Pediatric tympanoplasty: Decision making and technical aspects

Blake C. Papsin

Introduction

- pediatric CHL
  - incidence /impact

- specific entities
  - tympanoplasty
  - ossiculoplasty
**Tympanoplasty**

- most common otologic procedure in children
- focus on success rates
- should focus on decision making
  - timing of surgery
  - technique
  - Eustachian tube health

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**Tympanoplasty**

- pediatric tympanoplasty differs from adult:
  - etiology
  - growth
  - importance of audition

- surgical results are variable

- experiential data
Definitions

- myringoplasty
  - drum

- tympanoplasty
  - drum
  - middle ear

- mastoidectomy
  - drum
  - middle ear
  - mastoid

Tympanic Membrane Healing

- normal healing
  - epithelialization

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Tympanic Membrane Healing

- normal healing
- epithelialization
- contraction
- growth inhibition
Tympanic Membrane Perforation

- middle ear needs aeration
  - ET dysfunction
  - recurrent OM
  - foreign body
Tympanoplasty

- set-up for normal repair
- initiate epithelialization
- diminish obstacles

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Tympanoplasty

- set-up for normal repair
- initiate epithelialization
- diminish obstacles
- guide edges

Top Ten Tympanoplasty Tips from Toddlers to Teens

1. upper respiratory system
2. define the outcome
3. age
4. otorrhea
5. characteristics affects decisions
6. mind the jugular system
7. material
8. pull-up don’t push-up
9. craniofacial anomalies
10. durability results from decisions
1. Upper Respiratory System

- Ear is a component
- Eustachian Tube
- Mucosa
  - Allergy
  - Irritative
  - Environmental
  - Immunologic

Middle Ear Ventilation
Contralateral Eustachian Tube

- best predictor of success
- generally paired system
- observation
  - unilateral microtia
  - decreased OM in normal ear

Pressure with swallowing

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2. Define Outcome

- quality of life
- otorrhea
- hearing
  - preservation
  - restoration

“Successful” Tympanoplasty

- surgeon
  - intact drum
  - no morbidity

- patient/family
  - ability to swim
  - symptom resolution
  - improved hearing
Morbidity

- taste disturbance
- ear sticks out
- noticeable scar
- pain
- allergic reaction

- hearing loss
- facial palsy

### Complications and Adverse Postoperative Events

<table>
<thead>
<tr>
<th>Type of Complication</th>
<th>No. of Ears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repereferation</td>
<td>10/2 (22)*</td>
</tr>
<tr>
<td>ACM</td>
<td>6</td>
</tr>
<tr>
<td>DME</td>
<td>5</td>
</tr>
<tr>
<td>Arthrosis</td>
<td>5</td>
</tr>
<tr>
<td>Hearing loss</td>
<td>4</td>
</tr>
<tr>
<td>Keratin pearl</td>
<td>4</td>
</tr>
<tr>
<td>Granulation tissue</td>
<td>4</td>
</tr>
<tr>
<td>DE</td>
<td>2</td>
</tr>
<tr>
<td>Wound infection</td>
<td>1</td>
</tr>
<tr>
<td>Tympanosclerosis</td>
<td>1</td>
</tr>
<tr>
<td>GOM</td>
<td>1</td>
</tr>
<tr>
<td>Cholesteatoma</td>
<td>1</td>
</tr>
</tbody>
</table>

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Relative Contraindications

- asymptomatic perforation
- unfit for surgery
- repeated failures
- unfavorable conditions
  - unstable contralateral ear
  - cleft palate (?)
  - smoking

3. Age

- age is the only factor which affects rate of success in children
3. Age

- age is the only factor which affects rate of success in children

- no it’s not!
3. Age

- age is the only factor which affects rate of success in children
- no it’s not!
- yes it is!!
4. Otorrhea

- is the otorrhea causing the perforation?

- is the perforation causing the otorrhea?

Middle Ear Physiology?

- Temperature 38°C
- Humidity 85%

- Temperature 54°C
- Humidity 30%
Middle Ear Physiology?

