Comprehensive Management of Vestibular Schwannoma

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Acknowledgement

- NSI

  - Chairman: Dr. Keith Black
Complex Lesions of the CPA

Congenital Rest Lesions: Epidermoid
Etiology of VS

• Likely local genetic event-Schwannomin
  – Low-dose radiation
  • (Cohort studies, Hiroshima & Nagasaki)
Acoustic Neuroma

Presenting Symptoms

N = 753

<table>
<thead>
<tr>
<th>1st symptom</th>
<th>86.7%</th>
<th>63.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing Loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progressive</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>Sudden</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Tinnitus</td>
<td>79.6%</td>
<td>15.9%</td>
</tr>
<tr>
<td>Dizziness</td>
<td>57.4%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Headaches</td>
<td>20.5%</td>
<td>-</td>
</tr>
<tr>
<td>Paresthesias</td>
<td>16.6%</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>9.3%</td>
<td></td>
</tr>
</tbody>
</table>
Management Considerations

- Preservation of life
- Preservation of function:
  - Facial motion
  - Hearing
  - Balance
Management Options

- Observation
- Surgery
- Radiation
Decision Making Factors

- Age (life expectancy vs average growth)
- General Health
- Tumor size
- Symptoms/Signs
- Patient Desire
Life Expectancy (2000)

• Male 74.1 years
• Female 79.5 years

Observation

- Risk of growth
  - Increases treatment risks
## Growth Over Time

<table>
<thead>
<tr>
<th>Author</th>
<th>No. pts.</th>
<th>Follow-up interval</th>
<th>% No growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deen HG, et al.</td>
<td>68</td>
<td>3.4 yrs</td>
<td>71%</td>
</tr>
<tr>
<td>Charabi, S et al.</td>
<td>123</td>
<td>3.8 yrs</td>
<td>12%</td>
</tr>
<tr>
<td>Fucci MJ, et al.</td>
<td>119</td>
<td>4 yrs</td>
<td>67%</td>
</tr>
<tr>
<td>Shin YJ, et al.</td>
<td>87</td>
<td>31 mos</td>
<td>62%</td>
</tr>
<tr>
<td>Tschudi DC, et al.</td>
<td>74</td>
<td>35 mos</td>
<td>69%</td>
</tr>
<tr>
<td>Walsh RM, et al.</td>
<td>72</td>
<td>37.8 mos</td>
<td>50%</td>
</tr>
</tbody>
</table>
Observation

• Hearing Loss
## Risk of Hearing Loss With No Tumor Growth

<table>
<thead>
<tr>
<th>Author</th>
<th>No. Patients</th>
<th>Follow-up period</th>
<th>% loss functional hearing(70/30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrick P, et al.</td>
<td>10</td>
<td>19+/-12.8 mos</td>
<td>43%</td>
</tr>
<tr>
<td>Walsh RM, et al</td>
<td>25</td>
<td>43.8 mos</td>
<td>25%</td>
</tr>
</tbody>
</table>
Gamma Knife Surgery
Cumulative number of treated patients
Radiosurgical Techniques

- Gamma Knife
- LINAC
- Cyber Knife
- Proton Beam
Stereotactic Radiosurgery

Current Indications

• Patient who is poor surgical risk (age, medical cond., etc.) with tumor < 3 cm

• Tumor < 3 cm with little doubt of diagnosis based upon imaging

• Younger patients with < 3 cm tumor who refuse surgery
Stereotactic Radiosurgery
Contraindications

- Tumor > 3 cm
- Larger tumor with mass effect
- Uncertain diagnosis
- Dizzy patients
- Facial nerve symptoms
- Cystic Tumors
Surgical Options

- Translabyrinthine
- Middle Fossa
- Retrosigmoid
Number of Acoustic Neuroma Surgeries

By Year and Procedure

Year of Surgery

Number of Procedures

Procedure

TLB
MF
Subocc

Year of Surgery

0
20
40
60
80
100
120
140
160

Acoustic Tumor Treatment
TL - AN REMOVAL

Indications

• Non-serviceable hearing (50% WRS/50dB SRT)

• Large tumors where hearing preservation is unlikely
## Acoustic Tumor Treatment

**Translabyrinthine Approach**  \( (N= > 5,000) \)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total tumor removal</td>
<td>99%</td>
</tr>
<tr>
<td>Recurrence requiring Rx</td>
<td>0.14%</td>
</tr>
<tr>
<td>Facial nerve preservation (Anatomic)</td>
<td>98.5%</td>
</tr>
<tr>
<td>Facial Nerve at 1 year</td>
<td></td>
</tr>
<tr>
<td>Grade I/II</td>
<td>82%</td>
</tr>
<tr>
<td>Grade III/IV</td>
<td>14%</td>
</tr>
<tr>
<td>Grade V/VI</td>
<td>4%</td>
</tr>
<tr>
<td>Further surgery</td>
<td>1%</td>
</tr>
<tr>
<td>Complications</td>
<td>2%</td>
</tr>
<tr>
<td>Mortality</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
Middle Fossa Craniotomy

W. House (1961)
Middle Fossa Craniotomy

• Indications
  – Up to 1 cm in the CPA
  – Laterally placed
  – Good hearing
Middle Fossa Craniotomy

• Advantages
  – Complete IAC exposure
  – Early facial nerve identification
## Acoustic Tumor Treatment

