadway, Seattle, WA 98122-5371

Robert H. Mathog, M.D. (1985)
4201 St. Antoine 5E, Detroit, MI 48201

Douglas E. Mattox, M.D. (1992)
1365 Clifton Rd., NE, Rm 2325, Atlanta, GA 30322

Gregory Matz, M.D. (1979)
2160 S. First Ave., Bldg 105-Rm 1870, Maywood, IL 60153

Thomas J. McDonald, M.D. (1987)
Mayo Clinic, 200 First St., S.W., Rochester, MN 55905

John T. McElveen, Jr., M.D. (1997)
3404 Wake Forest Rd., Ste. 303, Raleigh, NC 27609

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Michael J. McKenna, M.D. (1999)
243 Charles St., Boston, MA 02114-3096

William L. Meyerhoff, M.D. (1981)
5323 Harry Hines Blvd, Dallas, TX 75235-9035

Richard T. Miyamoto, M.D. (1987)
702 Barnhill Dr., Ste. 0860, Indianapolis, IN 46202

William H. Moretz, Jr., M.D. (1999)
818 St. Sebastian Way, Ste. 204, Augusta, GA 30901

Edwin M. Monsell, M.D. (1995)
2799 W. Grand Blvd. K8, Detroit, MI 48202

Joseph B. Nadol, Jr., M.D. (1988)
243 Charles St., Boston, MA 02114

Julian M. Nedzelski, M.D. (1987)
Sunnybrook Medical Ctr., 2075 Bayview Ave.
Toronto, Ontario, M4N3M5, CANADA

J. Gail Neely, M.D. (1985)
517 S. Euclid Ave., Box 8115, St. Louis, MO 63110

Ralph A. Nelson, M.D. (1995)
2100 W. Third St., Ste. 111, Los Angeles, CA 90057

John K. Niparko, M.D. (1995)
PO Box 41402, Baltimore, MD 21203-6402

James E. Olsson, M.D. (1993)
4410 Medical Dr. #550, San Antonio, TX 78229

Michael M. Paparella, M.D. (1968)
701 25th Ave. S., Ste. 200, Minneapolis, MN 55454

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Dennis Pappas, M.D. (1985)
2937 7th Ave. S., Birmingham, AL 35233

James J. Pappas, M.D. (1983)
10201 Kanis Rd., Little Rock, AR 72205

Simon C. Parisier, M.D. (1982)
186 E. 76th St., New York, NY 10021

Myles L. Pensak, M.D. (1992)
PO Box 670528, Cincinnati, OH 45267

Harold C. Pillsbury, M.D. (1988)
610 Burnett-Womack Bldg CB7070, Chapel Hill, NC 27599

Dennis S. Poe, M.D. (1995)
Zero Emerson Place, Ste. 2-C, Boston, MA 02114

Jack Pulec, M.D. (1969)
1245 Wilshire Blvd. Ste. 503, Los Angeles, CA 90017

Franklin M. Rizer, M.D. (1999)
3893 E. Market St., Warren, OH 44484

Peter S. Roland, M.D. (1992)
5323 Harry Hines Blvd, Dallas, TX 75235-9035

Allan Rubin, M.D. (1997)
3065 Arlington Ave., Toledo, OH 43614-2807

Leonard P. Rybak, M.D. (1989)
SIU PO Box 19638, Springfield, IL 62794

Clarence T. Sasaki, M.D. (1992)
Yale University, PO Box 208041
New Haven, CT 06520-8041

1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.

Robert T. Sataloff, M.D. (1990)
1721 Pine St., Philadelphia, PA 19103

Robert A. Schindler, M.D. (1983)
400 Parnassus Ave., Rm A-730, San Francisco, CA 94117

Alexander J. Schleuning, M.D. (1995)
3181 S.W. Sam Jackson Park Rd., Portland, OR 97201

Arnold G. Schuring, M.D. (1990)
3893 E. Market St., Warren, OH 44484

Mitchell Schwaber, M.D. (1993)
703 Overton Park, Nashville, TN 37215

Samuel H. Selesnick, M.D. (1999)
520 E. 70th St., Ste. 541, New York, NY 10021

Clough Shelton, M.D. (1995)
50 N. Medical Dr., 3C120, Salt Lake City, UT 84132

Herbert Silverstein, M.D. (1973)
1961 Floyd St., Ste. A, Sarasota, FL 33579

George T. Singleton, M.D. (1972)
Univ of FL - JHMHC, Box 100264, Gainesville, FL 32610

Aristides Sismanis, M.D. (1993)
1917 Windingridge Dr., Richmond, VA 23233

Mansfield F.W. Smith, M.D. (1973)
2400 Samaritan Dr., Ste.100, San Jose, CA 95124

Peter G. Smith, M.D. (1988)
621 S. New Ballas Rd., Ste. 597-C, St. Louis, MO 63141

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Gershom Jerry Spector, M.D. (1979)
1517 S. Euclid, Box 8115, St. Louis, MO 63110

Steven A. Telian, M.D. (1997)
1500 E. Medical Center Dr. TC1904L, Ann Arbor, MI 48109

Norman Wendell Todd, Jr. M.D. (1996)
1052 Castle Falls Dr., Atlanta, GA 30329

Phillip A. Wackym, M.D. (1997)
9200 W. Wisconsin Ave., Milwaukee, WI 53226

Jack J. Wazen, M.D. (1993)
111 E. 77th St., New York, NY 10021

Dudley J. Weider, M.D. (1990)
38 Rip Rd., Hanover, NH 03755

D. Bradley Welling, M.D. (1998)
456 W. 10th Ave., Columbus, OH 43210

Richard J. Wiet, M.D. (1987)
1000 Central St., Ste 610, Evanston, IL 60201

David F. Wilson, M.D. (1992)
911 N.W. 18th Ave., Portland, OR 97209

Eiji Yanagisawa, M.D. (1996)
98 York St., New Haven, CT 06511

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

****SENIOR MEMBERS****

Kedar Adour, M.D. 1999 (1988)
1000 Green St. #1203, San Francisco, CA 94133

Bobby R. Alford, M.D. 1997 (1970)
One Baylor Plaza, NA-102, Houston, TX 77030

Beverly Armstrong, M.D. 1988 (1960)
3034 Hampton Ave., Charlotte, NC 28207

H.A. Ted Bailey, Jr., M.D. 1994 (1969)
9601 Lile Dr. #1200 Med. Towers Bldg, Little Rock, AR 72205

Richard J. Bellucci, M.D. 1990 (1958)
162 E. 71st St., New York, NY 10021

Roger Boles, M.D. 1999 (1982)
Box 620203, Woodside, CA 94062

Wesley H. Bradley, M.D. 1988 (1961)
13 Saybrook E., Glenmont, NY 12077-9666

Seymour J. Brockman, M.D. 1988 (1964)
222 S. McCarty Dr., Beverly Hills, CA 90212

Richard A. Buckingham, M.D. 1994 (1969)
145 S. N.W. Highway, Park Ridge, IL 60068

Ralph J. Caparosa, M.D. 1992 (1972)
420 E. N. Ave. #402, Pittsburgh, PA 15212

Francis I. Catlin, M.D. 1996 (1975)
13307 Queensbury Lane, Houston, TX 77079

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

J. Ryan Chandler, M.D. 1994 (1973)
3170 Munroe Dr., Miami, FL 33133

D. Thane Cody, M.D. 1992 (1969)
P. O. Box 523136, Marathon Shores, FL 33052

James M. Cole, M.D. 1990 (1966)
1301 Red Lane, Danville, PA 17821

Wesley E. Compere, M.D. 1989 (1968)
4519 Mayapan Dr., LeMesa, CA 91941

James A. Crabtree, M.D. 1995 (1972)
1332 W.haven Rd., San Marino, CA 91108

Eugene L. Derlacki, M.D. 1989 (1958)
1 The Mews Franklin St., Geneva, IL 60134

James A. Donaldson, M.D. 1994 (1974)
600 Broadway, Seattle, WA 98122

Patrick J. Doyle, M.D. 1996 (1987)
150 - 809 W. 41st Ave., Vancouver, BC, V5Z 2N6 CANADA

Joseph G. Druss, M.D. 1971 (1939)
145 E. 92nd St., New York, NY 10028

Arndt J. Duvall III, M.D. 1993 (1971)
420 Delaware St. S.E., Box 396, Minneapolis, MN 55455

Abraham Eviatar, M.D. 1999 (1981)
25 Morris Lane, Scarsdale, NY 10583

1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.

Richard R. Gacek, M.D. 1998 (1969)
750 E. Adams St., Syracuse, NY 13210

Michael Glasscock III, M.D. 1997 (1973)
100 Pemberton Way, Austin, TX 78737

Irwin Harris, M.D. 1993 (1970)
2160 Century Woods Way, Los Angeles, CA 90067

Wiley H. Harrison, M.D. 1993 (1973)
707 N. Fairbanks Ct., Ste. 1010, Chicago, IL 60611

David A. Hilding, M.D. 1990 (1972)
3156 S. Plateau Dr., Salt Lake City, UT 84109

Jerome Hilger, M.D. 1975 (1951)
1700 Lexington Ave., Ste. 409, St. Paul, MN 55118

Albert Hohmann, M.D. 1990 (1970)
3154 Shoreline Lane, New Brighton, MN 55112

Jack V.D. Hough, M.D. 1990 (1960)
3400 NW 56th St., Oklahoma City, OK 73112

Howard P. House, M.D. 1975 (1947)
2100 W. Third St., Los Angeles, CA 90057

William F. House, M.D. 1995 (1964)
361 Hospital Rd., Ste. 327, Newport Beach, CA 92663

Raymond E. Jordan, M.D. 1975 (1953)
PO Box 7, Ozona, FL 34660-0007

Arthur L. Juers, M.D. 1972 (1952)
120 S. Hubbards Lane #408, Louisville, KY 40207

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Robert I. Kohut, M.D. 1998 (1976)
Medical Center Blvd., Winston-Salem, NC 27157