Temperature
21°C

Temperature
19°C

Humidity
49%

Humidity
47%

5. Characteristics of the Perforation

- size, position, revision and tympanosclerosis
- don’t impact success
- impact selection of:
  - technique
  - material
  - timing of OR

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Characteristics

- difficult characteristics
  - revision
  - total/subtotal TM perforation
  - anterior marginal perforations
  - tympanosclerosis

Lateral Graft Tympanoplasty with Alloderm
Lateral Graft Tympanoplasty

- equal closure rate
- “better” closure of air/bone gap

6. Mind the Jugular Vein

- elevating the annulus
- right > left
Mind the Jugular Vein

- elevating the annulus
- right > left
7. Choosing Materials

- temporalis fascia
- tragal perichondrium
- tragal cartilage
- allografts
  - Alloderm (human dermis)
  - Surgysis (porcine submucosa)
Butterfly Graft Tympanoplasty

- case selection:
  - <1/3 of drum
  - minimal contact with malleus

- advantages
  - fast
  - efficacious

Forming the Graft

- tragal cartilage
- one side with perichondrium
- form it into the shape of a ventilation tube
Forming the Graft

- tragal cartilage
- one side with perichondrium
- form it into the shape of a ventilation tube
Butterfly Graft Tympanoplasty

- great technique to have in your arsenal

8. Pull-Up Don’t Push Down

- gelfoam causes middle ear fibrosis
  - reduced aeration?

- prefer to suspend graft
  - clips
  - pegs
8. Pull-Up Don’t Push Down

- gelfoam causes middle ear fibrosis
  - reduced aeration?

- prefer to suspend graft
  - clips
  - pegs
Pegged Graft

Lifting the Tympanic Membrane

standard 12 to 6 tympanomeatal flap
Lifting the Tympanic Membrane

graft pulled into a straight line to peg

standard 12 to 6 tympanomeatal flap

extended flap for inferior perforations
Lifting the Tympanic Membrane

graft pulled into position for coverage

9. Craniofacial Anomalies

- no difference in success rates!!
- big difference in canal anatomy
- big difference in decisions when to operate
  - operate later (surgical bias)
  - actual success rate by age is the same
10. Durability

- all about decisions
  - technique
  - material
  - timing of operation
  - desired outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Healing Rate</th>
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<tbody>
<tr>
<td>Graft technique</td>
<td>44/55 (80%)</td>
</tr>
<tr>
<td>Medial</td>
<td>15/17 (88%)</td>
</tr>
<tr>
<td>Lateral</td>
<td></td>
</tr>
<tr>
<td>Contralateral ear</td>
<td>37/45 (82%)</td>
</tr>
<tr>
<td>Normal</td>
<td>23/27 (85%)</td>
</tr>
<tr>
<td>Abnormal</td>
<td></td>
</tr>
<tr>
<td>Patient age, y</td>
<td></td>
</tr>
<tr>
<td>&lt;6</td>
<td>5/6 (63%)</td>
</tr>
<tr>
<td>6-8</td>
<td>13/17 (76%)</td>
</tr>
<tr>
<td>9-10</td>
<td>13/18 (75%)</td>
</tr>
<tr>
<td>&gt;10</td>
<td>23/33 (65%)</td>
</tr>
<tr>
<td>Perforation size, %</td>
<td></td>
</tr>
<tr>
<td>0-25</td>
<td>22/25 (85%)</td>
</tr>
<tr>
<td>26-50</td>
<td>22/25 (85%)</td>
</tr>
<tr>
<td>51-75</td>
<td>5/5 (100%)</td>
</tr>
<tr>
<td>76-100</td>
<td>2/5 (40%)†</td>
</tr>
</tbody>
</table>

Bonus Tip

- watch this space!!
- tissue engineering
  - application in the eardrum in use
  - hyaluronic acid/fat graft
  - growth factor and gelfoam
Conclusions

- understand patient’s:
  - needs
  - expectations
  - anatomy
  - physiology

- each ear is different

“Ether Day” (October 16, 1846) by Robert C. Hinckley

Paediatric Temporal Bone Course
University of Toronto
August 2013

Contact:
adrian.james@sickkids.ca