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Vestibular Testing Considerations for the Very Young

Violette Lavender, AuD
Cincinnati Children’s Hospital
Our Program

- Open every Thursday
- See 3 children a week for testing
- Several more a week for rehab
- Referrals from ENT, Neurology, Sports Medicine, Rehab Medicine (Trauma), Hem/Onc
- Team meetings once a month

Goals Today

Identify special considerations when testing young children
  - Bedsides/ In office screening
  - VNG
  - Rotary Chair
  - VEMP
  - VHIT
General Tips

- Make Parent feel comfortable-child will take their cue
- We use the Team Testing approach
- Find out ahead of time what motivates the child
- Audiologic evaluation prior to testing
- Surprise bucket!

Who Is At Risk for a Vestibular Disorder?

- Cochlear Malformations (EVA, Partitioning defects, common cavity, mondini)
- Syndromes (Waardenburg, Usher’s, Pendred, etc)
- VIII Nerve Defects ("wispy nerve", absent nerve, ANSD)
- Otoxicity-Vestibulotoxicity
- Head Trauma (Sports related or accidental)
How to Find the Ones at Risk

- CCHMC protocol to use Ages and Stages
- pDHI on the horizon!
- Ask the questions—you’ll be surprised!

Ages and Stages example

<table>
<thead>
<tr>
<th>GROSS MOTOR</th>
<th>22 Youth Questionnaire page 1-42</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When you show your child how to hold a large ball, does he try to hold it by reaching for it without using hands? If your child already holds a ball, mark “yes” for this item.</td>
<td></td>
</tr>
<tr>
<td>2. Does your child use his hands well, including his feet, for climbing, jumping, or walking?</td>
<td></td>
</tr>
<tr>
<td>3. Does your child walk alone or with some help up to 50 feet? He may need to hold onto the wall or rail.</td>
<td></td>
</tr>
<tr>
<td>4. Does your child walk alone up or down at least two stairs at a time?</td>
<td></td>
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<tr>
<td>5. Does your child jump with both feet landing on the floor at the same time?</td>
<td></td>
</tr>
<tr>
<td>6. Without holding onto anything for support, does your child get in and out of his bed or high chair by climbing forward?</td>
<td></td>
</tr>
</tbody>
</table>

Continued
1. **SCORE AND TRANSFER TOTALS TO CHART BELOW:** See ASQ:3 User’s Guide for details, including how to adjust scores if item responses are missing. Score each item (YES = 10, SOMETIMES = 5, NOT YET = 0). Add item scores, and record each area total. Is the chart below, transfer the total scores, and fill in the circles corresponding with the total scores.

<table>
<thead>
<tr>
<th>Area</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>12.04</td>
</tr>
<tr>
<td>Gross Motor</td>
<td>27.75</td>
</tr>
<tr>
<td>Fine Motor</td>
<td>29.61</td>
</tr>
<tr>
<td>Fearless Sealing</td>
<td>29.32</td>
</tr>
<tr>
<td>Personal Social</td>
<td>30.07</td>
</tr>
</tbody>
</table>

2. **Bedsides**

- Fukuda
- Head Thrust
- Ocular Motor Assessment
- Head Righting
- Protective Reflexes
- Dynamic Visual Acuity Examination
- Standing on one foot
Head Thrust

Ocular Motor
Balance - Eyes Closed

Protective Reflexes / Head Righting
VOR

- Standard VNG protocol
  - Postional tests
  - Dix Hallpike (sometimes omitted)
  - Ocular Motor Exam
  - Caloric Irrigations
  - High Frequency Headshake
- Often, ocular-motor evaluation completed in the rotary chair enclosure due to restricted movement
VNG findings

- Ocular motor timing can be off, look for ability or inability to do the task.
- Our lab uses the cut off: Nystagmus present in greater than 50% of the positions is significant.
VNG

- Caloric Irrigations is still the gold standard for identifying side of lesion, particularly when it comes to the horizontal semicircular canal
  - Let the kids touch and see everything first
  - Let them know how long the test is
  - This must be the absolute last test.

