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the REGISTRY

Newsletter of the NIDCD National Temporal Bone, Hearing and Balance Pathology Resource Registry

Inside:

The REGISTRY is published semi-annually by the NIDCD National Temporal Bone, Hearing and Balance Pathology Resource Registry. The Registry was established in 1992 by the National Institute on Deafness and Other Communication Disorders (NIDCD) of the National Institutes of Health to continue and expand upon the former National Temporal Bone Banks (NTBB) Program. The Registry promotes research on hearing and balance disorders and serves as a resource for the public and the scientific community about research on the pathology of the human auditory and vestibular systems.

Histologic Evaluation of the Tissue Seal and Biologic Response Around Cochlear Implant Electrodes in the Human

Joseph B. Nadol, Jr., M.D. and Donald K. Eddington, Ph.D.

Department of Otology & Laryngology, Harvard Medical School and the Department of Otolaryngology, Massachusetts Eye and Ear Infirmary, Boston, MA

INTRODUCTION

Although bacterial meningitis has been reported as an infrequent complication of cochlear implantation using a variety of electrode designs (1-4) an apparent increase in the incidence of this complication was the subject of a recent conference (5). The United States Food and Drug Administration has issued a public health notification stating that cochlear implant recipients may be at greater risk for meningitis (6). The cause of meningitis in cochlear implant recipients has not been firmly established. In an analogous surgical situation, namely stapedectomy, in which a foreign body is placed in the middle ear and is in contact with perilymph, meningitis has been reported from 20 days to 5 years after surgery (7-11). In each case, acute suppurative otitis media was found in the operated ear clinically, histologically, or both. In 4 of the 5 cases with histologic data, a polyethylene tube had been used as an interposition between the lenticular process and the oval window. In each case, histologic evidence suggested that bacteria gained access to the inner ear via the oval window probably because of an open communication between the middle ear and perilymph. Thus in each case, there was clear histologic evidence that meningitis was otogenic and by direct extension from the middle ear.

Given the incidence of meningitis in cochlear implants and the analogous situation of otogenic meningitis following stapedectomy, it is reasonable to question the integrity of the tissue seal between the electrode array of a cochlear implant and the middle ear and the tissue response at the cochleostomy site secondary to the presence of the electrode. A defect in the tissue seal between the middle and inner ear following cochlear implantation has been proposed as part of the pathogenesis of meningitis (12). To date, no study has systemically evaluated the tissue

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NEWS AND ANNOUNCEMENTS

Look for the Registry's Exhibit at these upcoming meetings

The Association for Research in Otolaryngology 2004 MidWinter Meeting will be held in Daytona Beach, Florida on February 22-26, 2004. More information is available on their website.

http://www.aro.org/

American Academy of Audiology Meeting

The American Academy of Audiology will be holding their 16th Annual Convention & Expo on March 31–April 3, 2004 in Salt Lake City, Utah. For more information please visit their website.

http://www.audiology.org

The 2004 Annual Meeting & OTO EXPO will be held on September 19-22, 2004 at the Jacob K. Javits Convention Center in New York City, New York. For more information please visit their website:

http://www.entlink.net/meetings/index.cfm

SHHH 19th International Convention
"Hearing in The Heart ❤ land with family"
June 10 - 13, 2004
Omaha Hilton
Omaha, Nebraska
Visit their website for more information.
http://www.hearingloss.org/html/convention.html

Send Us Your News!
Send us your news and annoucements regarding hearing and/or balance loss or temporal bone research! (See page 3 for contact information.)

THANK YOU SHHH

The Registry would like to thank all the people who stopped by our booth at the SHHH International Convention in Atlanta, Georgia. Once again, the people of SHHH showed their support of the Registry and how much they support hearing research. We had such a great response from everyone who stopped by the booth. Thank you all.

DNA Program

Have you signed up to be a part of the Registry's DNA program? All our registered donors are encouraged to join our DNA program. This program greatly enhances your temporal bone donation and it's easy to do. For further information contact the Registry at (800) 822-1327.

REGISTRY NEWSLETTER AVAILABLE ONLINE

The National Temporal Bone Registry's semiannual newsletter, *The Registry*, is now available on the Registry's website. Several of the past newsletters are also available. Subscribers can be notified via email about current issues and will be directed to the newsletter by a link to our site. Please contact us through our website or call (800) 822-1327 to be added to the email list.

