Putting Neuromotor Screening Into Practice: Webinar 2

May 8, 2013
5:00 pm Central
# AGENDA

<table>
<thead>
<tr>
<th>Agenda Item</th>
<th>Speaker</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome and Project Introduction</td>
<td>Pat Heinrich, RN, MSN, QI Advisor</td>
<td>5 min</td>
</tr>
<tr>
<td>Discuss Action Plans and Feedback</td>
<td>Pat Heinrich facilitate</td>
<td>20 min</td>
</tr>
<tr>
<td>Educational Content – Neurological Exams/Related Tests</td>
<td>Max Wiznitzer, MD, FAAP</td>
<td>25 min</td>
</tr>
<tr>
<td>Next Steps Introduce Next Action Plan</td>
<td>Pat Heinrich</td>
<td>10 min</td>
</tr>
</tbody>
</table>
Action Period 1: Feedback

• What do you need from others?
• What do you want to share with others?
• What did you learn?
  – How has your care impacted patients?
  – Suggestions for changes to the algorithm?
• Are you able to implement the steps in the algorithm?
Objectives

At the end of this presentation, the participants will be able to

• Improve skills in completing pediatric neuromotor physical exams and feedback

• Collect feedback from families to assess family experience with care
Neuromotor Exam
Neuromotor Exam

- Cranial nerves
- Strength/Movement
- Tone
- Sensation
- Coordination
- Reflexes
Neuromotor Exam

- **Strength/Movement**
  - Spontaneous movement
    - Generalized assessment of movement
  - Gait
    - Speed/posture
    - Pelvic stability
    - Toe walk (calf size)
  - Elicited movement
    - Gower sign
Assessment of General Movements
Neuromotor Exam

- Cranial nerves
- Strength
- Tone
- Sensation
- Coordination
- Reflexes
Neuromotor Exam

- Cranial nerves
- Strength
- Tone
- Sensation
- Coordination
- Reflexes
Tone

• Resistance of muscle to stretch
• Types
  – Phasic
  – Postural
• *Components*
  – Central nervous system
  – Lower motor neuron system
  – Supporting tissues
CNS Hypotonia

- Benign congenital hypotonia
- Chromosomal disorders
- Brain malformation
- Brain injury
- Neurometabolic disorders
- Spinal cord dysfunction
Lower Motor Neuron Hypotonia

• Anterior horn cell
  – Spinal muscular atrophy
  – Polio
• Peripheral nerve
• Myoneural junction
  – Myasthenia gravis
  – Botulism
• Muscle
  – Myopathy
  – Muscular dystrophy
Hypotonia
Non-neurologic Causation

• Connective tissue disorders
• Osteogenesis imperfecta
• Systemic illness
• Failure to thrive
Assessment of Tone

- Deep tendon reflex
- Active tone
  - Resting position
  - Traction response
  - Ventral suspension
  - Vertical suspension

Full term Newborn
Assessment of Tone
Ventral Suspension

• Newborn
• 6 Weeks
• 3 months
• 6 months
Assessment of Tone

• Passive tone *(Assessment of Angles)* *
  – Scarf sign
  – Hip abduction
  – Heel-ear angle
  – Popliteal angle
  – Foot dorsiflexion
Assessment of Tone

<table>
<thead>
<tr>
<th>AGE</th>
<th>SCARF SIGN</th>
<th>POPLITEAL ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 months</td>
<td>Midclavicular-Midline</td>
<td>≥80°</td>
</tr>
<tr>
<td>4-6 months</td>
<td>≥Midline</td>
<td>≥90°</td>
</tr>
<tr>
<td>7-9 months</td>
<td>≥Midline</td>
<td>≥110°</td>
</tr>
<tr>
<td>10-24 months</td>
<td>≥Midline</td>
<td>≥110°</td>
</tr>
<tr>
<td>3-6 years</td>
<td>≥Midline</td>
<td>120-160°</td>
</tr>
</tbody>
</table>

adapted from Amiel-Tison & Gosselin 2001
Neuromotor Exam

- Cranial nerves
- Strength
- Tone
- Sensation
- Coordination
- Reflexes
Reflexes

• Deep tendon reflexes
  – Biceps
  – Knee

• Primitive reflexes
  – Asymmetric tonic neck
  – Moro
  – Parachute
  – Lateral prop
Features of Spasticity

- Persistent primitive reflexes
- Increased DTRs
- Increased tone
Features of Cerebral Hypotonia

• Evidence of brain dysfunction
• Association with dysmorphic features or nonbrain malformations
  • * Good strength *
  • * Intact to brisk DTRs *
• Evidence of spasticity
Spinal Cord Dysfunction

