NONVERBAL LEARNING DISABILITY & ASPERGER’S DISORDER

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Objectives

1. Participants will learn the specific neuropsychological characteristics of individuals with Nonverbal Learning Disabilities (NLD).

2. Participants will learn the current status of the support for the diagnosis of NLD.

3. Participants will learn the specific diagnostic criteria for Asperger’s Syndrome (AS).

4. Participants will learn about differential diagnosis regarding NLD and AS.
History - Gerstmann Syndrome

- Josef Gerstmann- Austrian-American neurologist
- Wrote 1st published article on Gerstmann Syndrome
- Symptoms
  - Finger agnosia
  - Right-left orientation confusion
  - Agraphia
  - Acalculia
Johnson & Myklebust

- Proposed a nonverbal type of disability characterized by absence of serious language problems and adequate or above skills in reading and writing,
  - Higher verbal than performance IQ
  - Problems in visual-spatial processing
  - Spatial orientation, right-left orientation, body image, motor learning
  - Difficulties in temporal perception
  - Handwriting
  - Mathematics
  - Distractible
  - Perseveration
  - Disinhibition
- Deficiencies in social perception - “unable to comprehend the significance of many aspects of his environment”
- (Myklebust, 1967; Johnson & Myklebust, 1975; Boshes & Myklebust, 1964)
Byron Rourke

- **Neuropsychology of Learning Disabilities: Essentials of Subtype Analysis** (1985)
- Identified a group of children with a pattern of neuropsychological strengths and weaknesses
Rourke’s Description of NLD

- Neuropsychological assets in auditory perception, auditory attention, and auditory memory, especially for verbal material.
- Adequate skills in rote verbal memory & language, amount of verbal associations and language output.
- Poor visual-spatial organizational, psychomotor, tactile-perceptual, and concept formation skills, simple motor skills may be well developed
- Academic assets = single-word reading & spelling.
- Academic difficulties in (e.g., arithmetic, science)
- Difficulties in informal learning (e.g., as transpires during play and other social situations).
- Psychosocial deficits, primarily of the internalized variety, are usually evident by late childhood and adolescence and into adulthood.
# Cognitive/Neuropsychological

## Strengths
- VIQ > PIQ by 10-15 pts or more
- Good receptive & expressive language, High in Similarities
- Verbal Recognition, Repetition, Associations, Storage, Output
- Auditory Perception
- Verbal Attention & Rote Memory
- Focus on Details
- Simple motor skills intact
- Grip strength normal
- Finger tapping average

## Deficiencies
- PIQ < VIQ, Block Design, Object Assembly, Picture Arrangement & Coding
- Bilateral Tactile Perception (more on left)
- Finger localization, fingertip number writing
- Tactile Form Recognition & Memory
- Bilateral Visual Perception
- Visual Memory (particularly as figures become more complex)
- Visual discrimination/Visual figure ground
- Visual spatial organizational abilities
- Perseveration
- Attention
- Selective attention
- Novel Material
- Understanding the big picture
- Concept Formation
- Nonverbal Problem Solving
Specific NLD Proposed Criteria

- (1) Less than two errors on simple tactile perception and suppression vs. finger agnosia, finger dysgraphesthesia, and astereognosis. Simple composite greater than 1 SD below the mean. Simple tactile-perceptual skills are superior to complex tactile-perceptual skills.
- (2) WRAT /WRAT -R standard score for Reading is at least 8 points greater than Arithmetic. Single word reading is superior to mechanical arithmetic.
- (3) Two of WISC/WISC - R Vocabulary, Similarities, and Information are highest of the Verbal scale. Straightforward and/or rote verbal skills are superior to those involving more complex processing (e.g., Comprehension).
- (4) Two of WISC/WISC -R subtests Block Design, Object Assembly, and Coding subtests are the lowest of the Performance scale. Complex visual-spatial-organizational skills and speeded eye-hand coordination are impaired.
- (5) Target Test at least 1 SD below the mean. Memory for visual sequences is impaired.
- (6) Grip strength within one standard deviation of the mean or above vs. Grooved Pegboard Test greater than one standard deviation below the mean. Simple motor skills are superior to those involving complex eye-hand coordination, esp. under speeded conditions.
- (7) Tactual Performance Test Right, Left, and Both hand times become progressively worse vis-à-vis the norms. Complex tactile-perceptual and problem-solving skills under novel conditions are impaired.
- (8) WISC/WISC -R VIQ > PIQ by at least 10 points. Verbal skills are superior to visual-spatial-organizational skills.