Fred H. Linthicum, Jr., M.D. 1991 (1967)
2100 W. Third St., Los Angeles, CA 90057

William H. Lippy, M.D. 1999 (1988)
3893 E. Market St., Warren, OH 44484

Ward B. Litton, M.D. 1995 (1969)
17 Eagle Pointe Pass, PO Box 266, Rapids City, IL 61278

H. Edward Maddox III, M.D. 1996 (1970)
6249 Terwilliger, Houston, TX 77057

Richard E. Marcus, M.D. 1987 (1975)
691 Sheridan Rd., Winnetka, IL 60093

Brian F. McCabe, M.D. 1997 (1965)
200 Hawkins Dr.-E230GH, Iowa City, IA 52242

William W. Montgomery, M.D. 1997 (1975)
243 Charles St., Boston, MA 02114

James A. Moore, M.D. 1987 (1952)
Mail returned 6/99 - addressee unknown

Eugene N. Myers, M.D. 1994 (1974)
200 Lothrop St., Ste. 500, Pittsburgh, PA 15213

George T. Nager, M.D. 1994 (1968)
550 N. Broadway, Baltimore, MD 21205-2020

Ralph F. Naunton, M.D. 1993 (1968)
DCSD-NIDCD-EPS-400B
6120 Executive Blvd., Rockville, MD 20892

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Claude L. Pennington, M.D. 1993 (1973)
PO Box 1916, Macon, GA 31202

W. Hugh Powers, M.D. 1992 (1975)
728 Wind Willow Way, Simi Valley, CA 93065

Shokri Radpour, M.D. 1998 (1989)
1481 W. 10th St., Indianapolis, IN 46202

J. H. Thomas Rambo, M.D. 1983 (1958)
150 E. 77th St. Apt. 8A, New York, NY 10021

Frank N. Ritter, M.D. 1993 (1972)
2675 Englave Dr., Ann Arbor, MI 48197

Mendell Robinson, M.D. 1991 (1969)
130 Waterman St., Providence, RI 02906

Max L. Ronis, M.D. 1997 (1972)
3400 N. Broad. St., Philadelphia, PA 19140

Robert Ruben, M.D. 1996 (1974)
3400 Bainbridge Ave., Greene Pav, Bronx, NY 10467

Wallace Rubin, M.D. 1992 (1967)
3434 Houma Blvd, Ste. 201, Metairie, LA 70006

Richard L. Ruggles, M.D. 1993 (1967)
11201 Shaker Blvd., Cleveland, OH 44104

Joseph Sataloff, M.D. 1994 (1960)
1721 Pine St., Philadelphia, PA 19103

William H. Saunders, M.D. 1996 (1972)
456 W. 10th Ave., Columbus, OH 43210

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

John J. Shea, Jr., M.D. 1998 (1967)
6133 Poplar Pike, Memphis, TN 38119

James L. Sheehy, M.D. 1994 (1965)
2100 W. Third St., Los Angeles, CA 90057

J. Brydon Smith, M.D. 1980 (1958)
21 Farrington Dr., N. York Ontario, CANADA

James B. Snow, Jr., M.D. 1993 (1973)
33506 Tuckahoe River Rd., Easton, MD 21601

Malcom H. Stroud, M.D. 1990 (1967)
4412 Stanhope Ave., Dallas, TX 75205

Harold G. Tabb, M.D. 1990 (1961)
1430 Tulane Ave., New Orleans, LA 70112

G. Dekle Taylor, M.D. 1985 (1965)
13500 Mandarin Rd., Jacksonville, FL 32223

Paul H. Ward, M.D. 1994 (1972)
10833 LeConte Ave., Los Angeles, CA 90024

Roger E. Wehrs, M.D. 1996 (1975)
6909 S. Evanston, Tulsa, OK 74136

William H. Wilson, M.D. 1989 (1972)
1133 Oneida St., Denver, CO 80220

Ben T. Withers, M.D. 1986 (1964)
14 E.Greenway Plaza Unit 12R, Houston, TX 77046

Robert J. Wolfson, M.D. 1994 (1971)
2 Logan Square, Ste. 1810, 18th St., between Arch & Cherry
Philadelphia, PA 19103

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

****EMERITUS**

Lavonne Bergstrom, M.D. 1992 (1977)
304 20th St., Manhattan Beach, CA 90266

Donald W. Goin, M.D. 1994 (1987)
799 E. Hampton Ave. Ste. 510, Englewood, CO 80110

Robert J. Keim, M.D. 1997 (1987)
13504 Green Cedar Lane, Oklahoma City, OK 73131

Anthony J. Maniglia, M.D. 1999 (1989)
11100 Euclid Ave., Cleveland, OH 44106

James L. Parkin, M.D. 1997 (1986)
Address Unknown - Mailed Returned

Leonard R. Proctor, M.D. 1997 (1989)
8102 Halton Rd., Baltimore, MD 21204

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

****ASSOCIATE**

Richard A. Altschuler, PhD (1992)
1301 N. Ann St., Ann Arbor, MI 48109

Karen I. Berliner, PhD (1995)
2252 Linnington Avenue, Los Angeles, CA 90064

Barbara A. Bohne, PhD (1979)
Washington Univ SOM Box 8115, St. Louis, MO 63110

Robert A. Butler, PhD (1978)
950 E. 59th St., Chicago, IL 60637

Cesar Fernandez, M.D. (1973)
1700 E. 56th St. Suite 3805, Chicago, IL 60637

Ruth Gussen, M.D. (1977)
3124 Rehabilitation Center, Los Angeles, CA 90024

Mohamed A. Hamid, PhD (1992)
551 East Washington, Chagrin Falls, OH 44022

Maureen T. Hannley, PhD (1992)
AAO-HNS, One Prince St., Alexandria, VA 22314

Joseph E. Hawkins, Jr., PhD (1972)
1301 East Ann St., Ann Arbor, MI 48109

Raul Hinojosa, M.D. (1989)
5316 Hyde Park Blvd, Chicago, IL 60615

Vincente Honrubia, M.D. (1972)
10833 LeConte Ave., Los Angeles, CA 90024

Makoto Igarashi, M.D. (1973)
Nihon University 8-24 Kudan-minami
4chome Chiyoda-ku Tokyo 102, JAPAN 102-0074

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Salvatore J. Iurato, M.D. (1994)
via L. Ricchioni 10-N I-70124 Bari, ITALY

Pawel J. Jastreboff, PhD (1997)
10127 Frost Way, Ellicott, MD 21042

Walter H. Johnson, PhD (1960)
30 Bond St., Toronto, Ontario M5B 1W8, CANADA

Lars-Goran Johnsson, M.D. (1979)
Saynavakuja 4B6, Sipoo 12170, FINLAND

S.K. Juhn, M.D. (1980)
2001 6th St. SE, Minneapolis, MN 55455

Nelson Y.S. Kiang, PhD (1969)
18 Cedar Lane Way, Boston, MA 02108

Paul R. Kileny, PhD (1994)
1500 E. Medical Ctr. Dr. TC 1904, Ann Arbor, MI 48109

Robert S. Kimura, PhD (1978)
243 Charles St., Boston, MA 02114

Merle Lawrence, PhD (1959)
2743 Ocean Dr., E-41, Vero Beach, FL 32963

David J. Lim, M.D. (1973)
2100 West Third St., 5th Fl, Los Angeles, CA 90057

Brenda Lonsbury-Martin, PhD (1997)
Univ. of Miami Ear Inst. M805 PO Box 016960, Miami, FL
33136

Michael Merzenich, PhD (1986)
Univ. of CA Coleman Lab HSE 871, San Francisco, CA 94143

Josef M. Miller, PhD (1979)
1301 East Ann St., Ann Arbor, MI 48109

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Tetsuo Morizono, M.D. (1985)
Fukuoka University Medical School
814-01 Rm Jonak-Kufukuoka Nanakuma 7-45-1, JAPAN

William D. Neff, PhD (1978)
3080 Hideway Court, Morris, IL 60450

Daniel J. Orchik, PhD (1996)
6133 Poplar Pike, Memphis, TN 38119

Walter A. Rosenblith, M.D. (1970)
M.I.T. Rm 3-240, Cambridge, MA 02139

Edwin W Rubel, PhD (1986)
Dept. of Oto-RL-30 Univ. of WA, Seattle, WA 98195

Jai H. Ryu, PhD (1989)
Bowman Gray SOM, Winston-Salem, NC 27157

Isamu Sando, M.D. (1975)
203 Lothrop St., Pittsburgh, PA 15213

Jochen Schact, PhD (1992)
1301 East Ann St., Ann Arbor, MI 48109

S. Richard Silverman, PhD (1950)
2431 NW 41st St., Gainesville, FL 32606

Catherine A. Smith, PhD (1962)
16200 S. Pacific Hwy. #34, Lake Oswego, OR 97034

Jack McLean Snyder, PhD (1992)
Dept. of Oto-RL-30 University of WA, Seattle, WA 98195

Ruediger Thalmann, M.D. (1971)
Washington Univ SOM 517 S. Euclid Ave., St. Louis, MO 63110

Charles G. Wright, M.D. (1999)
5323 Harry Hines Blvd., Dallas, TX 75235

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Sabina Regina Wullstein, M.D. (1999)
Oberer Neubergweg 10 D- 97074, Wurzburg

Galdino Valvassori, M.D. (1970)
697 Sheridan Rd., Winnetka, IL 60093

Thomas Van De Water, M.D. (1987)
302 1410 Pelham Pkwy S., Bronx, NY 10461

Jack A. Vernon, PhD (1974)
3515 S.W. Sam Jackson Park Rd., Portland, OR 97201

Joseph J. Zwislocki, ScD (1984)
Inst. of Sensory Research Syracuse Univ., Syracuse, NY 13244

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

****CORRESPONDING**

Soontorn Antarasena, M.D. (1997)
Dept. of Otolaryngology Rahvithi Hospital
Rajvithi Road, Phyathai Bangkok 10400, THAILAND

Daniel J. Bagger-Sjoback, M.D. (1995)
Dept. of Otolaryngology Karolinska Hospital
17176 Stockholm S104, SWEDEN

Mr. J. Barton Booth (1995)
18 Upper Wimpole Street
London W1M7TB, U.K.