- Hypotonia as feature of spinal “shock” and associated with:
  - Poor spontaneous movement
  - Hypo/areflexia
  - Respiratory distress with diaphragmatic breathing
  - * Penile erection *
  - Bowel and bladder dysfunction
  - Autonomic instability
Hypotonia
Lower Motor Unit Dysfunction

- * Impaired strength * (may be intermittent)
- * Decreased or absent DTRs *
  - May be intermittent
- Muscle fasciculations
- Muscle atrophy
- Abnormality usually limited to nervous system
Hypotonia
Lower Motor Unit Dysfunction

• Decreased DTR
  — * Out of proportion to strength *
    • Anterior horn cell
    • Peripheral nerve
  — * Proportional to strength *
    • Myoneural junction
    • Muscle
Assessment of Hypotonia

- Without significant weakness
  - MRI
  - Chromosomal analysis
  - DNA testing
  - Metabolic testing

- With significant weakness
  - Creatine kinase
  - EMG
  - Tensilon test
  - Nerve/muscle biopsy
  - DNA testing
  - Enzyme assays
References
High and Low Tone Exam


• http://pathways.org/lower-left-nav/pathways-videos/typical-atypical-development-comparisons-videos

• http://childmuscleweakness.org/index.php/videos

• http://library.med.utah.edu/pedineurologicexam/html/home_exam.html
Dyspraxia and Developmental Coordination Disorder
Basic Definitions

- **Praxis** is the ability to learn and perform age-appropriate complex purposeful movements.

- **Apraxia** is defined as an impairment in the ability to accomplish previously-learned and performed complex purposeful movements that is not explained by a more elemental sensory or motor dysfunction such as ataxia, reduced selective motor control, weakness, involuntary motor activity or sensory impairment.

- **Developmental dyspraxia** is defined as a failure to acquire age-appropriate complex purposeful movements that is not explained by the presence of inadequate opportunity, demonstration or practice, or a more elemental sensory or motor dysfunction such as ataxia, reduced selective motor control, weakness, involuntary motor activity or sensory impairment.
Evaluation of Dyspraxia

• History
  – Early development features
  – Slow progression or loss of skills
  – Present features
    • Avoidance of athletic activities
    • Slow, awkward run or walk
    • Bumps into objects
    • Impaired use of scissors, crayons
    • Utensil grasp
    • Speed of dressing
    • Poor ball play
## Red Flags for DCD: What to watch for at different ages

<table>
<thead>
<tr>
<th>AGE</th>
<th>OBSERVATION</th>
</tr>
</thead>
</table>
| **3 years** | Frequent tripping when running  
            Difficulty sitting in table and chair  
            Unable to hop on one foot  
            Fist grasp of crayon  
            Poor spoon feeding |
| **4 years** | Unable to throw ball with direction  
            Unable to catch 12” ball  
            Not exploring playground equipment  
            Not alternating steps on descent  
            Can’t do up zippers  
            Can’t cut along a line |
| **5 years** | Can’t jump from 2 foot height  
            Unable to catch a tennis ball  
            Can’t walk along a line  
            Can’t draw a stick person  
            Messy eater  
            Needs help with dressing |
| **6 years** | Fearful and/or avoids active play  
            Inaccurate throw and catch  
            Cannot skip  
            Awkward/tense pencil grasp  
            Poor legibility and/or speed of printing  
            Avoids fine motor activities, e.g., crafts, creative |
| **7 years** | Limited participation in sports/extra curricular  
            Trouble with written work  
            Cannot ride bicycle  
            Messy eater/can’t cut meat  
            Cannot tie shoes |
| **8 years** | Predominantly sedentary activities  
            Dislikes sports and active recreation  
            Can’t keep up with written work  
            Gap between verbal and written work is obvious  
            Limited social engagement  
            Self-deprecating comments |
| **9 years** | Academic grades are impacted by written work  
            Social isolation  
            Decreased fitness level/weight gain  
            Frustration with writing/homework  
            Victimization/bullying |
# Parent interview guide

The following parent interview guide has been developed to give you specific cues about concerns that may reflect the child's coordination difficulties.