The following criteria are currently under investigation:
- 7 or 8 of criteria = definite NLD
- 5 or 6 of criteria = probable NLD
- 3 or 4 of these criteria - Questionable NLD
- 1 or 2 of these features: Low Probability of NLD

## Rourke’s Proposed ICD Criteria

<table>
<thead>
<tr>
<th>Bilateral deficits in tactile perception, usually more marked on the left side of the body.</th>
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<tbody>
<tr>
<td>Bilateral deficits in psychomotor coordination, usually more marked on the left side of the body.</td>
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<tr>
<td>Extremely impaired visual-spatial-organizational abilities.</td>
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<tr>
<td>Substantial difficulty in dealing with novel or complex information or situations. A strong tendency to rely on rote, routinized approaches and memorized responses (often inappropriate for the situation), and failure to learn or adjust responses according to potentially corrective informational feedback.</td>
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<tr>
<td>Impairments in nonverbal problem-solving, concept-formation, and hypothesis-testing.</td>
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### Rourke’s Proposed ICD Diagnostic Criteria for NLD

<table>
<thead>
<tr>
<th>Distorted sense of time. Estimating elapsed time over an interval and estimating time of day are both notably impaired.</th>
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<tr>
<td>Well-developed rote verbal abilities (e.g., single-word reading and spelling), frequently superior to age norms, in the context of notably poor reading comprehension abilities (particularly evident in older children).</td>
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<tr>
<td>High verbosity that is rote and repetitive, with content/meaning disorders of language and deficits in the functional/pragmatic dimensions of language.</td>
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<tr>
<td>Substantial deficits in mechanical arithmetic and reading comprehension relative to strengths in single-word reading and spelling.</td>
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<tr>
<td>Extreme deficits in social perception, social judgment, and social interaction, often leading to eventual social isolation/withdrawal. Easily overwhelmed in novel situations, with a marked tendency toward extreme anxiety, even panic, in such situations. High likelihood of developing internalized forms of psychopathology (e.g., depression) in late childhood and adolescence.</td>
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</tbody>
</table>
Primary Neuropsychological Assets
Auditory Perception -- Simple Motor
Rote Material

Secondary Neuropsychological Assets
Auditory Attention -- Verbal Attention

Tertiary Neuropsychological Assets
Auditory Memory -- Verbal Memory

Verbal Neuropsychological Assets
Phonology – Verbal Recognition
Verbal Repetition – Verbal Storage
Verbal Associations – Verbal Output

Academic Assets
Graphomotor (late)/Word Decoding
Spelling/ Verbatim Memory

Socioemotional Assets

Primary Neuropsychological Deficits
Tactile Perception – Visual Perception
Complex Psychomotor --- Novel Material

Secondary Neuropsychological Deficits
Tactile Attention -- Visual Attention
Exploratory Behavior

Tertiary Neuropsychological Deficits
Tactile Memory -- Visual Memory
Concept Formation -- Problem Solving

Verbal Neuropsychological Deficits
Oral-Motor Praxis-- Prosody
Phonology-Semantics -- Content
Pragmatics -- Function

Academic Deficit
Graphomotor (Early)/Reading Comprehension
Mechanical Arithmetic/Mathematics
Science
Socioemotional Adaptive Deficits
Adaptation to Novelty/Activity Level
Social Competence/Emotional Stability
1) core deficits in processing complex and nonlinguistic perceptual tasks who also develop social problems (perceptual + social)

2) meet subtype 1 and also have neuropsychological deficits in attention & executive functioning (perceptual + social + EF)

3) meet subtype 1 and have social cognition impairments that manifest in reciprocal social interactions, social communication and emotional functioning (perceptual + social + emotional)

4) meet subtype 2 and have same social cognition impairments as subtype 3 (perceptual + social + EF +
4 Subtypes of NLD

- Davis & Broitman (2011)
- All children with NLD have significant visual-spatial and executive function difficulties
- 1st Core subtype have visual-spatial executive functioning, mild social and academic difficulties
- 2nd Children with visual & executive functioning difficulties that significantly impact their social functioning
- 3rd Children with visual & executive functioning difficulties and significant academic problems
- 4th Children with visual-spatial, executive functioning, social and academic difficulties where all areas are functionally impaired
Hale & Fiorello (2004)