Please visit the Registry's website.

http://www.tbregistry.org

NIDCD National Temporal Bone, Hearing and Balance Pathology Resource Registry
Massachusetts Eye and Ear Infirmary
243 Charles Street
Boston, MA 02114-3096

(800) 822-1327 Toll-free Voice
(617) 573-3711 Voice
(888) 567-3277 Toll-free TTY
(617) 573-3838 Fax
e-mail: tbregistry@meei.harvard.edu
Web: www.tbregistry.org

Brochures about Temporal Bone Research and Donation Order Free-of-Charge for Your Office, Clinic or Organization

The NIDCD National Temporal Bone, Hearing and Balance Pathology Resource Registry, which is dedicated to promoting research on hearing and balance disorders through the study of temporal bones, has published two informational brochures, which you may request for display in your office and /or waiting rooms. Both brochures encourage individuals with hearing or balance disorders to bequeath their temporal bones to scientific research.

That Others May Hear is a short form brochure which describes briefly the functions of the Registry, and answers commonly asked questions regarding the temporal bone donation process. (Dimensions: 9" x 4")

The Gift of Hearing: Learning about Temporal Bone Donation is a 16-page, full-color booklet which describes in more detail and with diagrams, the structures of the ear, types of auditory disorders, the microscopic study of the temporal bone, and the benefits of temporal bone research. It also answers commonly asked questions regarding the temporal bone donation process. (Dimensions: 7" x 10")

If you are willing to display either of these brochures, please complete the form and return it to the Registry, by fax or mail. **The brochures will be sent to you free of charge.**

ORDER FORM

Please send me (circle or fill in quantity):

The Others May Hear: 25 50 100 _____ copies (free of charge)
The Gift of Hearing: 25 50 100 _____ copies (free of charge)
Donor Enrollment Pack: 5 10 _____ copies (free of charge)

Name: _____

Address: _____

Address: _____

City, State, Zip: _____

Telephone: _____

Mail or fax this form to the Registry at:

NIDCD National Temporal Bone, Hearing and Balance Pathology Resource Registry
Massachusetts Eye and Ear Infirmary
243 Charles Street
Boston, MA 02114-3096
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Or submit your request using email:
tbregistry@meei.harvard.edu

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seal and biologic response at the cochleostomy site in the human. The purpose of the present study was to histologically examine the tissue seal and biologic response in 21 temporal bones from 20 individuals who had undergone cochlear implantation during life with a variety of electrode systems including the Symbion Ineraid®, Cochlear Nucleus® and Advanced Bionics Clarion® devices.

The temporal bone specimens were serially sectioned in the horizontal (axial) plane at an average thickness of 25 micrometers. All serial sections passing through the cochleostomy site and electrode track were examined in order to evaluate the tissue seal at the cochleostomy, the presence or absence of an extra-cochlear electrode sheath, and finally to seek evidence of a cellular inflammatory response near the electrode. The clinical records were reviewed to document the electrode system used, the number of years between implantation and death, the type of tissue seal used at the time of surgery, and the age and sex of the patient.

RESULTS

The patients ranged in age from 54 to 84 years and had been implanted from 1 to 12 years prior to death. The tissue seal between the inner ear and middle ear was evaluated at and within the cochleostomy and also in the middle ear. In the area of the cochleostomy and just within the cochlea, there was a robust fibrous and bony tissue response in all 21 ears (Fig. 1). This fibrous tissue and new bone formation did not seem to be influenced by the type of grafted tissue used for the cochleostomy seal (fat, fascia, muscle and fascia, connective tissue, or soft tissue). No recognizable open communication or potential communication between the middle ear and inner ear was seen in any of the 21 ears.

Inflammatory cells such as mononuclear leukocytes, histiocytes and foreign body giant cells were present in 12 of the 21 temporal bones (57%) (Fig 2). No statistically significant relationship was found between the presence or absence of inflammatory cells and the type of tissue used as a graft or the electrode type. The inflammatory response seemed to be most intense and prevalent at the cochleostomy site. There was no correlation between the presence or absence of the inflammatory cell infiltrate and the age at or duration of implantation.