## Parent Interview: Listening for DCD

<table>
<thead>
<tr>
<th>Name</th>
<th>Date (dd/mm/yy)</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>CONCERN</th>
<th>COMMENTS</th>
</tr>
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<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
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</tbody>
</table>

| Do you have any concerns about your child's development, learning or behaviour?  
Listen for difficulty learning new things, particularly motor-based tasks, increased effort, frustration | ○ Low   | ○ Some   | ○ High   |
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
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</table>

| What types of activities does your child enjoy?  
Listen for primarily sedentary activities, e.g., computer, TV, video games. | ○ Low   | ○ Some   | ○ High   |
<table>
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<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>

| Are there activities that he/she tends to avoid?  
Listen for drawing, cutting, printing, ball games, sports, playground, running | ○ Low   | ○ Some   | ○ High   |
<table>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
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</tbody>
</table>

| How is he/she managing self-care routines, e.g., dressing independently; doing up buttons, zippers, tying shoes, cutting meat, spreading with a knife?  
Listen for continuing dependence on parents or frustration with these tasks. | ○ Low   | ○ Some   | ○ High   |
<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>

| Does your child play any sports or active games?  
Listen for lack of participation or for pattern of quitting activities after a few weeks. | ○ Low   | ○ Some   | ○ High   |
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>

| How does she/he enjoy school?  
What school activities are more challenging for him/her?  
Listen for school avoidance behaviours, psychosomatic complaints, and conflicts over homework and difficulties, particularly in written work, task completion. | ○ Low   | ○ Some   | ○ High   |
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<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>

| Does he/she have friends that he/she plays with?  
Listen for limited social network, parents having to initiate contact, loneliness, teasing, bullying. | ○ Low   | ○ Some   | ○ High   |
<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>

| When you think back, is there anything that you have tried to teach your child to do that has taken longer than you think it should have?  
Listen for doing up fasteners, tricycle or bicycle riding, tying shoes, ball games, soccer kicks. | ○ Low   | ○ Some   | ○ High   |
<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Low</td>
<td>○ Some</td>
<td>○ High</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation of Dyspraxia

• History
  – Comorbid conditions
    • Verbal dyspraxia
    • Developmental language disorder
    • ADHD
    • Learning disability
    • Impaired visuospatial skills
  – Family history
Examination of Dyspraxia

• General exam
  – Vision and hearing
  – Musculoskeletal disorder
  – Hemiatrophy

• Neurologic exam
  – Strength
  – Tone
  – Sensation
  – Ataxia or tremor
  – Reflexes
Examination of Dyspraxia

• Soft signs
  – Choreiform movements
  – Mirror movements (synkinesis)
  – Spooning of extended hand
  – Motor overflow
    • Posturing on toe/heel walk
    • Jaw/tongue
    • Arm/hand flap
Examination of Dyspraxia

• Key considerations for assessment
  – Age
  – Familiarity with skill or gesture
  – Adequate demonstration or explanation of task
  – Understanding of requested action
  – Desire to cooperate/perform task
Examination of Dyspraxia

• Gross motor assessment
  – Rapid alternating movements
  – Hopping in place
  – Tandem gait
  – Standing in place
  – Ball play
    • Roll
    • Throw
    • Bounce
Examination of Dyspraxia

• Fine motor assessment
  – Handwriting
  – Shape drawing
  – Draw-a-Person
  – Gestures
    • Verbal command
    • Imitation of examiner
    • Real object
    • Pretend object
    • Isolated movement vs sequence
    • Novel vs learned action
Screening Activities

The following age-appropriate paper and pencil, balance and ball activities are provided to help physicians detect some of the fine motor coordination difficulties commonly associated with DCD. The activities are accompanied by cues to indicate what physicians might notice if a child has DCD. If the interview or screening activities indicate that the child is experiencing coordination difficulties, it may be helpful to refer him/her to an occupational therapist for motor assessment.

Screening Activities
Paper and Pencil

<table>
<thead>
<tr>
<th>BY AGE</th>
<th>SKILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Draw:</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Draw a person with at least three body parts</td>
</tr>
<tr>
<td>5</td>
<td>Print name (letters reversed may be present)</td>
</tr>
<tr>
<td>6</td>
<td>Print name first and last correctly</td>
</tr>
<tr>
<td>7</td>
<td>Draw:</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Draw a person with at least eight body parts</td>
</tr>
<tr>
<td>8</td>
<td>Copy the sentence “The quick brown fox jumps over the lazy dog” in one minute</td>
</tr>
<tr>
<td>9</td>
<td>Copy the sentence “The quick brown fox jumps over the lazy dog” in 30 seconds</td>
</tr>
</tbody>
</table>

Diagnostic cues: Drawing and printing
Watch for:
- head too close to paper
- awkward or tense pencil grip
- failure to use non-dominant hand to stabilize paper
- uses excessive force
- rotates the paper or the body

Screening Activities
Standing

<table>
<thead>
<tr>
<th>BY AGE</th>
<th>SKILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Stand on one foot for three seconds</td>
</tr>
<tr>
<td>5</td>
<td>Hop five times</td>
</tr>
<tr>
<td>6</td>
<td>Stand on one foot for 10 seconds</td>
</tr>
<tr>
<td>7</td>
<td>Skip forward for 20 feet</td>
</tr>
<tr>
<td>8</td>
<td>Stand on one foot for 20 seconds</td>
</tr>
<tr>
<td>9</td>
<td>Hop forward 5 times, stop and hold one foot balance for 5 seconds</td>
</tr>
</tbody>
</table>