- 2 types
- Executive novel problem solving - frontal
- Posterior visual-spatial holistic problem solving - right hemisphere
Specific Characteristics - Cognitive

- WISC-III - VIQ greater than PRI by 10 standard score points or more
- 80% have highest standard scores on Information, Similarities or Vocabulary
- 90% had lowest scores on Block Design, Object Assembly, Coding (Drummond, et al., 2005)
- Deficits in:
  - Perceptual and Quantitative Reasoning,
  - Theory of Mind
Attention

- Attentional Problems – maybe due to Visual Perceptual and tactile difficulties (Rourke, 2000)
- Auditory verbal attention intact
- Problems with Sustained Visual & Divided Attention
- Tend to be diagnosed with ADHD: Predominately Inattentive type (ADHD–PI) but may not be true ADHD (Semrud-Clikeman, 2007).
Executive Functioning

- Hypothesis generation
- Flexible problem solving;
- Self-monitoring;
- Behavior regulation;
- Integration of emotion with context
Speed and Efficiency of Processing

- Assets -- auditory verbal including sustained auditory attention, reading speed for simple words, and rapid oral word association
- Deficits -- visual attention, tracking, matching, decision making speed, verbal-visual naming, color naming and writing speed
Memory & Learning

- Assets - auditory verbal learning and memory
- Deficits - in visual-visual verbal learning, visual immediate, visual spatial working memory, delayed and long term recall of visual information, Tactile-Kinesthetic Learning and Memory; Location Memory
Visual Processing Deficits

- Visual Perception;
- Scanning-Tracking;
- Figure-ground disturbance
- Visual-spatial
- Constructional
Sensory-Motor Deficits

- Tactile-Kinesthetic;
- Tactile Defensiveness;
- Motor Sequencing,
- Strength
- Gross motor coordination (skipping, bike riding, jump roping)
- Fine Motor coordination (handwriting, coloring, cutting, tracing, fastening, fine motor speed & dexterity)
- Complex psychomotor tasks,
Language

- Asset - but language is pedantic, rote
- Poor prosody and high verbal production
NLD Communication Difficulties

Receptive
- May not understand social nuances in conversation (lack of tact)

May lack sense of humor
- Problems decoding prosodic or vocal intonations
- Problems reading facial expressions and gestures
- Concrete interpretation of metaphors

Expressive
- Good vocabulary
- Lack of gestures, facial expressions or vocal intonations
Social Deficits

- Facial recognition and emotional expression (visual attention/memory) (Corbett & Constantine, 2006; Fine, Semrud-Clikeman, Butcher, & Walkowiak, 2008; Rourke, 2000)
- Emotional nuancing in communication; poor receptivity to feeling states and states of others;
- Poor prosody and high verbal production does not promote positive social feed back
- Social judgment secondary to problems with reasoning & concept formation
- Adaptation to novelty
- Comprehension of humor deficits observed in NLD group with social perceptual difficulties (not in NLD group with just visual-spatial difficulties)(Semrud-Clikeman et al., 2008)
NLD Social Difficulties

Limited peer interaction, prefer one-to-one interaction, prefer younger peers

Problems forming friendships

Difficulty reading social cues

Socially awkward & inappropriate

May withdraw or isolate

Rigid, rule-bound

Disruptive play

Bossy, aggressive & defensive with peers

Problems with forming close personal attachments

Problems with interpersonal intimacy

Problems with adaptability

Problems with forming close personal attachments

Problems with interpersonal intimacy

Problems with adaptability
Emotional

- At risk for internalizing problems, e.g., anxiety & depression (Rourke, 1989; Little, 1993)
- Depression (Cleaver & Whitman, 1998) Children with sx$s of right hemisphere white matter dysfunction had arithmetic difficulties and showed significant levels of depression
- Petti et al. (2003) found that children with NLD had a higher percentage of internalizing diagnoses among children at psychiatric treatment facilities.
- Higher risk for suicidal behavior as compared to other LDs (Rourke, 1989; Bigler, 1989; Fletcher, 1989; Kowalchuk & King, 1989) - based on extremely small
Emotional

- Greenham (1999) – evidence not clear if emotional problems are cause or consequence
- Most individuals with NLD do not develop psychological problems, and very few commit suicide (Greenham 1999).