### Middle Fossa Approach (N=333)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total tumor removal</td>
<td>100%</td>
</tr>
<tr>
<td>Recurrence requiring Rx</td>
<td>0.4%</td>
</tr>
<tr>
<td>Facial nerve preservation</td>
<td>100%</td>
</tr>
<tr>
<td>Grade I/II</td>
<td>95%</td>
</tr>
<tr>
<td>Grade III</td>
<td>5%</td>
</tr>
<tr>
<td>Preoperative hearing preservation</td>
<td>60%</td>
</tr>
<tr>
<td>Serviceable hearing</td>
<td>65%</td>
</tr>
<tr>
<td>Measurable hearing</td>
<td>71%</td>
</tr>
<tr>
<td>Complications</td>
<td>2%</td>
</tr>
<tr>
<td>Mortality</td>
<td>0%</td>
</tr>
</tbody>
</table>
Retrosigmoid Approach
## Retrosigmoid Approach

Samii and Matthies (N= 1,000)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total tumor removal</td>
<td>97.9%</td>
</tr>
<tr>
<td>Recurrence requiring Rx (non-NF II)</td>
<td>0.8%</td>
</tr>
<tr>
<td>Facial nerve preservation</td>
<td>93%</td>
</tr>
<tr>
<td>(Early) Grade I/II</td>
<td>59%</td>
</tr>
<tr>
<td>Grade III/IV</td>
<td>20%</td>
</tr>
<tr>
<td>Grade V/VI</td>
<td>21%</td>
</tr>
<tr>
<td>Further surgery</td>
<td>1.7%</td>
</tr>
<tr>
<td>Preoperative hearing preservation</td>
<td>21%</td>
</tr>
<tr>
<td>Serviceable hearing</td>
<td>33%</td>
</tr>
<tr>
<td>Measurable hearing</td>
<td>52%</td>
</tr>
<tr>
<td>(small tumors &lt;30mm)</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td>9.2%</td>
</tr>
<tr>
<td>Mortality</td>
<td>1.1%</td>
</tr>
</tbody>
</table>
Acoustic Tumor Treatment
NF-II
Early Proactive Treatment
MF removal

Serviceable hearing 75%
Facial Nerve Grade I/II 95%
Grade III 5%
Recurrence 4%
Stereotactic Radiosurgery

Results

- N=162, 26% with previous resection, 4-10 year follow-up
- 98% “Tumor Control” = 62% smaller, 33% unchanged, 6% larger
- 79% H-B grade 1 FN
- 27% trigeminal hypesthesia
- 51% no change hearing
- 7% imbalance, 5% facial twitching, 3% hydrocephalus
Stereotactic Radiosurgery

Results


• N=153, 96 GK primary treatment, 57 post microsurgery, follow-up 1-10 yrs.

• 62.5% had decreased hearing after 2 yrs.

• 2% FN paresis

• 4% Trigeminal dysfunction

• Primary GK: 81% reduced, 12% no change, 6% enlarged

• Secondary GK; 6-GK5% reduced, 25% no change, 11% enlarged

• 6% required surgery post
Stereotactic Radiosurgery

Results

• Kondsiolka et al., 2003
• N=157
• Median f/u 9.1 years
• Median age 60 years
• Large number had prior surgery
• “Failure” less than 2%
Radiosurgical Unknowns
Malignant Tumor Formation

- Nine reported cases in the literature
- 4-5 year latency
- Uniformly Fatal
Long-Term Analyses

- Breen et al. pituitary adenoma
  - 64.7±12.9% control at 30 years
  - 2.7% malignant tumor formation
Benign Tumor Formation

- Meningioma/Schwannoma
- 16 to 30 year latency
- Doses of 1.5 Gy
- Relative risk: 8.4

Ron E., et al., NEJM; 1988
Soffer D. et al., J Neurosurg; 1983
Radiosurgical Failures
House Ear Clinic
Experience

- To date, more than 75 patients surgically treated after irradiation failure
- 6 patients resected after initial surgery f/b XRT
- Gamma knife and LINAC (fractionated and single-dose)
- Most common indication for revision surgery at HEC

Friedman et al., Laryngoscope; Oct. 2005
Methods

• Retrospective review (N=44)

• Historical controls
  – Sex, Age
  – Tumor size (mean 2.6cm)
Results

• Mean time to surgery 3.2 years
• 24% greater than 4 years
  – Range 5.2* mos - 15.8 yrs

* Cystic degeneration with brainstem compression.
PCNA Staining
Preoperative Symptoms

• Dizziness
  – 58% radiosurgical group vs 34% control group (p ≤ .03)
Facial Nerve Results

• Immediate 46% vs 24% Grade VI (p≤.01)

• 1 year 36% vs 67% Grade I or II (p≤.03)
Perioperative Complications

- No significant difference
Radiosurgical Failures

- No hearing salvage
- Poorer ABI performance
Non-irradiated Tumor
Irradiated Tumor
Conclusions

- Post-radiation
  - Tumors are more adherent
- Facial nerve results poorer
Auditory Rehabilitation
Single-Sided Deafness

Left

Direct BC from BAHA

Right

AC normal way
Auditory Brainstem Implant

• Indications
  – NF-2 patients

• Cochlear Corporation
  – 21 channel device
  – Surface array
  – PABI
Nucleus 24 ABI
ABI: Benefits

- Environmental sound awareness
- Closed-set word recognition
- Few patients with open-set word recognition
- Enhanced lip-reading
Penetrating Auditory Brainstem Implant

- Decrease current spread
- Improve tonotopic maps
- Improve selective stimulation of nerve populations
Decision Making in Vestibular Schwannoma Management

- Currently at the HEC, microsurgery remains the treatment of choice
  
- Early published radiosurgical failure rates 5-15%
  
- Radiotherapy excludes the chance of surgical hearing preservation in most instances
Decision Making in Vestibular Schwannoma Management

• Collaborative research and care are the keys to the management of these challenging tumors