Jean-Bernard Causse, M.D. (1995)
Villa Anfa L'Ardide Haute
Route de Maureihan 34500 Beziers, FRANCE

Paul A. Fagan, M.D.,FRACS (1997)
352 Victoria Street
Darlinghurst 2010 N.S.W., AUSTRALIA

Bernard Gil Fraysse, M.D. (1999)
Dept ORL - Hospital Purpan CHU de Toulouse
31059 Toulouse Cedex, FRANCE

Chong-Sun Kim, M.D. (1998)
Seoul National University Hospital
28 Yongon-Dong Chongno Gu
Seoul 110-744, KOREA

Wolf J. Mann, M.D. (1996)
Mainz Medical School 55131
Langenbeckstr .1 D65101 Mainz, GERMANY

Mr. David A. Moffat, MA, FRCS (1996)
10 Addenbrooke's Hospital Hills Road
Cambridge CB2 2QQ, ENGLAND

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Lars Odkvist, M.D. (1999)
Dept. ENT, University Hospital S-58185
Linköping, SWEDEN

Professor Ilmari Pykko (1997)
ENT Department Karolinska Hospital S-171 76
Stockholm, SWEDEN

Helge Rask-Andersen, M.D., PhD (1996)
Stigbergsvagen 11, 752 42
Uppsala, SWEDEN

Jens Thomsen, M.D. (1996)
ENT Department Gentofte University Hospital
DK-2900 Hellerup, DENMARK

**1999-2000 MEMBERSHIP LIST
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Pedro Albernaz (1993)
4405 NW 73rd Avenue Ste. 20-40003
Miami, FL 33166

Aziz Belal, M.D. (1993)
Neurotology Section Alexandria Ear & Eye Hospital
1 Sidi Gaber St. Alexandria, EGYPT

Edgar L. Chiossone, M.D. (1993)
20423 State Road 7 Suite 6102
Boca Raton, FL 33498

Ugo Fisch (1985)
Forchstrasse 26
Frenbach, SWITZERLAND

Jerome C. Goldstein, M.D. (1992)
4119 Manchester Lake Drive
Lake Worth, FL 33467

William E. Hitselberger, M.D. (1997)
2222 Oceanview Suite 199
Los Angeles, CA 90057

L.B.W. Jongkees (1968)
Reijnier Vinkeleskade 71 1071 S2 Amsterdam
Wilhelmina Gasthuis, THE NETHERLANDS

**1999-2000 MEMBERSHIP LIST
AMERICAN OTOLOGICAL SOCIETY, INC.**

Andrew Morrison (1985)
"Dyers" Marden Ash Chipping Ongar
Essex CM5 9BT, UK

Yasuya Nomura (1992)
Showa University 1-5-8 Hatanodai
Shinagawa-Ku Tokyo 142, JAPAN

Michel Portmann (1983)
114 Ave de' Ares
Bordeaux 33000, FRANCE

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John F. Tolan, M.D.
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ABSTRACTS

of the

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Annual Meeting**

AMERICAN OTOLOGICAL SOCIETY, INC.

May 13-14, 2000

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- To advance and promote medical and surgical otology including the rehabilitation of the hearing impaired.
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FELINE IMMUNODEFICIENCY VIRUS-MEDIATED GENE THERAPY OF MIDDLE EAR MUCOSA CELLS

Hamid R. Djalilian, M.D., Yasuhiro Tsuboi, M.D.
Wesley Obritsch, Jizhen Lin, M.D.

Hypothesis: To investigate the feasibility of gene therapy of the middle ear mucosa using a novel vector.

Background: Given present medications are unable to affect chronic otitis media, cholesteatoma, or tympanic membrane perforation, newer methods of treatment like gene therapy for these diseases must be explored. These genes can then be used to alter cytokines in the middle ear, slow or stop cholesteatoma growth, or improve tympanic membrane perforation healing. Feline immunodeficiency virus (FIV), a new lentiviral vector has been found to have greater than 90% efficiency in transfecting epithelial cells. Therefore, in vivo gene therapy of middle ear mucosal cells was attempted.

Methods: Twenty microliter of 10⁷ vectors/ml FIV carrying the gene for green fluorescence protein (GFP) was introduced into the middle ears of Sprague-Dawley rats via a bulla approach.

Results: Expression of the GFP gene was observed in the middle ear mucosal cells indicating transfection.

Conclusion: Gene therapy of the middle ear is feasible and has a potential in treating patients with chronic otitis media, cholesteatoma, or tympanic membrane perforation.

ANALYSIS OF THE DYSFUNCTIONAL EUSTACHIAN TUBE BY VIDEO ENDOSCOPY

Dennis S. Poe, M.D., Ashraf A. Halawa, M.B.Bch. M.S.
Osama A. Razek, M.B.Bch. M.S.

Objective: Human eustachian tubes (ET) with known ear pathology were inspected endoscopically and video recordings made for slow motion analysis of pathophysiology.

Setting: Ambulatory office in a tertiary referral center.

Subjects: 50 ears in 32 adults with pathological ears.

Interventions: Transnasal endoscopic examination of the nasopharyngeal opening of the eustachian tube during rest, swallowing, and yawning to study ET dilatory movements.

Main outcome measures: Slow motion video analysis of ET opening movements.

Results: 50 pathological ears were studied. Tubal function was graded on:

1. Extent of lateral excursion and progression of dilatory wave as estimates of tensor veli palatini and dilator tubae muscle function. Reduced function observed in 29 tubes.
2. Degree of mucosal disease. Significant in 34 tubes.
3. Polypoid or other obstructive mucosal changes. Present in 12 tubes.
4. Ease and frequency of tubal opening with maneuvers. 14 tubes opened occasionally, 15 only with maximal efforts, and 9 were unable to open.
5. Patulous tubes. All 5 clinically patulous tubes showed concavities in the superior third of the tube which is convex in normals.

All tubes with active ear pathology (otitis media with effusion, tympanic membrane retraction, draining ear) had significant abnormalities.

Correlation could not be made between severity of middle ear disease and severity of observed ET dysfunction.

Conclusions: Slow motion endoscopic video analysis was a useful technique in classifying types of ET pathology. Additional studies of dysfunctional tubes are needed to predict outcomes in operative ear cases and design intratubal therapy for chronically dysfunctional tubes.

LASER STAPEDOTOMY WITH CONSERVATION OF THE STAPEDIAL TENDON

Rodney C. Perkins, M.D.

The objective of this study was to develop a procedure that allows for the conservation of the stapedial tendon in the surgical correction of otosclerosis and to assess the results. The conservation of the tendon theoretically should provide protection against noise trauma in this group of patients.

Study Design: Patients in whom the procedure was done were studied prospectively.

Setting: Surgery was performed in an ambulatory surgical center with pre and postoperative studies done in an outpatient clinic.

Patients: Patients who had clinical otosclerosis and who were candidates for surgery were selected for the study.

Interventions: Patients in the study group had a laser stapedotomy with conservation of the stapedial tendon. The procedures were done under local analgesia on an outpatient basis.

Main Outcome Measures: Audiometric improvement in hearing and maintenance of stapedial reflex on impedance audiometry were assessed. Air conduction, bone conduction, speech discrimination and impedance audiometry were performed pre and postoperatively.

Results: Audiometric results were comparable to controls which had conventional laser stapedotomy with vaporization of the stapedial tendon. The stapedial reflex could be demonstrated postoperatively in the study group. There was no evidence of adverse effect, increased cost or significant surgical time and no increase in morbidity.

Conclusion: The technique provides a method for conservation of the stapedial tendon in patients undergoing laser stapedotomy for otosclerosis. In those patients it is expected that the protective function of the stapedial reflex will be maintained.

CURRENT USE OF IMPLANTS IN MIDDLE EAR SURGERY

Robert A. Goldenberg, M.D., John R. Emmett, M.D., F.A.C.S.

Hypothesis (objective): We report results of a survey of members of the American Otological Society (AOS) and American Neurotology Society (ANS) regarding their use of prostheses currently available for ossiculoplasty and stapedectomy. These findings are compared to a similar study presented by one of the authors in 1989.

Methods: Questionnaires were sent to the entire membership of the AOS and ANS with questions regarding biomaterial and prosthesis usage for stapes and chronic ear surgery, as well as satisfaction with each type of prosthesis used. Of the 585 questionnaires mailed, 245 were returned (41%). Only 188 of the 245 respondents performed middle ear surgery and their responses constitute the database for this study.

Results: For those respondents performing stapes surgery in both 1989 and 1999, the mean number of cases per year has increased from 33.1 to 37.5 ($p \leq .020$). The mean number of chronic ear cases has also increased from 103.0 in 1989 to 117.7 in 1999 ($p \leq .002$). As a biomaterial, autograft and homograft bone is used by most surgeons (58%) followed by autograft and homograft cartilage (46%), plastipore (46%) and hydroxylapatite (43%). In 1989, bone was used most (93%) followed by cartilage (78%) and plastipore (80%). Hydroxylapatite, which had just been introduced as a biomaterial, was used by only 8% of respondents. For stapes prostheses, the overwhelming majority of respondents currently use bucket handle (57%) or stainless steel/platinum pistons (57%). There was a high overall satisfaction rate in the use of these prostheses ($> 85\%$), with several exceptions. The lowest satisfaction rate was 72% for plastipore PORP and TORP. Usage and satisfaction rates will be presented for specific types of implants and compared to the earlier survey findings.

Conclusion: The current use of implants in middle ear surgery demonstrates a specific pattern with a high degree of user satisfaction. The preference for implants by respondents has remained stable over the past ten years; there has been a decrease in the percentage of use of bone, cartilage and plastipore with a corresponding increase in the use of hydroxylapatite.