- Bloom & Heath (2010) compared 23 12- to 15-year olds with NLD with 23 matching children with “general learning disability” (GLD) and 23 typicals
  - Self-report scale, an adolescent depression scale,
  - Facial affect recognition measure,
  - Ability to make six different facial expressions
  - Understanding of facial expressions.

  GLD did more poorly on recognition, expression, and understanding of emotions
  NLD group did not differ from the typical group
Co-morbidity- ADHD

- Higher rates of ADHD (e.g., Gross-Tur, Shaleve, Manor, & Amir, 1995; Voeller, 1986)
<table>
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<tr>
<th>NLD Emotional Difficulties</th>
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<tbody>
<tr>
<td>Lack of empathy or compassion</td>
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<tr>
<td>Self critical, perfectionistic, lack self-confidence</td>
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<tr>
<td>Increased risk for depression &amp; suicide</td>
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<tr>
<td>Problems modulating affect</td>
</tr>
<tr>
<td>Anxious, worried</td>
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<tr>
<td>Easily frustrated, loses control</td>
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</tbody>
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Academic

 assets

 - May initially have trouble with letter or number recognition & learning letter-sound relationships then become good readers
 - May lose place in reading
 - Good spelling skills
 - Average or above average in verbal language skills
 - Good syntax
 - Good rote memories
 - Problems generating ideas for essays, but

 deficits

 - Arithmetic (rarely achieve >6th grade level, even as adults (Rourke, 1995), number alignment
 - Word problems (money, measurement, esp. time–calendar & clock)
 - Quantitative analysis & size, weight & distance estimation
 - Physics, Hypothesis testing
 - Organization
 - Spatial representation of abstract nonverbal concepts (graphs, diagrams)
 - Written expression early problems with orthographic identification of letters spelling, graphomotor tactile and constructional deficits that affect legibility & accuracy
 - Reading comprehension for complex reading material (e.g., main idea & inferences), problems understanding characters/motives
 - Story Retelling, question response (Worling, Humphries, & Tannock, 1995)
## NLD Assets and Liabilities

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<thead>
<tr>
<th>Domain</th>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory-Motor</td>
<td>Auditory-Verbal</td>
<td>Tactile-Kinesthetic; Tactile Defensiveness; Motor Sequencing, Coordination, strength</td>
</tr>
<tr>
<td>Attention</td>
<td>Sustained Auditory; Rote Recall, Verbal</td>
<td>Sustained Visual, Divided Attention</td>
</tr>
<tr>
<td>Visual-Spatial</td>
<td>None</td>
<td>Visual Perception; Scanning-Tracking; Constructional</td>
</tr>
<tr>
<td>Language</td>
<td>Verbal Comprehension; phonological; Expressive, receptive, and repetitive</td>
<td>Prosody, Semantics; Content;</td>
</tr>
<tr>
<td>Memory &amp; Learning</td>
<td>Auditory-Verbal; Learning &amp; Memory for Rote Information</td>
<td>Visual Immediate, Working; Delayed, Recognition, Visual-Verbal Learning; Tactile-Kinesthetic Learning and Memory; Location Memory</td>
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# NLD Assets & Liabilities

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<th>Domain</th>
<th>Asset</th>
<th>Liability</th>
</tr>
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<tbody>
<tr>
<td>Executive</td>
<td>Verbal Problem Solving</td>
<td>Hypothesis generation and flexible problem solving; self-monitoring; behavior regulation; integration of emotion with Context</td>
</tr>
<tr>
<td>Speed &amp; Efficiency of Cognitive Processing</td>
<td>Verbal-Auditory; Word Retrieval; Rapid Verbal Word Association</td>
<td>Visual Tracking and Matching; Verbal-Visual Naming; Color Naming; Writing Speed</td>
</tr>
<tr>
<td>General Cognitive</td>
<td>Verbal Reasoning</td>
<td>Perceptual and Quantitative Reasoning, Theory of Mind</td>
</tr>
<tr>
<td>Academic Achievement</td>
<td>Literal Comprehension; Decoding; Verbal Arithmetic; Spelling</td>
<td>Mechanical Arithmetic; Science; Writing; Gist Reading Comprehension</td>
</tr>
<tr>
<td>Social-Emotional</td>
<td>General Knowledge; verbal skills</td>
<td>Language Pragmatics; Nonverbal Cues &amp; Behavior; Social Judgment</td>
</tr>
</tbody>
</table>
Early Signs of NLD 0-6 years

A. Delays in reaching all developmental milestones, including acquisition of speech, followed by a late, but rapid development of speech & other verbal abilities (particularly rote skills), usually to above-average levels. May speak in a monotone.

