The Evolution of Surgical Treatment for Acoustic Neuromas

Andrew T. Parsa, MD, PhD
University of California, San Francisco
Department of Neurological Surgery

3 quotes

• "More people have died from acoustic neuroma surgery than acoustic neuromas" M. Sisti MD
• "95% of the morbidity occurs during resection of the last 5% of the tumor" P. McCormick MD
• "It’s a lot of work for a little tumor" J. Bruce MD

Outline

• Introduction (students and residents)
• Historical Overview
• Personal Influences
• Approaches
• Relevant Literature Review
• Future Objectives

Acoustic Neuroma

• Superior Vestibular Nerve
• 8-12 mm from brainstem at junction of peripheral and central myelin (Osteiner-Redlich zone)
• Histologically Benign
• Clinically not benign with hearing loss, tinnitus, and dysequilibrium

Types of Hearing Loss

• Conductive hearing loss
• Sensorineural hearing loss
• Mixed hearing loss
• Central Hearing loss

Sensorineural Hearing Loss

• occurs when there is damage to the inner ear (cochlea) or to the nerve pathways from the inner ear (retrocochlear) to the brain.
• not only involves a reduction in sound level, or ability to hear faint sounds, but also affects speech understanding, or ability to hear clearly.
• Sensorineural hearing loss can be caused by:
  - birth injury
  - drugs that are toxic to the auditory system,
  - genetic syndromes
  - noise exposure
  - Viruses
  - head trauma
  - Aging
  - tumors.
The "Classic" Audiometric Finding

Auditory Brainstem Response (ABR)

ABR in Acoustic Neuroma

- **Most Large Tumors**
  - No Waves: 20 - 30%
  - Wave V delay: 40 - 60%

- **Most Specific**
  - Wave I: 10 - 20%
  - Nothing after: 10 - 20%
  - Normal: 10 - 20%

Intracanalicular

Cisternal

Brainstem Compressive
Outline

• Introduction (students and residents)
• Historical Overview
• Personal Influences
• Approaches
• Relevant Literature Review
• Future Objectives

Skull Base Surgery-History

• 1777-Sandifort: 1st well documented AN
• 1846-Morton: 1st successful use of anesthesia
• 1867-Lister:
  • On a new method of treating compound fractures, abscesses, etc., with observations on the conditions of suppuration. Lancet 1867;1:326.

Sir William Macewan (1848-1924)

1st True Skull Base Surgeon

Pyogenic Infective Diseases of the Brain and Spinal Cord, 1893

Pioneered treatment of otogenic intracranial infections

Results not surpassed until CT

1st clear description of mastoiditis

Turned down Chair of Surgery at JHH (went to Halstead)

Victor Horsley (1857-1916)

Father of modern neurosurgery

1st laminectomy for spinal tumor
1st carotid ligation for aneurysm
1st transcranial approach to pituitary

Pioneered intracranial trigeminal nerve section for neuralgia
1st use of bone wax for bleeding

Victor Horsley con’t

• Present at 1st modern brain tumor surgery
• Hospital for Epilepsy & Paralysis in London
• Tumor Localization by the neurologist Alexander Bennett
• Aseptic surgery by Rickman Godlee
• Using Bennett’s knowledge of neuroanatomy and pathophysiology, Godlee was able to plan his craniotomy directly over the tumor, and easily remove the tumor (glioma).
• The patient survived the immediate operation, but succumbed to purulent cerebritis a month after surgery.
Sir Charles Ballance
Father of Skull Base Surgery
Neurosurgeon and Aural Surgeon
Advanced cerebral localization along with Ferrier, Beevor, and Sherrington
Assisted Horsely in 1st extramedullary spinal tumor
Popularized radical mastoidectomy
Lined mastoid cavities w/skin graft
1st to drain otogenic abscess following cerebellar localization
1st successful removal of AN (1894) AND used intracranial nerve stimulation