VIBRATORY SAMPLE MAGNETOMETRY OF STAPES PROSTHESES AND MANUFACTURING MATERIALS

Mark J. Syms, M.D., Derrick W. Peterman, Ph.D.

OBJECTIVE: Assess the ferromagnetivity of stapes prostheses using a vibratory sample magnetometer (VSM).

DATA SOURCES: Previously, stapes prostheses from different manufacturers were placed in a 1.5-tesla MRI field to determine their ferromagnetic properties. Two series of Xomed prostheses were found to be ferromagnetic. Vibratory Sample Magnetometry was performed on 16 samples, including ferromagnetic 420F stainless steel. VSM testing was performed using a LDJ Model 9600 VSM in accordance with American Society for Testing and Materials standard A894.

RESULTS: A VSM measures the magnetic dipole moment of a sample in a magnetic field. The magnetic field is swept over a range of magnetic fields, and the magnetic dipole moment is plotted as a function of field. In a ferromagnetic material, the dipole moment plot demonstrates hysteresis. The samples made with 316L stainless steel, which is used in otologic implants, are fairly non-magnetic relative to the 420F stainless steel. The torque and linear force on the prosthesis in a given magnetic field can be calculated from the results of VSM.

CONCLUSION: VSM demonstrates that prostheses made with 316 L stainless steel are relatively non-ferromagnetic when compared to 420F stainless steel. The forces acting on a prosthesis in a given magnetic field can be calculated using VSM. The safety performing MRI on patients with these implants needs to be reassessed.

MIDDLE EAR PROSTHESIS DISPLACEMENT IN HIGH STRENGTH MAGNETIC FIELDS

Michelle D. Williams, MS4, Patrick J. Antonelli, M.D., Lorna Williams, M.D.

Hypothesis: Middle ear prostheses made from “non-ferromagnetic” metals reportedly displace *in vitro* in the presence of high magnetic fields used in magnetic resonance imaging (MRI). We have postulated that the prosthesis displacement seen with “non-ferromagnetic” prostheses *in vitro* would not be clinically significant *in vivo*.

Methods: Middle ear prostheses made from “magnetic” (420K stainless steel) and “non-magnetic” metals (316K stainless steel and platinum) were analyzed for magnetic field (MF) interactions at 4.7 Teslas using both *in vitro* and *in vivo* methods. *In vitro* testing included measurements of angular deflection and torque at graded distances and angles relative to the MF. *In vivo* testing was assessed by implanting prostheses in cadaveric temporal bones and performing clinical MRI protocols. Prosthesis displacement was measured semi-quantitatively.

Results: Angular deflection was observed in all samples made from “non-magnetic” stainless steel. The negative control (platinum) demonstrated no deflection, and the positive control (“magnetic” stainless steel) deflected > 90 degrees. Torque analysis showed movement or total displacement in 5 of 6 “non-magnetic” stainless steel prostheses. Prostheses made from “non-magnetic” stainless steel remained in place without appreciable loosening *in vivo* following MRI. Prostheses made with known ferromagnetic properties were frequently, but not consistently displaced with MR.

Conclusion: Middle ear prostheses made from low-ferromagnetic stainless steel do move in the presence of high MF *in vitro*; however, this does not appear to be clinically significant *in vivo*. MRI should be undertaken with caution in individuals with prostheses made from stainless steel with strong ferromagnetic properties.

PROGNOSTIC FACTORS IN OSSICULOPLASTY: A STATISTICAL STAGING SYSTEM

John L. Dornhoffer, M.D., Edward K. Gardner, M.D.

Objective: The Middle Ear Severity Index (MERI) is a previously described scoring system based on several middle ear factors felt to be important in the outcome of otologic surgery, such as perforation, cholesteatoma, mucosal disease, revision surgery, and ossicular status. A high composite MERI would theoretically be associated with a poor outcome. The purpose of this presentation was to perform a weighted statistical analysis of the scoring system used in the MERI to determine which factors best predict audiologic outcome in ossiculoplasty.

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Intervention: Patients undergoing ossiculoplasty using the Dornhoffer HAPEX[®] partial ossicular replacement prosthesis (PORP[™]) or total ossicular replacement prosthesis (TORP[™]), with or without mastoidectomy, between 1994 and 1998 were identified and included for study if adequate post-operative audiometric information was available.

Main Outcome Measures: Hearing results based on a 4-frequency puretone average air-bone gap (PTA-ABG) were analyzed using a weighted linear regression to determine which factors described by the MERI were most predictive of outcome.

Results: 204 ossiculoplasties were available for analysis. While the MERI system developed a fairly linear function of severity index versus PTA-ABG for the group, as a whole, certain factors, such as Belucci classification, cholesteatoma, and presence of the stapes superstructure, appeared to be over-rated in this scheme. On the other hand, the status of the middle ear mucosa was not adequately emphasized.

Conclusion: Based on the statistical analysis of the MERI system using a standardized ossiculoplasty technique, a new middle ear scoring system is presented which incorporates changes directed by statistical analysis and are felt to better predict hearing outcome.

ANTERIOR SUBANNULAR T-TUBE FOR PROLONGED MIDDLE EAR VENTILATION DURING TYMpanoplasty: LONG-TERM FOLLOW-UP

Ravindhra G. Elluru, M.D., Ph.D., Reena Dhandu, M.D.
Joel A. Goebel, M.D., J. Gail Neely, M.D.

Objective: We have previously described the use of anterior subannular T-tubes (n=20) for long term middle ear ventilation. In the present study we examine a larger patient population (n=36) and a longer follow-up interval (>2 years) to evaluate the efficacy and safety of anterior subannular tympanostomy.

Study Design: Retrospective non-randomized case review.

Setting: Tertiary referral hospital.

Patients: A series of 36 consecutive patients with a diagnosis of eustachian tube dysfunction, adhesive otitis media and/or chronic otitis media with a perforation, who underwent tympanoplasty.

Intervention: A subannular T-tube was placed anteriorly at the time of tympanoplasty to provide long term middle ear ventilation.

Main Outcome Measures: The main outcomes of this study are tube position, tube patency, and middle ear ventilation. In addition hearing was evaluated both pre- and post-operatively and any complications were noted.

Results: There were 36 patients and ears who received an anterior subannular T-tube at the time of tympanoplasty. There were 22 females and 14 males with a median age of 36 years (range = 10-75 years). All 36 patients had eustachian tube dysfunction, 14 had adhesive otitis media, 9 had chronic otitis media, 4 had a cholesteotoma, 8 had perforations, and 2 patients had a cleft palate. All patients underwent a tympanoplasty, 19 had concomitant ossiculoplasty and 8 had a mastoidectomy. Follow-up ranged from one month to 40 months (mean = 21 months). Three tubes had extruded within 2 years. Post-operative complications included an extruded prosthesis, a tipped prosthesis, and 2 cases of persistent tympanic membrane retraction. All other tubes were patent and showed no evidence of migration. Furthermore, there were no cases of anterior canal blunting or ingrowth of epithelium around the tube.

Conclusions: Anterior subannular tympanostomy is a safe and effective method for long-term middle ear ventilation in patients with chronic eustachian tube dysfunction.

DELAYED FACIAL PALSY AFTER STAPEDECTOMY

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

Objective: To study the incidence, pathogenesis, and prevention of delayed facial palsy after stapedectomy.

Study design: Retrospective case review.

Setting: Otology/Neurotology referral center.

Patients: A series of 2152 stapedectomy procedures in the last twelve years.

Intervention: Delayed facial palsy after stapedectomy was studied.

Main outcome measure: House-Brackmann facial nerve grading system and serum antibody titer tests for herpes simplex virus type I, type II and varicella zoster virus.

Results: Delayed facial palsy occurred in 11 of 2152 procedures. Delayed facial palsy occurred from 5 to 16 days, with a mean of 8 days, after stapedectomy. Predisposed factors were bony facial canal dehiscence, with bare facial nerve herniation in 5 patients, chorda tympani nerve stretched, manipulated, or cut in 2 patients, granulomatous reaction to gelfoam in 1 patient, fever blisters on the upper lip in 1 patient, and viral sinusitis in 2 patients. Elevated anti-varicella antibody titers were found in all 6 patients studied. Anti-simplex type I and II antibodies titers were elevated in 5 of 6 patients. Acyclovir was effective in preventing delayed facial palsy in one revision stapedectomy patient, who had delayed facial palsy after prior stapedectomy in the same ear with elevated anti-herpes antibody titer.

Conclusion: Delayed facial palsy occurred in 0.51 % after stapedectomy. Serologic investigation suggests activation of latent herpes virus. Mechanical irritation of the facial or chorda nerve during operation may trigger the activation. Anti-herpes virus agent Acyclovir may prevent delayed facial palsy after stapedectomy in patients suspected of this complication.

INCIDENCE OF FACIAL NERVE DEHISCENCE AT SURGERY FOR CHOLESTEATOMA

Samuel H. Selesnick, M.D., FACS, Alastair G. Lynn-Macrae, M.S.

Objective: Facial paralysis can occur after surgery for cholesteatoma. The risk of facial nerve injury is great when the nerve is not covered by its normal bony Fallopian canal. The objective of this study was to identify the incidence of facial nerve dehiscence in patients undergoing surgery for cholesteatoma.

Study Design: Retrospective chart review.

Setting: Tertiary referral hospital

Patient Population: An assessment of all cases performed by the senior author from 1991 - 1999 revealed 59 patients with adequate data available for analysis. These patients ranged in age from 3 to 92 years. Sixty seven surgeries were performed in total.

Intervention: Surgery for cholesteatoma including tympanoplasty and mastoidectomy.

Outcome Measure: The presence of facial nerve bony dehiscence after exenteration of disease, and postoperative facial nerve function.

Results: 33% of the total surgeries analyzed, 30% of the initial surgeries and 35% of the revision surgeries were found to have facial nerve bony dehiscence. The dehiscence was present in the tympanic portion of the facial nerve in the vast majority of patients. Of the 97% of patients with normal preoperative facial nerve function, all retained normal function postoperatively.