B. Below normal amount of exploratory behavior. An apparent aversion for any type of exploration of new stimuli/situations.

C. Impaired development of complex psychomotor skills (e.g., climbing, walking).

D. Avoidance of novelty & preference for highly familiar objects, situations, & information.

E. Preference for receiving information in verbal as opposed to visual format.

F. Strength in rote verbal memory (e.g., reciting the alphabet). Intelligence may be overestimated.

G. Deficits in perception and attention in both the visual and tactile domains.

H. Notably better auditory-verbal memory than visual or tactile memory.

I. Initial problems in oral-motor praxis, and longstanding, mild difficulties in pronouncing complex, polysyllabic words.

J. Frequently described as “inattentive”.
Characteristic Evident in Older Children (> 7 Years)

A. Impaired capacity to analyze, organize, and synthesize information, with associated impairments in problem-solving and concept-formation.

B. Despite high levels of verbosity, very significant impairments in language prosody, content, & pragmatics. “Cocktail-party” speech patterns, with high volume of verbal output but relatively little content (meaning) & very poor pragmatics.

C. Strengths in single-word reading/recognition, but may have problems with tracking (30% of NLD children need to be retrained to read fluently) & reading comprehension.

D. Problems in arithmetic.

E. Fine motor problems, coloring, cutting, & handwriting in early school years, often improving to normal levels but only with considerable practice.

F. Deficient social perception, social judgment, and social interaction. Poor perception & comprehension / interpretation of facial expressions of emotion, and marked deficits in providing non-verbal communication signals.

G. May develop stress, anxiety, obsessional preoccupation, depression, self esteem, attentional problems (Palomobo & Berenberg, 1999)

H. With advancing years, a tendency to become normoactive and then hypoactive. Problems in "attention" in formal and informal learning environments tend to disappear as the situational stimulus and response demands become more verbal in nature.
Middle & High School

A. Social skills deficits even more important, difficulty getting along with peers & teachers
B. Math & science even more challenging
C. More emphasis on executive functioning in written expression and reading
D. Increased risk for psychiatric disorders such as depression (Mokros, Poznanski, & Merrick, 1989)
E. May do well in learning a foreign language, drama, language arts
F. Transition planning becomes essential
Etiology

- NLD is the phenotype that may be due to various causes
- Hydrocephalus
- Agenesis of the Corpus callosum
- Turner’s Syndrome
- Fragile X
- Asperger’s Syndrome
- Williams Syndrome – similar strengths & weaknesses (Don, Schellenberg, & Rourke, 1999) = WS lower cognitive
- Neurofibromatosis
- leukomalacia
- spina bifida
Etiology

- Rourke presumed ‘right hemisphere’ dysfunction largely secondary to sub-cortical white matter differences and more association cortex.
- Findings from existing neurological cases does suggest involvement of the right hemisphere and possibly of white matter (Voeller, 1995).
- Further study is needed to determine the validity of the right hemispheric white matter hypothesis in NLD.
Filley, 2001

“the NLD syndrome remains a theoretical construct, and there is little documentation of right hemisphere damage in white (or gray) matter in children with this disability” (p. 262).

“the relevance of the NLD syndrome to the behavioral neurology of white matter must remain conjectural” (p. 204).

“careful correlation with neuroradiologic or neuropathologic data [is necessary] . . . to confirm or deny that white matter pathology is in fact present” (p. 262).
Etiology

- Semrud-Clikeman & Fine (2011) found a greater number of cysts on MRIs in children with NLD as compared to children with AS & controls.
- ¼ (7) of NLD had cysts or lesions, generally in the posterior region—occipital/cerebellar or parietal regions (visual spatial perception), equally in the right and left hemispheres and bilateral in the cerebellum.
- Not found as frequently in children with Asperger’s syndrome or with controls.
- One child w/Turner syndrome in the sample did not have a cyst/lesion.
- May be a structural abnormality or a genetic disorder that underlies the expression of nonverbal learning disability.
Asperger’s Syndrome
History