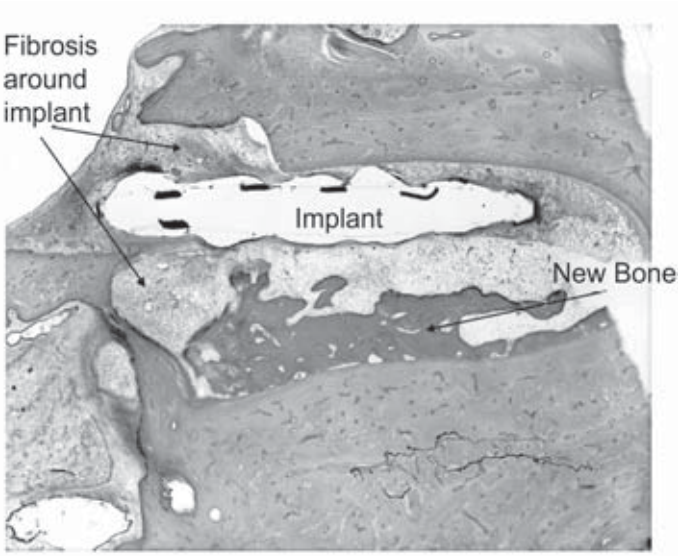

Fig. 1. Intracochlear seal surrounding electrode of cochlear implant. This 63-year old female had undergone a left cochlear implantation nine years before death. A dense fibrous and osseous reaction surrounds the electrode tract. Mag. = 20x

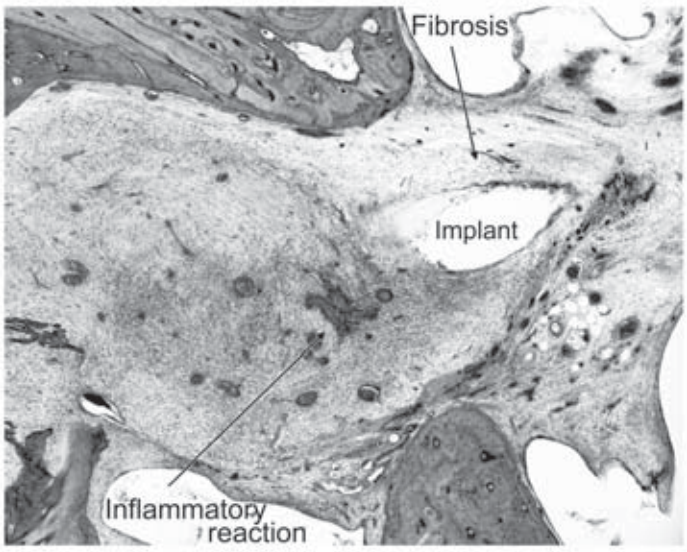

Fig. 2. This 70-year old man had undergone a right cochlear implant 12 years before death. There is fibrous tissue and inflammatory reaction near the implant at the cochleostomy site. Mag. = 35x

DISCUSSION

The histologic evidence presented in this study does not support an open communication between the middle and inner ear as part of the pathogenesis of bacterial meningitis as a late complication following cochlear

implantation. A robust osseous and fibrous sheath was found in all 21 temporal bones at the cochleostomy site in a variety of implant devices. Rather, the finding of a cellular inflammatory response in 12 of 21 temporal bones and in at least some of all three multichannel implant devices, suggests that late hematogenous contamination and colonization of the implant is a much more likely pathogenic mechanism.

Implanted prosthetic devices such as cerebrospinal shunt catheters, vascular catheters, and prosthetic cardiac valves may become infected within a few days or weeks of implantation or months or years later (13-16). Early postoperative infections are likely caused by bacterial contamination at surgery, whereas late infections are probably caused by hematogenous contamination of the prosthesis (13,16). It has been long recognized that the presence of an implanted foreign body may predispose to an infection, and the actual mechanism of potentiation of infection has been the subject of extensive investigation. Bacteria in the presence of a foreign body seem to be much more resistant to antibiotics. There may be several reasons for this. Bacteria may adhere to a foreign body creating a biofilm and hence a barrier to access by antibiotics (17). In addition, even in the absence of a biofilm, bacteria adherent to a polymer appear to be resistant to antibiotics, perhaps because they assume a dormant phase (18,19). In addition it is well known that even "biocompatible" prosthetics may induce an inflammatory response (20-22) in the form of lymphocytes, macrophages, and foreign body giant cells, and there may be up-or-down regulation of inflammatory mediators in the presence of a foreign body (23-25). The presence of a foreign body and the inflammatory reaction to it seem to result in inactivation of neutrophils (26-28) by decreasing both the phagocytic and bactericidal capacity of these cells (29-30); by increasing apoptosis of polymorphonuclear leukocytes (31); and by depleting neutrophil stores of superoxide and myeloperoxidase, part of the intracellular microbicidal mechanism (26,30). Such inactivation of inflammatory cells may lead to intracellular survival of bacteria making them resistant to most antibiotics (32-34).

The pulative mechanism of late hematogenous contamination, rather than otogenic meningitis via a defective tissue seal between middle and inner ear, has implications for possible strategies to prevent meningitis after cochlear implantation, such as inclusion of bactericidal agents in future electrode designs (35-37), directed antibiotic prophylaxis at the time of surgical implantation (38,39) and the use of vaccines (40).