Conclusions: Facial nerve dehiscence in our series was far greater than that reported in the literature, underscoring the fact that this is an under appreciated finding. These findings merit increased surgeon vigilance when dissecting near the facial nerve. Intraoperative facial nerve monitoring, has proven to be of value in facial nerve preservation during acoustic neuroma resections, and may have a role during surgery for cholesteatoma.

A META-ANALYSIS OF HEARING RESULTS IN INTRATYMPANIC GENTAMICIN THERAPY

Michelle L. Facer, D.O., Colin L.W. Driscoll, M.D.
Stephen G. Harner, M.D. George W. Facer, M.D.
Charles W. Beatty, M.D., Thomas J. McDonald, M.D.

Objective: Intratympanic gentamicin is a well-established and effective treatment for patients with intractable vertigo of a peripheral vestibular etiology. Sensorineural hearing loss is a potential complication of the treatment and is directly related to the dose delivered. The risk of hearing loss with various treatment regimens has not been clearly delineated. The objective of this study is to establish the risk of hearing loss and clarify the relationship between hearing loss and drug dose.

Data Sources: A MEDLINE search of the English literature up to June 1999 was conducted using the search terms intratympanic, gentamicin, vertigo and Meniere's disease. The bibliographies of each article were reviewed to identify other relevant publications.

Study Selection: All studies reporting pre and post treatment hearing results and treatment dose were included. The Meta-Analysis also includes the prospectively collected data from approximately 100 patients treated at the author's institution.

Data Synthesis: Pre and post treatment hearing results are compared, and the relationship with treatment dose explored.

Conclusions: Intratympanic gentamicin can be delivered with limited risk to hearing in patients with vertigo of peripheral labyrinthine origin. In patients with useful hearing the goal of treatment should be to deliver the lowest dose of gentamicin that relieves the symptoms. Some current protocols may use a dose higher than necessary for vertigo control and increase the risk of hearing loss.

QUALITY OF LIFE ASSESSMENT OF PATIENTS WITH MENIERE'S DISEASE

John P Anderson, Ph.D., Jeffrey P. Harris, M.D., Ph.D.

This reports on an unfunded preliminary study to describe of the Health-Related Quality of Life situation of 12 Meniere's patients, who have failed conventional therapy and are candidates for further medical intervention at this Tertiary referral center. Assessments, using the Quality of Well-being Scale (QWB) and the Centers for Epidemiological Studies -- Depression Scale (CES-D) were taken pre-treatment, and post-treatment follow-ups will be made.

Pre-treatment QWB results, on a scale from 0 (for death) to 1.0 (for asymptomatic full function) showed Meniere's patients to average .568, roughly equal to that of elderly patients with advanced COPD (.550), but above that of non-institutionalized Alzheimer's patients (.506). This figure indicates Meniere's patients lose $(1.000 - .568 =) .432$ Quality-Adjusted Life Years (QALY) for each year spent in this situation. CES-D results (on a 0-60 scale) averaged 22, where a score of 16 or above indicates clinically significant depression.

These measures indicate that (1) the pre-treatment condition of Meniere's patients may be measured by these instruments, and (2) that the instruments appear to be in substantial agreement about the serious impairment of patients' Quality of Life.

Treating physicians indicated surprise at the breadth and level of debilitation characteristic of these Meniere's patients.

IRB# 980609

THE WANING ROLE OF VESTIBULAR NERVE SECTION AND LABYRINTHECTOMY FOR INTRACTABLE MENIERE'S DISEASE

Anis A. Ahmadi, B.S., Patrick J. Antonelli, M.D., George T. Singleton, M.D.

Objective: The purpose of this study is to assess the impact of intratympanic gentamicin (ITG) therapy on the need for invasive surgery (labyrinthectomy and vestibular nerve section) for intractable Meniere's disease.

Study Design: Retrospective case review

Setting: Tertiary referral center

Patients: All patients receiving surgical treatment for Meniere's disease, not controlled by medical therapy, for the 5 years preceding our adoption of ITG (1987 - 1991) and the most recent 5 year period (1994 - 1998).

Main Outcome Measures: Type, efficacy, and complications of surgical therapy.

Results: From 1987 through 1998, 65 patients with intractable Meniere's disease underwent labyrinthectomy (18), vestibular nerve section (2), ITG (30), or endolymphatic sac surgery (13). Though surgical volume doubled from the first 5 years (16) to the last 5 years (31), the need for labyrinthectomy dropped by 79% (14 to 3) and the use of ITG rose dramatically (0 to 22, $p < 0.0001$). Of the 3 patients treated with labyrinthectomy over the last 5 years, 2 did not have adequate support to perform ITG at home or to return for outpatient therapy, and one patient was not offered ITG. Vestibular nerve section has not been needed in the last 5 years. Only one patient with bilateral disease reported no improvement with ITG. Complete or substantial control of vertigo was equal with ITG and invasive ablative techniques (90 vs. 89%).

Conclusion: The success of intratympanic gentamicin therapy has markedly reduced the need for more invasive ablative surgery for intractable Meniere's disease.

IMPLANTATION OF THE SEVERELY MALFORMED COCHLEA

Andrew J. Fishman M.D., J. Thomas Roland M.D.
George Alexiades, M.D., Noel L. Cohen M.D.

Objective: Numerous reports attest to the efficacy and safety of cochlear implantation in the more commonly encountered inner ear malformations of incomplete partition and enlarged vestibular aqueduct. Few, however, have addressed the implantation of the severely malformed cochlea. This study reports the safety and efficacy of implanting patients with severe inner ear malformations.

Study Design: Clinical case study.

Setting: Tertiary referral center.

Patients and Intervention: Four patients with a small common cavity deformity and one with severe cochlear hypoplasia limited to a basal bud of 3.3 millimeters were implanted with a multichannel cochlear implant and followed for a period of one to three years. Preoperative imaging required both high resolution CT scanning and MR imaging in order to assess the presence of an implantable cavity and evidence of a cochlear nerve, as well as the position of the facial nerve which was aberrant in this population.

Main Outcome Measures: Complications and post implantation auditory performance.

Results: All five patients were successfully implanted without facial nerve injury or wound infection. The number of implanted electrodes ranged from ten to twenty. One patient with a small common cavity disorder developed a CSF leak associated with a partial intracanalicular array placement that was managed conservatively with continuous lumbar spinal drainage. All five patients are receiving significant postoperative improvement in auditory performance following implantation.

Conclusion: It is safe and efficacious to implant patients with severe cochlear malformations.

THE MANAGEMENT OF FAR-ADVANCED OTOSCLEROSIS IN THE ERA OF COCHLEAR IMPLANTATION

Michael J. Ruckenstein, M.D., M.Sc.

Kristine O. Rafter, M.A., Douglas C. Bigelow, M.D.

Objective: To evaluate issues pertaining to cochlear implantation in patients with far advanced cochlear otosclerosis.

Study Design: Prospective Cohort

Setting: Tertiary care referral center

Patients: Seven adult patients (18 years of age or older) referred for management of profound hearing loss, the etiology of which was determined to be otosclerosis.

Intervention: Cochlear Implantation with multichannel cochlear implant device.

Main Outcome Measures: Benefit from cochlear implant as measured by CID sentence scores, incidence and management of facial nerve stimulation, technical issues pertaining to cochlear implantation in this patient population.

Results: All patients demonstrated significant improvement in auditory function as measured by performance on CID sentence scores and ability to engage in telephone conversation. Facial nerve stimulation was present in 2/7 patients, and was managed with deactivation of the stimulating electrodes. Ossification in the basal turn of the cochlea, detected on preoperative CT scan, necessitated placement of the electrode into scala vestibuli in 2 patients and utilization of a thinner electrode (Nucleus 24) in a third patient.

Conclusion: Patients with profound hearing loss secondary to otosclerosis derive excellent benefits from cochlear implantation. Surgical implantation may be complicated by ossification of the cochlea, which can be detected on preoperative CT scan. Electrode activation may be complicated by facial nerve stimulation, which can be addressed with programming strategies.

IS COCHLEAR IMPLANTATION POSSIBLE AFTER ACOUSTIC TUMOR REMOVAL?

Aziz Belal, M.D.

Methods: Eight temporal bones that belongs to seven patients who underwent acoustic tumor removal during their life were histologically examined. Special emphasis was put on examining the patency of the cochlear turns, survival of the spiral ganglion cells and cochlear nerve.

Results: Following middle fossa removal of acoustic tumor with unsuccessful hearing preservation, the cochlea was ossified, the spiral ganglion cells were degenerated and the cochlear nerve fibrosed. Following translabyrinthine acoustic tumor removal, the cochlear turns were filled with blood which gradually organized into fibrous tissue and bone. Total cochlear ossification was complete months after the surgery. The spiral ganglion cells and the cochlear nerve have almost completely degenerated.

Conclusions: The possibility of cochlear implantation after acoustic tumor surgery depends on two factors: patency of the cochlear turns, and survival of the spiral ganglion cells and cochlear nerve. There is progressive osteogenesis of the cochlear turns following acoustic tumor removal. The process seems to take months to be completed and is directly related to preservation of the blood supply to the cochlea. If cochlear implantation is indicated, the earlier the better, i.e., like meningitis. Following retrosigmoid or middle fossa approaches, cochlear implantation may be done after one month of the initial surgery. Following translabyrinthine acoustic tumor removal, the internal coil may be inserted at the time of initial surgery. Survival of the neural structures in the cochlea and of the cochlear nerve is also directly related to preservation of its blood supply. Determination of nerve survival by the promontory test may be a crucial prerequisite in cases with unsuccessful hearing preservation.

ADULT COCHLEAR IMPLANT PATIENT PERFORMANCE WITH NEW ELECTRODE TECHNOLOGY

Terry Zwolan, Ph.D., Paul R. Kileny, Ph.D.
Sharon Smith, M.S., Dawna Mills, M.S.

