Practical Overview of Neuropsychological Testing

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Purpose of Presentation

• Discuss necessary basics in administration and interpretation of most popular Neuropsychological tests used with children exposed to lead:
  • What are the tests used?
  • Why are the tests chosen?
  • How are the tests interpreted?
WHAT ARE THE TESTS ADMINISTERED BY NEUROPSYCHOLOGISTS?

• Different Batteries – A battery approached is based on the recognition that a number of tests might be necessary to respond to a referral question.
• Repeatable Fixed Battery
• Flexible Battery
Most Used Tests

- Intellectual tests
- Visuoconstructive abilities tests
- Learning and memory Tests
- Verbal Tests
- Academic Tests
- Executive motor abilities Tests
- Projective/Personality tests
- Questionnaires
Basic steps in Assessment

• Review of records
• Intake/clinical interview
• Behavioral Observations
• Administration of evaluation
• Administration of parent questionnaires, rating scales, self-report inventories
Determining The Tests

• The best practice is casting a broad net.
• Test choices are determined by reason for referral.
• The child’s age.
• The capability of the child.
• The time available to perform the evaluation.
HOW ARE THE TESTS ADMINISTERED?

• Begin by creating a non-threatening and therapeutic rapport with the child.

• Based on specific domains
SPECIFIC DOMAINS

- Language
- Visuoconstruction
- Inhibitory capacity/Executive Function
- Attention
- Motor & Sensory
- Learning and Memory
- Academic
- Projective/affective/development Screening
Language/verbal Skills

• Language specific basic skills include the capacity to produce phonemes, lexical development, naming and production of words, speech comprehension and linguistic aspects of writing and reading.

• Language skills also include expressive and receptive components. Skills such as vocabulary definitions or applied verbal skills are also included in this domain.
Visuoconstruction

• Non-verbal abilities associated with the processing and manipulation of visual designs, the spatial or physical aspects of environmental objects or constructional skills.

• These abilities are assessed by tasks such as drawing designs, recognizing objects presented in degraded form or embedded in a more complex visual array, or assembling puzzles or block designs.
Visuoconstruction

• Constructional tasks include motor output which requires mental manipulation of spatial information such as identification of the correct outline of an object presented in cut-up form, matching faces and angles
Inhibitory capacity/Executive Function

• **Attention** – focuses on the ability to attend to stimuli over a period of time. Tests such as Continuous Performance Tests are often used to measure this skill.

• The capacity to take in and report back stimuli immediately after presentation such as Forward Digit Span or Visual Pointing Span. The Stroop Color-Word Test is a brief measure of selected or focused attention.
Continuous Performance Tests

- **Continuous performance tests** (CPT) are those tests that assess vigilance. These tests are used by neuropsychologists to differentiate ADHD from normal groups including important variables such as error of omission and commission. There are many tests to measure this domain, but the Conners Continuous Performance Test.
Executive function: working memory/Inhibition

- This construct refers to both broad and very specific behaviors such as abstract reasoning, problem solving and concept formation.
- It measures the capacities to learn and manipulate stimuli such as Digit Span Backward, Visual Pointing Span Backward, to invoke strategies for manipulating novel stimuli.
Learning and Memory

• **Learning and memory** different aspects of memory function.

• **Declarative memory** is generally divided into anterograde and retrograde memory function.
Anterograde memory

- Learning new information, retention of information over shorter and longer delays, and the ability to retrieve information already in memory.
- Verbal and visuospatial. It is associated with dominant and non-dominant functions. Measured: stories, lists of words, designs or objects for immediate learning, with delayed recall and recognition - multiple choice format
Retrograde Memory

- The capacity to remember events that have occurred or learned in the past.
- The tasks measured in these tests could include presenting to the child: famous faces, questions about historical events or facts, or questions about personal history.
Procedural Learning and Memory

• The capacity to learn and remember a problem-solving sequence such as reading words in a mirror or a motor skill.
• For example driving a car.
• SNACIREMA = AMERICANS
Working Memory

• The ability to acquire the "set" of new tasks and to maintain the set of the task while completing it, as well as the ability to flexibly switch from one set of task requirements to another. It requires strategic planning, impulsive control and organization.

