Stapes Surgery
A Novice’s Approach to Developing Proficiency

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Objectives

- Understand the Indications for Surgery
- Review the Surgical Approach for Surgery
- Review Common Findings and Complications
Developing Proficiency

- Surgery of Methodical Technique
- Experience
  - 100 cases\(^1\)
  - 10 cases per year
  - Otology Courses
- Goal of Success
  - ABG of 10dB or less

History

- John Shea – 1956
  - Credited with first stapedectomy
  - Used a vein graft and nylon prosthesis
Indications for Surgery

- Conductive Hearing Loss in an otherwise normal ear
- Carhart’s Notch
- Negative Tuning Forks
  - BC>AC at 256 and 512
-Absent Stapedial Reflex
Role of CT Scan

- Is it Necessary?
- Concerns for SCCD
- Visualization of Otosclerotic Foci
  - Cone Beam CT vs Multislice CT
- Children – check for inner ear and ossicular deformities
Consent to Surgery

STAPEDECTOMY

Types of Hearing Impairment
The external ear and the middle ear conduct sound; the inner ear receives it. If there is some difficulty in the external or middle ear, a conductive hearing impairment occurs. If the trouble lies in the inner ear, a sensorineural or nerve hearing impairment is the result. When there is difficulty in both the middle and the inner ear a mixed or combined impairment exists. Mixed impairments are common in otosclerosis.

Otosclerosis
Usually otosclerosis spreads to the stapes or stirrup bone, the final link in the middle ear transformer chain. The stapes rests in the small groove, the oval window, in intimate contact with the inner ear fluids. Anything that interferes with its motion results in a conductive hearing impairment. This type of impairment is called stapedial otosclerosis, and is usually curable by surgery. The amount of hearing loss due to involvement of the stapes and the degree of nerve impairment present can be determined only by a hearing test.

Surgical Description
Stapedotomy or stapedectomy is performed through the ear canal under local or general anesthesia. A small incision may be made behind the ear to remove muscle or fat tissue for use in the operation. With the use of the operating microscope the eardrum is elevated and turned forward. The hearing bones are palpated and the diagnosis of otosclerosis of the stapes is confirmed. The laser is routinely used to vaporize parts of the stapes and the remainder of the stapes is removed with an instrument. A small opening is made in the footplate of the stapes. A stainless steel, titanium or platinum piston (prosthesis implant) is then placed into this opening and connected to the second hearing bone, or the incus. The eardrum is then returned to its normal position. While pistons in current use are safe with lower power MRI machines (1.5 Tesla or less), only titanium, platinum, and stainless steels are compatible with MRI scanning at all strengths. You should ask your surgeon what material is to be implanted and keep this information for future reference. The stapes prosthesis allows sound vibrations from the ear canal to the inner ear fluids, correcting the conductive hearing loss. The hearing improvement obtained is usually permanent. Most stapes surgery patients may go home the same evening the next morning. Most patients may return to work in seven days depending on the occupational requirements. One should not plan to drive a car or leave the hospital. Air travel is permissible three weeks following surgery. Automobile travel is usually permissible immediately.

RISKS AND COMPLICATIONS OF SURGERY
The risks of surgery within the ear are low compared to those of untreated infections. Besides the risk of general anesthesia, the general complications involved with surgery include, but are not limited to:

Hearing loss: In two percent (2%) of the cases the hearing may be further impaired due to the development of scar tissue, infection, blood vessel spasm, infection of the inner ear, or lack of inner ear fluid (fistula). In less than one percent, despite a perfect surgery, the hearing may be damaged such that complete hearing loss may occur and one may not be able to benefit from a hearing aid in that ear. For this reason the poorer hearing ear is usually selected for surgery. When further loss of hearing occurs in the operated ear, really, re-exploration may be necessary when hearing loss occurs, but time is usually given to allow the ear to heal completely.

Tinnitus: Most patients with otosclerosis notice tinnitus (head noise) to some degree. The amount of tinnitus is not necessarily related to the degree or type of hearing impairment. Following successful stapedectomy, tinnitus is often decreased in proportion to the hearing improvement, but occasionally may be worse.

Dizziness: This is normal for a few hours following a stapedectomy and may result in nausea and vomiting. Some uneasiness is common during the first few postoperative days; dizziness on sudden head motion may persist for several weeks. On rare occasions dizziness is prolonged.

Taste Disturbance and Mouth Dryness: Taste disturbance and mouth dryness are not uncommon for a few weeks following surgery. In five percent of the patients this disturbance may persist.

Eardrum Perforation: A perforation (hole) in the eardrum membrane is an unusual complication of the surgery. It develops in less than one percent (1%) and usually is due to an infection. Fortunately, should this complication occur, the membrane may heal spontaneously. If healing does not occur then surgical repair may be required.