Objective: In 1998, clinical trials were initiated to study the CLARION Electrode Positioning System (EPS) with the standard pre-curved electrode array in adults. In 1999, clinical trials were initiated to study use of the CLARION HiFocus Electrode, plus the EPS, in adults. The purpose of this study was to evaluate the performance of patients implanted with this new technology and to compare to that obtained by patients implanted with the standard CLARION array.

Study Design: This paper will present data obtained at several different implant facilities who participated in the clinical trial. All subjects participated in preoperative testing with hearing aids and postoperative testing with the EPS and/or HiFocus Electrode. Results obtained by patients in the clinical trial were compared to results obtained by patients implanted with the CLARION device without a positioner and/or with a positioner but not using the new HiFocus electrode array.

Setting: The study was carried out at several cochlear implant centers affiliated with tertiary medical centers.

Patients: Patients consisted of postlingually deafened adults who received a CLARION cochlear implant.

Interventions: Patients participated in pre- and post-operative testing that included psychophysical measurements and speech perception testing performed 1, 3, 6, and 12 months post-activation

Main outcome measures: Primary outcome measures included speech perception, impedance, and psychophysical data.

Results: Preliminary analysis of group data show superior speech perception performance for patients implanted with the EPS system, and for patients implanted with the new HiFocus Electrode. Differences between the two groups in their psychophysical responses will be presented.

HEARING REHABILITATION USING THE BAHA™-BONE ANCHORED HEARING AID: RESULTS IN 35 PATIENTS

The Osseointegrated Implant Study Group*

Objective: This study evaluates the U.S. experience with the first 35 patients who have undergone rehabilitation using NobelBiocare's BAHA™ bone anchored hearing aid.

Study Design: This study is a multicenter, non-blinded, prospective case series.

Setting: 12 US tertiary referral centers.

Patients: Eligibility for BAHA implantation included patients with a hearing loss and an inability to tolerate a conventional hearing aid, with bone conduction levels at 50 db or less at 0.5, 1, 2, and 4 KHz.

Intervention: Patients who met audiologic and clinical criteria were implanted with the NobelBiocare BoneAnchored Hearing Aid.

Main outcome measures: 1) Preoperative air and bone conduction thresholds; 2) Postoperative BAHA-aided thresholds; 3) Hearing improvement as a result of implantation (preoperative bone vs. postoperative air conduction thresholds); 4) Implantation complications.

Results: The most common indications for implantation included chronic otitis media and/or draining ears (14 patients) and external auditory canal stenosis or aural atresia (1). Overall, each patient had an average improvement of 36.5 db +/- 19 db with the use of the BAHA. Closure of the air-bone gap to within 5 db of the preoperative bone conduction thresholds (postoperative BAHA-aided threshold vs. preoperative bone conduction threshold) occurred in 18 patients (51%). 11 patients (31%) demonstrated "overclosure," of the preoperative bone conduction threshold of the better hearing ear. Complications were limited to local infection and inflammation at the implant site in 4 patients. Patient response to the implant was uniformly satisfactory.

Conclusions: The BAHA bone-anchored hearing aid provides a reliable adjunct for auditory rehabilitation in appropriately selected patients, offering a means of dramatically improving hearing thresholds in patients with conductive or mixed hearing loss who are otherwise unable to benefit from traditional hearing aids.

* 1) Lawrence R. Lustig MD, 2) H. Alex Arts MD, 3) Derald E. Brackmann MD, 4) Timothy B. Maloney MD, 5) Cliff A. Megerian MD, 6) Gary F. Moore MD, 7) Karen M. Moore MA, 8) Thomas E. O'Connor MA, CCC-A, 9) William Potsic MD, 10) Jay T. Rubinstein MD, PhD, 11) S. Srirredy MA, 12) Charles A. Syms III MD, 13) George Takahashi, PhD, 14) David M. Vernick, MD, 15) Phillip A. Wackym MD, 16) John K. Niparko MD.

SURGICAL TECHNIQUES FOR IMPLANTING THE VIBRANT SOUNDBRIDGE MIDDLE EAR HEARING DEVICE

Alec Fitzgerald O'Connor, FRCS

Objectives: To review the different techniques used for Vibrant Soundbridge implantation and relate them to outcome measures.

Study Design: A consecutive series of patients who had the Vibrant Soundbridge device implanted followed up from between six and twenty-eight months.

Setting: The study was undertaken in a tertiary referral unit.

Patients: Twelve patients with moderate to severe sensorineural hearing loss were implanted using three different incisions. Both limited and extensive tympanotomies were created. Two different techniques for crimping the prosthesis onto the incus were employed.

Main Outcome Measures: Comparison of pre and post implanted air conduction thresholds. Ease of access and stability of the audio processor. The feasibility of positioning and crimping the Floating Mass Transducer whilst avoiding damage to the chorda tympani, without uncovering the facial nerve or removing the buttress between the fossa incudis and the surgical tympanotomy. The functional gains of the device were related to the crimping technique,

Results: No significant differences were noted in the air conduction threshold pre and post implantation. Minimal access using a double flap incision is adequate for implanting and protecting the device. Sufficient access to the meso tympanum can be achieved whilst conserving the buttress and leaving the facial nerve uncovered. However, the chorda tympani may on occasions be sectioned. Crimping of the prosthesis with straight forceps may be able to achieve a better prosthesis/ossicular interface.

Conclusion: Using technique honed from cochlear implant surgery, Vibrant Soundbridge implantation is a safe procedure. In order to gain maximum benefit, instruments and device design may need to be reviewed.

IRB Approval not applicable.

UPDATE ON CONSERVATIVE MANAGEMENT OF PATIENTS WITH ACOUSTIC NEUROMAS

Dick L. Hoistad, M.D., George A. Melnik, M.D., Bulent Mamikoglu, M.D.
Cathleen A. O'Connor, M.S., Richard J. Wiet, M.D.

Objective: To update our 1995 experience with conservative management of acoustic neuromas.

Study Design: Retrospective chart review.

Setting: Private practice and tertiary care referral setting.

Intervention: 90 out of 600 patients with an acoustic neuroma were treated conservatively. At least two magnetic resonance imaging (MRI) scans were required of all patients.

Main Outcome Measure: Change of tumor size over time was evaluated as were clinical symptoms: hearing status, tinnitus, balance disturbance, aural fullness, vertigo, headache, and facial pain, numbness, or weakness.

Results: Of 90 patients the average follow-up time interval was 28.1 months. 42 of 90 patients demonstrated a change in tumor size. These patients exhibited an average total growth of 0.47 cm over a mean follow-up time of 25.8 months, and this correlates with an average growth of 0.22 cm per year. Of the remaining 48 patients, no growth was demonstrated with a mean follow-up of 30.4 months. Of the 90 patients managed conservatively, 76 reported headache (84%), 59 tinnitus (66%), 32 balance disturbance (36%), 25 aural fullness (28%), 24 vertigo (27%), 6 headache (7%), 4 facial numbness (4%), 2 facial weakness (2%), and 0 facial pain (0%).

Conclusions: Conservative management for select patients with acoustic neuroma is a reasonable choice of management instead of gamma knife radiation or microsurgery. There are situations where the individual morbidities associated with surgery or radiation are not in the patients' best interests. A third option is necessary in patients who can not or do not wish to undergo these other treatments.

COMPARISON OF KI-67 AND C-FOS STAINING PATTERN IN GLOMUS JUGULARE AND GLOMUS TYMPANICUM

Mohammad.Mujtaba, M. D., Thomas J. Roland, M.D.
Dennis G. Pappas, M.D., Dean E. Hilman, Ph.D.

Hypothesis: The size of the jugulo-tympanic paraganglioma(JTP) is directly related to the density of Ki-67 stained cells and indicates the rate of tumor growth.

Background: Ki-67 antibody reacts with cells in the active phase of replication. The density of Ki-67 stained cells and tumor size may indirectly show the rate of growth.

Method: Nine surgical tumor specimens, which included both glomus tympanicum (GT) and glomus jugulare (GJ), were investigated using immunohistochemical and ultrastructural analysis. Ki-67, c-fos, gamma tubulin and S-100 stained tumor sections were analyzed, using a light microscope interfaced with a PC based mapping program. EM analysis was done for structural differences.

Result: Large-sized GJ had a higher density of Ki-67 and c-fos stained cells and a lower density of the gamma tubulin stained cells as compared with smaller sized tumors. GJ tumors had a higher density of S-100 stained cells than the GT tumors. Furthermore, large sized GJ had increased number of mitochondria, NSG, RER and Golgi apparatus, as compared to the smaller sized GJ. GT tumors had a variable staining pattern that was not related to their size.

Conclusion: There is a positive correlation between the size of the GJ and the density of Ki-67 and c-fos stained cells but a negative correlation for gamma tubulin. Increased number of cellular organelles might reflect the rapid tumor growth rate. We conclude that Ki-67 and c-fos antibodies are indicative of the faster growth rate in GJ tumors but are not useful for determination of GT tumors growth rate.

ETANERCEPT THERAPY FOR IMMUNE-MEDIATED COCHLEOVESTIBULAR DISORDERS. PRELIMINARY RESULTS IN A PILOT STUDY

Hyon K. Choi, M.D., MPH, Dennis S. Poe, M.D.
Mahboob U Rahman, M.D., PhD

Etanercept therapy for immune-mediated cochleovestibular disorders. - A preliminary result in a pilot study

Background: Immune-mediated cochleovestibular disorders (IMCVD) continue to present a management challenge to the otolaryngologist. Immunosuppressive drugs like cyclophosphamide and anti-rheumatic agents such as methotrexate are employed for IMCVD and are associated with variable efficacy, slow onset of effects, and sometimes serious toxicity. We describe the preliminary results of our experience in patients with IMCVD treated with etanercept, a TNF-alpha receptor blocker recently FDA approved as a potent rheumatoid arthritis medication.

Methods: Twelve patients who met the clinical criteria for progressive IMCVD and had failed to adequately respond to steroid administration were treated with etanercept 25mg subcutaneous injection twice a week. The main outcome measurement was assessment of hearing change by pure tone and word discrimination audiometry. When present, vertigo and tinnitus were assessed.