Diagnostic cues: Hopping or standing on one foot
Watch for:
- child looks at feet
- exaggerated arm movements
- lack of rhythm in hops
- heavy, flat foot or stiff legged landings
- holds body rigidly

Screening Activities
Throw and catch a tennis ball

<table>
<thead>
<tr>
<th>BY AGE</th>
<th>SKILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Throw with direction to a person five feet away</td>
</tr>
<tr>
<td>5</td>
<td>Catch tennis ball with two hands from five feet away (can use body to trap the ball)</td>
</tr>
<tr>
<td>6</td>
<td>Catch tennis ball with two hands from five feet away (hands only, not body)</td>
</tr>
<tr>
<td>7</td>
<td>Bounce and catch ball — two handed catch</td>
</tr>
<tr>
<td>8</td>
<td>Bounce and catch ball — one handed catch</td>
</tr>
<tr>
<td>9</td>
<td>Throw ball at wall from 5 feet away and catch with two hands before it bounces.</td>
</tr>
</tbody>
</table>

Diagnostic cues: Throwing and bouncing a tennis ball
Watch for:
- lack of adjustment of body position
- inaccurate aim
- poor judgment of force needed
- changes hands between trials
- doesn’t look at target

Diagnostic cues: Catching a tennis ball
Watch for:
- turns away / closes eyes / flinches
- arms and hands don’t “give” with contact from the ball
- doesn’t adjust/correct if unsuccessful
- positions self incorrectly, e.g., arms too wide apart
DCD-Questionnaire ‘07
References - Dyspraxia

• http://dcd.canchild.ca/en/
Action Plan 2 – Preparation

to be completed by Complete by May 20, 2013

Education

• Review Today’s webinar and videos
  – Neurological Exam and Related Related Tests, presented by Max Wiznitzer, MD, FAAP

• Identify remaining questions/learning needs

• Seek help/support if needed
Action Plan 2 Activities – Preparation cont.

to be completed by Complete by May 20, 2013

Plan for Patient Feedback

• Plan 2-3 survey questions to gain feedback from family - after exam

• Consider printing 3x5 note pages with 2-3 questions to get feedback at visit end from families you serve.

• Collect in a box at check-out area.

• Review patient feedback during your ongoing team meetings, using feedback to inform your future work

• Complete by May 20, 2013
Action Plan 2 Activities - Patient Exams

Complete patient exams

• Identify one patient for first exam - to be completed May 20-27, 2013
  – Ask scheduler to block additional time for this visit
  – If possible, start using algorithm and doing exams on patients without previously identified risk factors

• Perform the first physical exam – to be completed by May 27, 2013
Action Plan 2 Activities
Continuing Exams and Patient Feedback

to be completed May 28-June 20, 2013

• Compete additional patient exams

• Feedback from patient/family
  – Give family survey card at end of visit.
  – Collect in a box at check-out area.
  – Review patient feedback during your ongoing team meetings, using feedback to inform your future work
Action Plan 2 Activities – Final Steps

• Complete AP 2 Brief Survey - to be completed by June 20, 2013
  https://www.surveymonkey.com/s/3SKQ9L8

• Plan feedback to AAP on next Webinar - to be completed by June 27, 2013
Next Steps

• Webinar 3: Patient Care if Motor Delay is Identified, presented by Dipesh Navsaria, MD, FAAP - June 27, 2013

• Action Period 3: Develop a system for referral and monitoring in the medical home - June 28-August 9, 2013

• Complete the Action Plan 3 Brief Survey - August 9, 2013

• Follow-up Conference Call - August 15, 2013

• Complete post-survey and project evaluation - August 30, 2013
Project Resources

• Project Listserv
  NMS@listserv.aap.org
  – Communicate with other teams and project leaders

• Project Web page
  http://aap.org/quiin/NMS
  – Find project materials, tools, Webinar recordings
Contact Us!

- Jill Healy, MS, QuIN Program Manager  
  jhealy@aap.org  |  800/433-9016, ext 7122
- Rachel Daskalov, PEHDIC Program Manager  
  rdaskalov@aap.org  |  800/433-9016, ext 7863
- Pat Heinrich, RN, MSN, Quality Improvement Advisor  
  pat@heinrichllc.com  |  617/686-6161

Acknowledgement
The development of the clinical report and algorithm that are being tested as part of this project was funded by the American Academy of Pediatrics through the Public Health Program to Enhance the Health and Development of Infants and Children through a cooperative agreement (5U58DD000587) with the Centers for Disease Control and Prevention’s National Center on Birth Defects and Developmental Disabilities.
Questions