Pediatric Modifications - Calorics

- “Scuba Diving”
- Use water, when possible, due to small canals
- Use of monothermal warm caloric screen when appropriate (Lightfoot, 2009)
- We tell the children that the water is “magic”. Tasking for 120 seconds go quickly when they use their imagination to tell you all about their “flying” or “spinning” adventures!
- Use of 42 deg warm water for pediatric patients who cannot tolerate full 44 deg
  - Our lab norm cut-offs for this temperature – 22% UW and 29% DP
- Air calorics needs to point at TM for full 60 sec
  - Good for TM perforation and tubes WARNING: be mindful if you see a paradoxical response
  - WARNING: be careful not to seal off the ear canal and build too much pressure for both water and air
Pediatric Modifications VNG

- Use of a TV instead of a light bar so the children follow a cartoon character instead of red dot
- TV also helps pacify children between tests or if they need a break

Tasking Ideas

- Singing songs
- Guess what I’m Thinking About
- Describe your playroom/house/school/dog
- Name a color and they have to tell you something that is that color
- Name a letter and they have to tell you something that starts with that letter
- Easy math or spelling words
- Counting
- List your classmates/friends
- Listing: ice creams flavors, toppings on a sundae, pizza toppings, nintendo/playstation games, classmate names, cartoon characters, plots to movies, TV shows, and books
Rotary Chair Pediatric Modifications

We have 3 options for recording eye movement:
- See-through goggles
  - Binocular recording
  - Does not obstruct vision
  - Door must be closed
  - Best option for older children
- Single camera goggle
  - Door can be left open, mask occludes vision.
  - Good for claustrophobic or young children.
  - Only one eye can be recorded
- Electrodes
  - Do not have to keep eyes open, however door has to be shut
  - You can record horizontal channel only (3 electrodes)
  - Drawback: very noisy with children who move a lot

Car Seat Additions

6 year old who is too small to reach the head restraint
2 year old who just barely reaches the head restraint
Perfect Fit with Booster Seat

Rotary Chair Pediatric Modifications

- Use of booster seat (ages 3-7) and car seat (3 and under).
- Some children can sit on parents lap (not ideal, we rarely use this)
- Team Testing: One can run the equipment, one goes in the enclosure with the child
  - Holds hands down off of the goggles
  - Mom or dad can be in the enclosure
- We call it the “Rocket Ship” or blasting off
Testing .16 Hz

Testing .04 Hz
Example Normal RC

- Easy, non invasive
- Unsure if we are testing what we are testing, new test
- Sticker of child’s choice to stare at on the wall
- Video on a small target (e.g. iPhone)
- Constant distraction (i.e. what is pooh wearing on that sticker) due to discomfort with tight goggles
- Chair that allows child to put feet firmly on a surface, so they don’t swing legs.
vHIT Prep

vHIT Calibration

continued
vHIT Test

- Easy, non invasive
- We are getting this on our very young
- Ear specific
- Two divisions of the VIII nerve
- Quick

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**cVEMP and oVEMP**

- Easy, non invasive
- We are getting this on our very young
- Ear specific
- Two divisions of the VIII nerve
- Quick
oVEMP

• Measuring presence or absence
• 38% cut off for asymmetry, lab norms
• One person runs equipment and one holds video
• Give child a break by putting phone/iPod down in their lap between runs
cVEMP

- Easy
- VERY motivating
- Ear specific data
No significant differences in oVEMP latencies than adults

Larger amplitudes than previous studies due to electrode montage for oVEMP

cVEMP shows shorter latencies than adults in normals

Occasional delayed cVEMP latencies in children with Benign Paroxysmal Vertigo of Childhood and Migraine Variants
Despite all of your great efforts....

Contact information

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Pediatric Vestibular Disorders Symposium

Speakers Include:
- Jennifer Braswell-Christy, PT, PhD
- Sharon Cushing, MD
- Devin McCaslin, PhD
- Thierry Morlet, PhD
- Gretchen Mueller, PT, DPT
- Violette Lavender, AuD

Topics
- Vestibular / balance therapy for children with peripheral vestibular hypofunction
- Development of the vestibular system
- Development of an outcome measure: the Pediatric Dizziness Handicap Inventory
- Medical management of a dizzy child
- Particularities of vestibular testing in children
- Vestibular function in children with cochlear implants
- Common types of Pediatric Balance Disorders
- Case presentations and panel discussion

Cincinnati, Ohio
October 23-24, 2015