Results: Eight patients are reported with more than 2 month follow-up (mean duration of 4 months) and six of them had progressive or fluctuating hearing loss in their only hearing ear. Five of the eight had significant improvement in hearing, tinnitus, and vertigo. One had improvement in tinnitus and vertigo with stabilization of the previously progressive hearing loss. The other two had no appreciable changes in these outcomes. In five of the six with hearing improvement or stabilization, the benefits persisted up to the last visit (all >3months). One of the six had initial dramatic improvement but deteriorated after 5 months. The patient's hearing was rescued with addition of leflunomide to etanercept.

Conclusions: Our preliminary data suggest that etanercept therapy may be efficacious and safe for patients with IMCVD at least in a short-term basis. The results provide further evidence for the immune basis in IMCVDs and warrant additional study to better determine the potential clinical utility of etanercept for IMCVD.

RISK FACTORS FOR HEARING LOSS IN NEONATES

Stilianos E. Kountakis, M.D., Ph.D., John Skoulas, M.D.
Diane Phillips, M.S., CCC-A 4, C. Y. Joseph Chang

Objectives: To identify potential risk factors for neonatal hearing loss which are not included in the current joint committee on infant hearing (JCIH) high risk registry.

Methods: A series of consecutively born neonates with risk factors for hearing loss based on the 1994 JCIH registry were screened prospectively. There were 110 subjects with hearing loss and 636 subjects without hearing loss. Data collected as potential risk factors for infant hearing loss included not only those on the JCIH list but also others which we believed may be significant. The infant hearing screening was performed using auditory brain stem testing. Statistical analysis of data was performed using the chi-squared test.

Results: We identified 11 risk factors that were associated with hearing loss in our neonatal population, in addition to the factors listed by the JCIH. These are: length of stay in the intensive care unit, respiratory distress syndrome, retrolental fibroplasia, asphyxia, meconium aspiration, neuro-degenerative disorders, chromosomal abnormalities, drug and alcohol abuse by the mother, maternal diabetes, multiple births and lack of prenatal care.

Conclusion: This study identifies 11 risk factors in addition to those currently on the high-risk registry published by the JCIH for neonatal hearing loss. The inclusion of these additional risk factors in neonatal screening programs may improve the detection rate of neonates with hearing loss. Further study will be needed to determine whether inclusion of these additional risk factors in a hearing screening program can provide an efficacious alternative to the use of universal infant screening.

LIDOCAINE PERFUSION OF THE INNER EAR PLUS IV LIDOCAINE FOR TINNITUS

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

Objective: To report the results of lidocaine perfusion of the inner ear plus intravenous lidocaine for intractable tinnitus.

Study design: Retrospective case review.

Setting: Otolaryngology/Neurotology referral center.

Patients: Lidocaine perfusion of the inner ear plus IV lidocaine was performed on 71 ears of 63 patients with intractable tinnitus. Patients were followed for one month to one year.

Intervention: Approximately 0.5 ml of hyaluronan containing 20 mg of lidocaine per milliliter is injected into the round window niche. The patient remains with this ear while receiving 500 mg of lidocaine intravenously over two hours. The procedure is performed for three consecutive days. Hearing and spontaneous nystagmus are tested the second and third mornings.

Main outcome measure: Subjective evaluation of the tinnitus by the patient. Complete relief: no more tinnitus. Near-complete relief: occasional tinnitus reduced to a non-troublesome level. Partial relief: intermittent tinnitus is not as loud as before and may occasionally be troublesome. No relief: constant tinnitus remains the same.

Results: Tinnitus relief (complete, near complete, or partial) was achieved in 35 of 50 ears, 70%, in 1 month, in 20 of 26 ears, 76.9%, in 3 months, and in 10 of 12 ears, 83.3%, in 1 year. Hearing remained the same in all patients except one, in which there was a slight loss. Temporary paralytic spontaneous nystagmus occurred in 22 ears, irritative in 21 ears, and no spontaneous nystagmus in 25 ears.

Conclusion: Lidocaine perfusion of the inner ear plus IV lidocaine is effective in the treatment of intractable tinnitus without significant side effect.

ROLE OF IMAGING IN THE CLINICAL DIAGNOSIS OF INNER EAR DISORDERS

Arvind Kumar, M.D., Mahmood Mahfee, M.D.
Scott W. DiVenere, M.D. Han Soo Bae, B.S.

Objective: In the clinical setting of unilateral hearing loss, unilateral tinnitus, dizziness, and facial paralysis, modern imaging has effectively served to “rule out acoustic tumor.” However, in the majority of patients, no tumor is found and the cause of the symptoms remains unclear. The objective of this study is to demonstrate the diagnostic potential of advanced imaging for disorders of the inner ear and adjacent nerves.

Study Design: Retrospective case review

Setting: Tertiary referral center

Patients: Individuals presenting with unilateral hearing loss, unilateral tinnitus, dizziness and/or facial paralysis

Interventions: Diagnostic review of patients’ clinical, audiologic, vestibular, and imaging studies

Main outcome measure: Comprehensive clinical data of patients with unilateral inner ear symptoms was correlated with results of advanced imaging

Methods: Several case studies are presented in which comprehensive clinical data is correlated with results of advanced imaging and specific inner ear diagnoses were established. Examples of such diagnoses include hemorrhage into the inner ear, cochlear dendritic demyelination, cochlear otosclerosis, inflammatory lesion of the meatal and intralabyrinthine facial nerve and inner ear, intralabyrinthine schwannoma and endolymphatic sac tumor.

Conclusions: We have shown that when advanced imaging of the inner ear is correlated with comprehensive clinical data, specific pathologic entities of the inner ear can be confidently diagnosed. Should all patients with unilateral inner ear symptoms be referred for this costly imaging? We feel that more data is needed and a multicenter study of patients with unilateral inner ear symptoms would provide data which would help develop guidelines for an appropriate algorithm.

AN INTERACTIVE THREE-DIMENSIONAL COMPUTER MODEL OF THE TEMPORAL BONE

Masayuki Inouye, M.D, Joseph Roberson, M.D.
Kevin Montgomery, PhD., Michael Stephanides, M.D.

Basic science reports

Hypothesis/Goal: Development of a three-dimensional interactive computer model of the temporal bone.

Background: Learning temporal bone anatomy is an integral part of every otolaryngology residency program. The standard curriculum is comprised of temporal bone dissections, operative experience, and examination of histology. Essential to a working understanding of this complex anatomy is the ability to conceptualize the temporal bone in three-dimensions. Computer-generated models are the newest addition to the teaching armamentarium. Recent advances in bioimaging and computer technology have enabled the creation of an anatomically accurate three-dimensional model of the temporal bone.

Methods: Fifty serial histologic sections of the temporal bone were scanned into a Silicon Graphics Indigo Elan computer. The images were then processed using RAVE (Reconstruction And Visualization Environment), software which was developed at this institution. Contours were drawn around various structures, including ossicles, nerves, vessels, and the cochleovestibular system. These contours were then registered and a three-dimensional surface mesh was created. RAVE visualization software was then used to produce a three-dimensional model of each structure. Features of this program include the ability to add or remove any object, control proximity, rotation, color and transparency, produce a cutting plane, visualize stereoscopically, and manipulate the model in virtual reality with real otologic instruments which are tracked in space.

Results: An interactive three-dimensional computer model of the temporal bone.

Conclusions: While otologic training will continue to be based on temporal bone dissections and operative experience, advances in computer technology have allowed the creation of an innovative adjunct to the teaching armamentarium.

HISTOPATHOLOGY OF RESIDUAL AND RECURRENT CONDUCTIVE HEARING LOSS FOLLOWING STAPEDECTOMY

Joseph B. Nadol, Jr., M.D.

Hypothesis: Histopathology of temporal bones from patients who in life had undergone stapedectomy may provide new information concerning the causes of both residual and recurrent conductive hearing loss (CHL).

Background: Although closure of the air bone gap to within 10 dB occurs in approximately 90% of primary stapedectomy, a residual CHL occurs in approximately 10% and recurrent CHL may occur in up to 35% of cases. Revision surgery has provided clinical information concerning putative causes of failure of the primary surgery, including erosion of the incus, bony regrowth at the oval window and displacement of the prosthesis. Most reports on the histopathology of temporal bones from such patients have focused on complications of surgery with little attempt to correlate postoperative air bone gap with the observed histopathology.

Methods: A retrospective review of our collection of temporal bones ascertained 22 cases with postoperative CHL of 10 dB or greater (air bone gap averaged at 500, 1000, 2000, 3000, and 4000 Hz, using postoperative air and bone conduction levels) following stapedectomy. These temporal bones were prepared by standard methodology for light microscopy.

Results: Of the 22 cases with postoperative CHL equal to or greater than 10 dB, there were 19 with residual CHL, 2 with recurrent CHL, and 1 with both residual and recurrent CHL. The most common histopathologic correlates of residual and recurrent hearing loss included resorptive osteitis of the incus (64%), obliteration of the round window by otosclerosis (23%), the prosthesis lying on a residual footplate fragment (23%), the prosthesis abutting the bony margin of the oval window (18%), adhesions in the middle ear (14%) and new bone formation in the oval window (14%). The mean postoperative CHL in those temporal bones with round window obliteration (n=5) or resorption of the incus (n=14) was 38 dB and 27 dB respectively. Those cases with three findings had a greater postoperative conductive hearing loss than those with one finding.

Conclusions: Histopathology of temporal bones from patients who in life had undergone stapedectomy provides useful information concerning causes of both residual and recurrent conductive hearing loss. These data provide a basis for improving both surgical technique and prosthesis design.

IRB approval number: 94 01 011X

HISTOLOGIC STUDIES OF THE POSTERIOR STAPEDIO-VESTIBULAR JOINT IN OTOSCLEROSIS

Saumil N. Merchant, M.D., Armagan Incesulu, M.D.
Robert J. Glynn, Sc.D., Joseph B. Nadol, Jr., M.D.