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DEAFNESS RESEARCH FOUNDATION

HOLDS ITS FIRST CITIZENS RESEARCH CONFERENCE:

Advancements in Hearing Research & Technology

This year, the Deafness Research Foundation (DRF) launches a new program to bring hearing health directly to the public. DRF's Citizens Research Conference will be held regionally throughout the country and will serve as an exciting opportunity to exchange information on hearing, hearing loss, coping strategies, the latest in cutting-edge research and technology, as well as social aspects of hearing loss including ways to improve accessibility. Each conference will appeal to a wide number of people by incorporating education and entertainment. DRF's Citizens Research Conferences will be an excellent way for the public to learn more about their own hearing.

The first Citizens Research Conference was presented by DRF and New York University, School of Medicine, Department of Otolaryngology. The event took place on December 11 at NYU School of Medicine. A number of preeminent researchers from the field spoke about the latest in hearing research and technology. This was followed by a question and answer period. This Citizens Research Conference was sponsored by Advanced Bionics Corporation as the Platinum Sponsor and Cochlear Corporation as the Gold Sponsor.

Please join us at one of our future conferences. A tentative schedule is listed below.

March 13 – Long Island, NY
April 10 – Chicago, IL
May – Boca Raton, FL
August – California
TBA – New York, NY

For more information or to attend future events, please contact Mychelle Balthazard by phone at 202-289-5850, ext. 1010 or by email at Mychelle@drf.org

Otopathology Mini-Travel Fellowship Program

The NIDCD National Temporal Bone Registry is pleased to announce the availability of a mini-travel fellowship. The fellowship provides travel funds for research technicians and young investigators to visit a temporal bone laboratory for a brief educational visit, lasting approximately one week. The emphasis is on the training of research assistants, technicians and junior faculty. The fellowship is available to:

1. U.S. hospital departments who aspire to start a new temporal bone laboratory.

2. Inactive U.S. temporal bone laboratories that wish to reactivate their collections.

3. Active U.S. temporal bone laboratories that wish to learn new research techniques.

Two fellowship awards will be made each year ($1,500 per fellowship). The funds may be used to defray travel and lodging expenses. Applications will be decided on merit. Those awarded the fellowship will be required to submit a brief report.

Interested applicants should submit the following:

1. A 1-2 page outline of the education or training aspect of the proposed fellowship.

2. Applicant's curriculum vitae.

3. Letter of support from applicant's temporal bone laboratory director or department chairman.

4. Letter from the host temporal bone laboratory, indicating willingness to receive the traveling fellow.

Applications should be sent to:

Saumil N. Merchant, M.D.
NIDCD National Temporal Bone Registry
Massachusetts Eye and Ear Infirmary
243 Charles Street
Boston, MA 02114

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PLEASE! Notify us of your change of address before you move. Each undelivered newsletter is returned to the Registry office at a cost of $.50. Our loss is over $1.00 per unit. *Thank you*!

LETTERS TO THE REGISTRY (from individuals who have pledged their temporal bones for research)

Q. I am preplanning my funeral. What information should I give my funeral director?

A. It is extremely important that you notify the funeral director of your intention to donate your temporal bones when you pass away. You need to supply the funeral home with a copy of your signed consent form and the Registry's toll-free number. Upon your passing, the funeral director will be able to contact us as soon as possible, so that we can make arrangements.

Q. After I pass away, what should my family do?

A. The Registry should be notified as soon as you pass away. This can be done in several ways. If you pass away in a hospital, many family members have the hospital staff notify us. If you pass away at home, your family can contact us or have the funeral director contact us when they are notified. We usually try to have the removal done within twenty-four hours so that funeral arrangements can be finalized without thought to the donation.

Q. Will I be able to donate my temporal bones if I am enrolled in a whole body donor program?

A. Each body donation program has different guidelines in regard to multiple donations. You would need to check with the whole body program and notify the Registry.

Q. Why have I been sent update forms?

A. The Registry tries to keep up-to-date otologic records on all their donors. By sending out the update forms, we can update address information, changes in next of kin information, and any updates to medical records. Medical records are the most important part of a donor's chart. Recently, there have been changes to the way the Registry can request medical records. The new federal HIPAA regulations require that a physician or hospital should receive a signed and dated medical release form within 45 days of the date on which it was signed. As many facilities do not retain records beyond a period of seven years, it is extremely important that we collect medical records on our donors at least every two to three years.

If you have any questions, please feel free to contact the Registry at 800-822-1327.