• The ability to inhibit external stimuli and focusing on a specific required task is also included in this domain
Motor and Sensory

- Individual’s capacity to carry out manual motor activities generally assessed using the hands (manual motor dexterity), with evaluation of speed and accuracy.
- Tasks may be simple (tapping a computer key or finger tapping apparatus).
- Tasks may be complex requiring coordination and speed (pegboard tasks) or integrative writing or matching symbols.
Memory and Learning Tests

- Wechsler Memory Scale III (WMS-III)
- California Verbal Learning Test-II
- Wide Range Assessment of Memory and Learning (WRAML)
- Benton Visual Retention Test
Academic/Achievement

- Measures skills - reading words or paragraphs, spelling and completing arithmetic problems.
- Woodcock-Johnson-III-Tests of Achievement
- Nelson-Denny Reading Test
- Stanford Diagnostic Mathematics Test
- Test of Written Language-3 (TOWL-3)
- Woodcock Reading Mastery Tests-Revised
- WRAT-R
Projective/Affective Developmental Screening

Tests that look at description, habits, relational, behavioral and other aspects of the child.

- Rating Scales
- Personality Tests
- Mood Assessment Tests
- Behavioral Scales
- Functional Assessments
How are the Tests Interpreted?

• Scores or numbers by themselves do not offer much meaning to the clinician if one does not keep in mind that assessment tools are first and foremost clinical instruments.
Intelligence Tests

- Federal Guidelines as of 2002 mandates that an ability/achievement comparison be made when assessing children for school before a child is placed in special education.
- Intelligence tests or a decline in IQ is used as a measure in most scientific studies relating to the effects of lead.
Importance of Intelligence Tests

• Allows for comparison of age peers
• Quick appraisal of strengths and weaknesses
• Useful stratification by age, education and/or gender and cultural group.
• Existence of multiple parts that are Co-normed permitting comparison of performances across tests.
Limitations of Intelligence Tests

• They are insufficiently sensitive or specific to determine neuropsychological dysfunction.
• IQ tests are not instruments validated with respect to brain function.
• All tasks whether verbal-based or performance-based are learned within a culture and within a setting. These settings could include the home, the school and the community.
• IQ tests are not domain-specific and of limited use for inference about brain function.
Important Assumptions

• It is very important to understand that the skills, training and experience of the clinician are of principal importance to make the proper interpretation of the responses obtained in an examination.
Important Assumptions

• Scores or numbers by themselves from one or two tests alone should be interpreted with caution.

• Clinicians interpret a pattern of multiple test scores which is not always possible to find in the studies conducted among children exposed to lead.
Essentials in Test Interpretation

• Relevance of research and new findings relating to lead. Findings cannot always integrate all the data, which might differ from the data presented by specific child being tested.
• Recognition of gaps in the literature relating to lead.
• Understanding the nature of studies of population exposed to lead.
CONFOUNDING VARIABLES:

• Learning disabilities
• Language issues
• Acculturation
• The environment: culture, languages, SES.
• Stressors in the home or family: Illnesses, migration, loss of job, living in a shelter, divorce, death.
• Genes or familial traits
<table>
<thead>
<tr>
<th>Z-Score</th>
<th>IQ Score</th>
<th>T-Score</th>
<th>Scaled Score</th>
<th>%ile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Average</td>
<td>Low Average</td>
<td>Average</td>
<td>High Average</td>
<td>Above Average</td>
</tr>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
</tr>
<tr>
<td>55</td>
<td>70</td>
<td>85</td>
<td>100</td>
<td>115</td>
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<td>60</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>16</td>
<td>50</td>
<td>84</td>
</tr>
</tbody>
</table>

The diagram illustrates a normal distribution with percentiles and z-scores. The table provides the corresponding scores for various percentiles.
The Relevance of the Interpretation

Pitfalls of over generalization or focusing on – a poor performance might be due to many reasons including:

The child not being motivated to do well, being anxious and/or depressed, hostile to the testing environment rather than impairment.
Relevance of the Clinical observation

Tests scores must be interpreted in relation to the context of the examination in which they were obtained. Not to do so renders the process meaningless.

On the other hand, clinical observations that are not supported by standardized and quantifiable testing lack the comparability necessary for accurate diagnosis and opinion.
CONCLUSION

• Rendering an opinion of the Neuropsychological functioning of a child exposed to lead is accomplished by documenting neuropsychological strengths and weaknesses.

• Every clinician determines the format to use, but the report needs to include sufficient information that accurately assess all variables that have impacted the child’s life, including the lead exposure.