Objective: To characterize involvement of the posterior stapedio-vestibular joint (SVJ) in otosclerosis, with special reference to stapes surgery.

Background: Long-term success of the laser STAMP, anterior crurotomy and similar partial stapedectomy procedures depends on lack of ankylosis and lack of otosclerosis involving the *posterior* SVJ. Previous work has shown that the air-bone gap in otosclerosis correlates with narrowing and loss of the SVJ space. However, the type and distribution of otosclerotic involvement of the posterior SVJ space has not been well characterized.

Methods: Histologic assessment of all serial sections through the oval window niche in 140 temporal bones with otosclerosis. (Age range: 20-95 years, mean = 68).

Results and Conclusions:

(1.) 2/140 bones had otosclerosis exclusively at the posterior joint. Of the remaining 138 bones, all of which had otosclerosis at the anterior joint, 82 bones also had otosclerosis at the posterior joint. Of the 56 bones without otosclerosis of the posterior joint, there was bony ankylosis of the posterior joint in 3 bones. Thus, 53 bones (38%) had neither ankylosis nor otosclerosis involving the posterior joint, and would be potentially suitable for a laser STAMP or a similar procedure.

(2.) There was no correlation between otosclerosis at the posterior joint and age, sex, or duration of conductive loss. Otosclerosis at the posterior joint in one ear was significantly associated with its presence at the posterior joint in the opposite ear, ($P=0.01$).

(3.) The audiogram could *not* be used to reliably predict otosclerotic involvement of the posterior SVJ or the degree of footplate pathology such as ankylosis.

A COMPARISON OF ENG RESULTS WITH POSTUROGRAPHY FINDINGS FROM THE BALANCETRAK 500

Manali Amin, M.D., Marian Girardi, M.A.,
Horst R. Konrad, M.D., Larry F. Hughes, Ph.D.

Objective: To determine a correlation between conventional ENG findings with results obtained from BalanceTrak 500 posturography assessment.

Study design: Individuals with a variety of dizziness and balance disorder symptoms were tested with both ENG (ocular motor studies, positional/positioning testing and caloric testing) and with computer posturography using the BalanceTrak 500.

Setting: Tertiary referral center.

Patients: Urban/rural Midwesterners referred for dizziness and balance dysfunction symptoms.

Intervention: Results of both testing modalities were sent to referring physicians for patient treatment.

Outcome Measures: ENG and posturography results.

Results: When ENG results are compared to BalanceTrak findings, a majority of those patients whose ENG findings indicated central and mixed etiologies, or peripheral lesions other than BPPV, had abnormal findings on posturography. Specifically, tests equivalent to the Balance Master Sensory Organization Tests (SOT) 4 and 5 and a new test, Limits of Stability (LOS), presented the most difficulty for these individuals. Patients with normal ENG findings and those with BPPV had mixed results on posturography.

Results for specific individual ENG tests were compared to posturography findings. A strong correlation was noted between abnormal caloric findings and abnormal LOS scores. These patients were more likely to have decreased scores on SOTs 2 and 4. However, most of these individuals had normal SOT 1 findings. Patients with abnormal positional testing had difficulty performing SOTs 2 and 4.

Conclusion: For many patients with dizziness and/or balance dysfunctions, posturography can provide additional information to that obtained with ENG testing. This is especially apparent for individuals who present with these symptoms but have normal or borderline normal ENG findings.

A VESTIBULAR PHENOTYPE FOR WAARDENBURG'S SYNDROME?

F. O. Black, M.D., F.A.C.S., S. C. Pesznecker, R.N.
K. Allen, M.S., C.C.C.-A., Claire Gianna, Ph.D.

Objective: To investigate vestibular abnormalities in subjects with Waardenburg's syndrome.

Study design: Retrospective record review.

Setting: Tertiary referral neurotology clinic.

Subjects: Twenty-two adult Caucasian subjects with confirmed diagnosis of Waardenburg's syndrome (10 type I and 12 type II; Asher & Friedman, 1996).

Intervention(s): (1) evaluation for Waardenburg's phenotype, (2) history of vestibular and auditory symptoms, (3) tests of vestibular and auditory function.

Main outcome measure(s): (1) Results of phenotyping, (2) results of vestibular and auditory symptom review (history), (3) results of vestibular and auditory function testing.

Results: Seventeen subjects were female, 5 were male. Age range was 21-58 years, with mean age of 38 years. Sixteen of the 22 subjects presented with chief complaint of vertigo, dizziness, or imbalance. Six had objective sensorineural hearing loss. Thirteen had an elevated summating/action potential (>0.40) on electrocochleography. All subjects except those with severe hearing loss ($n=3$) had normal auditory brain stem responses. In subjects with vestibular complaints, vestibulo-ocular tests (calorics, vestibular auto-rotation, and/or pseudorandom rotation) were abnormal in as many as 75%, and vestibulo-spinal function tests (computerized dynamic posturography, EquiTest®) were abnormal in as many as 63%, but there were no specific patterns of abnormality.

Conclusion: Waardenburg's syndrome subjects may present with a primary complaint of vestibular symptoms, and many have no hearing loss. Electrocochleography and vestibular function tests appear to be the most sensitive measures of functional abnormalities in Waardenburg's subjects who present with vestibular complaints.

Supported in part by NIH/NIDCD 00205, NASA NAG5-6329 and Legacy Research Advisory Council (RAC).

NAMES AND ADDRESSES OF PRIMARY AUTHORS

John P. Anderson, Ph.D.
USCD Medical Center
200 W. Arbor Drive 8895
San Diego, CA 92103

Patrick J. Antonelli, M.D., FACS
University of Florida
Dept. of Oto-Health Science Center
Box 100264, JHMHC
Gainesville, FL 32610-0264

Aziz Belal, M.D.
37 Syria Street, Rouchdy
Alexandria, Egypt

F. O. Black, M.D.
Dept. of Neurotology Research
P. O. Box 3950
1225 NE 2nd Ave., Ste 303
Portland, OR 97208-3950

John L. Dornhoffer, M.D.
University of AR for Medical Sciences
Dept. of Otolaryngology
4301 West Markham Slot 543
Little Rock, AR 72205

Ravindra G. Elluru, M.D., Ph.D.
Washington University
Dept. of Otolaryngology
660 South Euclid Ave.
Campus Box 8115
St. Louis, MO 63110

Michelle L. Facer, D. O.
Dept. of Otolaryngology
Mayo Clinic
200 First Street S.W.
Rochester, MN 55902

Andrew J. Fishman, M.D.
Dept. of Otolaryngology
NYU Medical Center
550 First Avenue
New York, NY 10016

Xianxi Ge, M.D.
6133 Poplar Pike
Memphis, TN 38119

Marian Girardi, M.A.
Division of Otolaryngology
SIU School of Medicine
P. O. Box 19662
Springfield, IL 62794-9662

Robert A. Goldenberg, M.D.
111 W. First St., Suite 600
Dayton, OH 45402

Dick L. Hoistad, M.D.
1000 Central, Suite 610
Evanston, IL 60201

Masayuki Inouye, M.D.
Dept. of Otolaryngology
Stanford University Hospital
300 Pasteur Drive
Stanford, CA 94305

Stilianos E. Kountakis, M.D., Ph.D.
University of Virginia Medical Center
P. O. Box 1008
Charlottesville, VA 22906-008

Arvind Kumar, M.D.
University of Illinois at Chicago
Eye & Ear Infirmary
1855 W. Taylor
Chicago, IL 60612

NAMES AND ADDRESSES OF PRIMARY AUTHORS

Jizhen Lin, M.D.
Box 396 UMHC
420 S. E. Delaware St.
Minneapolis, MN 55455

Lawrence R. Lustig, M.D.
Dept. of Otolaryngology-HNS
Johns Hopkins University
JHOC 6th Fl, 601 North Caroline St.
Baltimore, MD 21287-0910

Saumil N. Merchant, M.D.
Dept. of Otolaryngology
Massachusetts Eye & Ear Infirmary
243 Charles Street
Boston, MA 02114-3096

Mohammad Mujtaba, M.D.
Dept. of Otolaryngology-TH-513
NYU Medical Center
550 First Avenue
New York, NY 10016

Joseph B. Nadol, Jr., M.D.
Massachusetts Eye & Ear Infirmary
234 Charles Street
Boston, MA 02114-3096

Alec Fitzgerald O'Connor, FRCS
Auditory Implant Centre
St. Thomas' Hospital NHS Trust
Lambeth Palace Road
London, SE1 7EH

Rodney C. Perkins, M.D.
California Ear Institute at Stanford
801 Welch Road
Palo Alto, CA 94304

Dennis S. Poe, M.D.
Zero Emerson Place, Suite 2C
Boston, MA 02114

Mahboob U Rahman, M.D., Ph.D.
Arthritis Association
Massachusetts General Hospital
15 Parkman St.
Boston, MA 02114

Michael J. Ruckenstein, M.D.
University of Pennsylvania
Dept. of Otorhinolaryngology-HNS
3400 Spruce Street
Philadelphia, PA 19104

Samuel H. Selesnick, M.D.
Weill Medical College
Dept. of Otorhinolaryngology-HNS
5 Ravdin, 520 E. 70th St.
New York, NY 10021

John J. Shea, Jr., M.D.
6133 Poplar Pike
Memphis, TN 38119

Mark J. Syms, M.D.
Otolaryngology-HNS
Tripler Regional Medical Center
Honolulu, HI 96859-5000

Terry Zwolan, Ph.D.
University of Michigan
Cochlear Implant Program
475 Market Place, Bldg 1, Ste. A
Ann Arbor, MI 48108

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NOTES

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

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I, as senior author, am confirming that I/we have no real or apparent conflict of interest related to my/our participation in the American Otological Society's Annual Spring Meeting to be held May 13-14, 2000. In this regard, please be advised that I am disclosing below any publication, public positions, or memberships, as well as any personal financial interests (including equity positions, consulting agreements or employment arrangements) related to the proposed conference topic.

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Dennis S. Poe, M.D.
Clough Shelton, M.D.**

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