Facial Nerve: The facial nerve, which is responsible for providing motion to the face, runs through the middle ear. Each and every nerve surgery is performed with a computerized piece of equipment called a facial nerve monitor, which allows for safe and effective identification of the facial nerve. Use of this equipment helps to prevent, but does not completely eliminate, damage to the facial nerve. While extremely uncommon, damage to the facial nerve could result in permanent facial paralysis on the side of the surgical procedure.

PATIENT QUESTIONNAIRE (CIRCLE YOUR RESPONSE)

1. Have you read the written explanation of the surgery? 
   YES NO
2. Do you understand the purpose of the surgery? 
   YES NO
3. Do you understand the risks associated with surgery? 
   YES NO
4. Are you satisfied that all of your questions have been answered? 
   YES NO
5. Do you understand that there are no guarantees? 
   YES NO

I HAVE READ AND UNDERSTAND THE RISKS, COMPLICATIONS, PURPOSE OF SURGERY, AND ALTERNATIVE TREATMENTS.

SIGNED: ___________________________ DATE: ___________________________

PATIENT IS A MINOR, SIGNATURE OF PARENT OR LEGAL GUARDIAN: ___________________________

PHYSICIAN DECLARATION: I HAVE EXPLAINED THE CONTENTS OF THIS DOCUMENT TO THE PATIENT AND HAVE ANSWERED ALL THE PATIENTS QUESTIONS, AND TO THE BEST OF MY KNOWLEDGE I FEEL THE PATIENT HAS BEEN ADEQUATELY INFORMED AND HAS CONSENTED.

PHYSICIAN SIGNATURE: ___________________________ DATE: ___________________________
Patient Education

- Illustrations
- Animations
- You-Tube Videos
- Eyemagination for ENT
  - www.eyemaginations.com
- Website Education
Innovations

- Use of Laser$^1$ with handheld fibers
  - CO$_2$ – Absorbed by water
  - Argon/KTP – Absorbed by Hemoglobin
- New Prostheses
  - Titanium
  - Nitanol
- Microdrills

Nitinol – Ask about Nickel Allergy
Big Easy Piston
Osseostap Microdrill
Surgical Pearls

- Surgical Approach
- Confirm Diagnosis
- Stapedotomy
- Piston Placement
- Post-op Care
Surgical Approach

- Elevate Flap to Notch of Rivinus
  - Less likely to tear
- Use combination of small diamond burr (2mm) and bone curette to remove scutum
  - Helps protect Chorda - use saline soaked Gelfoam
- Remove enough Scutum to expose:
  - Facial Nerve
  - Pyramidal Eminence
  - Stapes
Confirm Diagnosis

- Palpate Malleus, Incus, and Stapes
  - Use the same instrument to palpate the malleus from the underside in every surgery
- While palpating the incus, note the correct location of the IS joint
- Once the IS joint has been separated, palpate the Malleus again
  - Fixation does not preclude a stapes procedure, but may need total ossiculoplasty in the future
Stapedotomy

- Measure first
  - Most patients 4mm, add .25mm
- Laser preferred
- Microdrill for Obliterative Otosclerosis
- Stapedotomy on posterior 1/3 of footplate
  - If stapedectomy, create a control hole first
- Use 24 Suction
  - Do not cover the hole
  - Do not suction the vestibule
Piston Placement

- Confirm that piston is secured to the incus
- Confirm that piston is within the stapedotomy
- Place small piece of fat around the stapedotomy
  - Fat graft from ear lobe at start of procedure
Post-op Care

- Check Tuning Fork in the Recovery Room
  - Weber should lateralize to operated ear
- Check for Nystagmus
- Packing Removal in One Week
- Audiogram on Day of Packing Removal
- Role of Steroids
  - Prednisone 60mg daily for 2 weeks
Complications: Intra-op

- **Chorda Tympani**
  - Damage to both can result in dry mouth syndrome and permanent taste alteration

- **Floating Footplate: Abort or Proceed?**
  - Do not retrieve if fragments displaced into vestibule
  - Total stapedectomy if able to remove fragments, then use a graft (vein, fat, or fascia\(^1\))

- **Gusher – CSF Leak**
  - Use a tissue graft, may proceed with placement of prosthesis, consider lumbar drain

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VIDEO
Complications: Post-op

- Dizziness / Imbalance
- Taste Alteration
  - Important to know for bilateral disease
- Hearing Loss
- Reparative Granuloma
- Recurrent or Persistent CHL
- Delayed Vertigo
- PLF
Cochlear Otosclerosis

- Suspect with a Mixed Hearing Loss
- Progressive Hearing Loss after Successful Surgery
- Counseling Prior to Surgery
- Medications
  - Sodium Flouride
  - Ca and Vit D
  - 3rd Generation Bisphosphonates

Conclusions

- Stapes Surgery Very Challenging
- Should have Generous Otologic Experience
- Need Consistency
- Follow Your Results