Application of ABR in Infants and Young Children

- Rationale
- Tone burst (frequency specific) ABR
- Bone conduction ABR
- Auditory steady state response (ASSR)
- Sedation and anesthesia
ABR: Protocol for bone conduction

- B-70 vibrator
- Mastoid placement
- Earlobe inverting electrodes (distance from transducer)
- Alternating click stimuli (or tone burst stimulation) to minimize stimulus artifact
- Slower rate (e.g., 11.1/sec) to enhance wave I
- 30 to 3000 Hz (need low frequencies)
- Begin near maximum intensity level (about 50 dB nHL)
- Identify wave I in ipsilateral array to verify test ear
- Plot latency/intensity function for wave V (vs. AC)
Bone Conduction: Effect of Transducer Factors
Bone Conduction:
Adjusting the Head Band for Infants
Bone Conduction:
Posterior Placement of the Oscillator
Bone Conduction:
Hold the Band, Not the Oscillator
AUDITORY BRAINSTEM RESPONSE
(air conduction)

K.R.C., 6 yrs., female

RIGHT EAR

I
III
V (6.90 ms)

95dB
85dB
(ipsilateral reference)

85dB
(contralateral reference)

65dB

60dB

Stimulus 15 ms

LEFT EAR

I
III
V (7.32 ms)

95dB
(ipsilateral reference)

95dB
(contralateral reference)

75dB

70dB

Stimulus 15 ms
RIGHT MASTOID

AUDITORY BRAINSTEM RESPONSE
(bone conduction)

K.R.C., 6 yrs., female

LEFT MASTOID

30dB
(ipsilateral reference)

10dB
(insilateral reference)

5dB

30dB
(ipsilateral reference)

15dB
(contralateral reference)

5dB

Stimulus

15 ms

I III V (7.24 ms)

I III V (7.48 ms)
Pure - Tone Audiometry

Pre-operative
PTA: 68dB
ST: 60dB

Post-operative
PTA: 18dB
ST: 20dB
ASSR: Case Report

- 3 year old boy
- Dx: Goldenhaar’s Syndrome
- Otologic Findings
  - Very small external ear canals with probable stenosis
- Previous audiologic assessment
  - sound field behavioral audiometry indicated moderate to severe hearing loss ABR threshold only for 500 Hz tone burst in left ear
  - Mild language delay
- Referred for ABR under light anesthesia
## Case Report (JC) : Bilateral Conductive Hearing Loss

### Behavioral Audiometry

<table>
<thead>
<tr>
<th>Frequency in Hz</th>
<th>Right Ear</th>
<th>Left Ear</th>
</tr>
</thead>
<tbody>
<tr>
<td>.25  .50  1K</td>
<td>2K  3K</td>
<td>4K  6K</td>
</tr>
<tr>
<td></td>
<td>dBHL</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SF</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>$F$</td>
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</tr>
<tr>
<td>60</td>
<td>SF</td>
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</tr>
<tr>
<td>100</td>
<td>SF</td>
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</tbody>
</table>

### Frequency in Hz

- **PT**
- **ABR**
- **ASSR**

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*Note: The diagram shows the hearing threshold levels for different frequencies in Hz for both ears.*
Case Report (JC): ABR for click and 4000 Hz tone burst stimulation
Case Report (JC):
ABR for 1000 and 500 Hz tone burst stimulation
Case Report (JC) : ABR for bone conduction click stimulation
Case Report (JC) : Bilateral Conductive Hearing Loss

Estimation of Audiogram with Tone-Burst and Bone Conduction ABR
Estimation of Air-Bone Gap with ABR

Click Intensity in dB nHL

Wave V Latency in msec

- Air conduction
- Bone conduction

35 dB
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ABR in the Clinic with Conscious Sedation
(e.g., chloral hydrate)
American Academy of Pediatrics Guidelines for Conscious Sedation (WWW.AAP.org/policy)

*Pediatrics 89, 1992*, p 1110-1115

Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures

*Pediatrics 110, 2002*, pp 836-838

Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures: Addendum
ABR in the Operating Room with Light Anesthesia (e.g., propofol)
## SEDATION OPTIONS:
*Clinic versus Operating Room*

<table>
<thead>
<tr>
<th>Setting</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic</td>
<td>Less expensive</td>
<td>Limited sedation options</td>
</tr>
<tr>
<td></td>
<td>Near or in audiology</td>
<td>Limited medical support</td>
</tr>
<tr>
<td></td>
<td>Scheduling ease</td>
<td>Increased liability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uncertain success/&gt; time</td>
</tr>
<tr>
<td>O.R.</td>
<td>Medical (ENT) support</td>
<td>More expensive</td>
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<tr>
<td></td>
<td>Ideal patient state</td>
<td>Remote location</td>
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<tr>
<td></td>
<td>Controlled sedation</td>
<td>Noisy environment</td>
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<tr>
<td></td>
<td>Limited liability</td>
<td>Complicated scheduling</td>
</tr>
</tbody>
</table>
Disadvantages of Anesthesia for in ABR Assessment of Children

- Delayed diagnosis (many months) due to problems with scheduling time in the operating room with medical support team (e.g., anesthesiologist)
- Ten fold increase in cost (> $4000 versus $400) associated with services in the operating room
- Medical risk of anesthesia and related procedures (e.g., intubation)
- Possible secondary neurological and cognitive deficits of anesthesia in children at risk for learning problems
- Inability to conduct a full auditory assessment in remote location outside of the audiology clinic
Thank you!

Questions?