Early Historical AN experience
• 1st unsuccessful attempt-McBurney (1891)
• Ballance-1st successful AN surgery (1894)
• 78% Surgical mortality
• Survivors w/ serious disability
• Dissection by finger

Harvey Cushing
• Introduced:
  – Meticulous anesthesia records
  – Continuous blood pressure monitoring
  – 1st surgeon to regularly use Xrays
  – Described the ‘Cushing response’
  – Introduced canine surgery for med students
  – Radically reduced blood loss with surgical clips & electrocautery
• Advocated surgeons be responsible for own Dx
• Meticulous dissection more important than speed

Cushing AN Technique
Intracapsular removal and subtotal resection
Meticulous dissection
Reduced mortality from 90% to 20%
By 1920, the Cushing model=neurosurgery model

Carl Olaf Nylén and his original monocular microscope
Operations on the temporal bone carried out with the help of the lens and the microscope.

By GUNNAR HOLMGREN.

The small dimensions of both windows of the labyrinth, of the stapes, of the tensor tympani muscle, of the processus cochleariformis and of other details of the internal wall of the tympanic cavity are the cause of considerable difficulties of technique in radical operations on the middle ear, of which every ear-surgeon is conscious. On operating with the naked eye it is impossible to free these areas completely from granulations and muco-periosteum and to clear away caries. Only with the help of optical magnification is that precision and security attained which this delicate field of operation calls for.

From Holmgren, G Acta Otolaryngol 1922
Walter Dandy (1886-1946)
- Cushing’s student
- Lifelong contentious rivalry w/Cushing
- Developed ventrigulography (injection of air into veins) for tumor localization and size estimation
- Advocated total AN excision
- Championed SOPF for AN
- Dropped mortality to 11% by 1941
- Championed VN section for Meniere’s

William F. House
- 1961- Attempted MF approach w/ Kurze using operating microscope for pts with cochlear otosclerosis
- Publicly ridiculed for the attempt
- 1964- House+Hitselburger revived translab approach for AN using operating microscope
- Immediately recognized for its importance
- Initially resisted by neurosurgical community

Outline
- Introduction (students and residents)
- Historical Overview
- Personal Influences
- Approaches
- Relevant Literature Review
- Future Objectives

Translabyrinthine

Retrosigmoid

Middle Fossa
Acoustic Neuroma Microsurgery at UCSF
Selection of Operative Approach

1985 - 1990
RS = TL >> MF

1995 - 2000
MF = TL >> RS

Outline
• Introduction (students and residents)
• Historical Overview
• Personal Influences
• Approaches
• Relevant Literature Review
• Future Objectives

Facial nerve injury in acoustic neuroma (vestibular schwannoma) surgery: etiology and prevention.
• A retrospective analysis of 611 patients
• Anatomical preservation of the facial nerve was achieved in 596 patients (97.5%)  
• In the immediate postoperative period, 62.1% of patients displayed normal or near-normal facial nerve function (House-Brackmann Grade 1 or 2). This number rose to 85.3% of patients at 6 months after surgery and by 1 year: 89.7%.  
• Size of tumor more significant than approach

Microanatomical variations in the cerebellopontine angle associated with vestibular schwannomas (acoustic neuromas): a retrospective study of 1006 consecutive cases.
• Experience matters
• Between July 1969 and January 1998, the senior author (D.M.L.) performed surgery in 1022 patients for acoustic neuroma: 705 (69%) via the retrosigmoid (suboccipital); 301 (29%) via the translabyrinthine; and 16 (2%) via the middle fossa approach.
Outline

- Introduction (students and residents)
- Historical Overview
- Personal Influences
- Approaches
- Relevant Literature Review
- Future Objectives

3 quotes

- "More people have died from acoustic neuroma surgery than acoustic neuromas" M. Sisti MD
- "95% of the morbidity occurs during resection of the last 5% of the tumor" P. McCormick MD
- "It's a lot of work for a little tumor" J. Bruce MD