- Described in 1944 by a Viennese pediatrician, Hans Asperger (1906-1980), Asperger Syndrome (AS) “autistic psychopathy”
- Asperger identified a special group of children (4 boys aged 6 to 11) with normal cognitive & linguistic development, but poor social skills
- Impairment in nonverbal communication, vague facial expressions, limited gestures, limited, exaggerated or inappropriate language
- Verbal communication idiosyncratic, precise quality
- Misunderstanding of humor
- Intellectualization of affect
- Clumsiness & poor body awareness
- Special interests
- Conduct problems
- Familial patterns
- Gender patterns (more males)
- Increased anxiety & fear
Lorna Wing, MD

- British psychiatrist
- Coined the term “Asperger’s syndrome” & proposed formal diagnostic criteria
- 1979 conducted an epidemiological study in London
  - Triad of Impairments:
    - Impairment of social interaction
    - Impairment of social communication
    - Impairment of social imagination, flexible thinking and imaginative play
299.80 Asperger’s Disorder

A. Qualitative impairment in social interaction, as manifested by at least two of the following:

1. marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
2. failure to develop peer relationships appropriate to developmental level
3. lack of spontaneous seeking to share enjoyment, interests, or achievements with other people
4. lack of social or emotional reciprocity
B. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
2. apparently inflexible adherence to specific, nonfunctional routines or rituals
3. stereotyped and repetitive motor mannerisms
4. persistent preoccupation with parts of objects
Diagnostic Criteria

- C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.
- D. No clinically significant general delay in language.
- E. No clinically significant delay in cognitive development or in the development of age appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.
- F. Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.
AS - Social Impairments

- May not like physical contact
- Inability to engage in appropriate play
- Extremely egocentric; self-centered
- Socially awkward
- Failure to develop developmentally appropriate peer relationships
- Lack of spontaneously seeking enjoyment
- Limited desire for social contact
- Difficulty understanding other people’s expressions & feelings
AS - Motor Impairments

- Odd Motor Mannerisms
- Delayed Acquisition of Motor Skills
- Poor Manipulative skills
- Impaired mirror-image imitation
- Poor Coordination & Balance
AS - Sensory Impairments

Sensitivity to Pain and Temperature

Sensitivity to taste and texture of food

Tactile Sensitivity

Visual Sensitivity to Certain Colors

Sound sensitivity - 3 types of noises:
1. sudden, unexpected noise (telephone ringing, dog barking, clicking of a pen)
2. high pitched, continuous noise (hair dryer, vacuum cleaner, mix-master)
3. confusing, multiple sounds (shopping centers, large classrooms)

Synaesthesia
- A sensation in one sensory system and as a result experiences a sensation in another modality
  - “Colored hearing” – seeing colors when hearing a sound
AS – Language Impairments

**Adult like speech/’little professors**

**May have no language delay; Well developed speech but poor communication**

**Poor prosody, monotone, strange intonation, rate (too fast), volume (too loud), poor fluency.**

**Poor ability to initiate and sustain conversation with peers**

**Monologue type speech; egocentric conversational style**

**Difficulty understanding metaphors/idioms/jokes**

**Lack of tact**

**Echolalia**
Emotional Co-morbidities

Depression
ADHD
ODD
Bipolar

Eating Disorders
Substance Use
Anxiety (GAD, PTSD, Social Phobias, Phobias, OCD, PTSD)
Other Co-morbidities

- Seizure Disorders
- Tourette’s & Tics
- Learning Disabilities
- Developmental Coordination Disorder
- Hyperlexia
Other Characteristics

- Rigidity in rituals & routines
- Above Average Rote Memory
- Executive Function Deficits
- Intense Interest in circumscribed subjects
- Nonverbal Learning Disability & Asperger’s Syndrome
NLD profile is often associated with AS (@80%), but AS is not always associated with NLD.

Individuals with AS present with virtually all characteristics of NLD (Rourke, 2000).

Most children with AS have a NLD profile, but not all children with NLD have AS.

Both NLD & AS have problems with social communication, and reciprocity, nonverbal communication, pragmatic language, and visual-spatial skills (Gunter, Ghaziuddin, & Ellis, 2002; Voeller, 1995).

Stronger verbal compared to performance skills on cognitive testing were found for children with AS or NLD (Gillberg & Billstedt, 2000; Klin et al., 1995).
NLD & AS

- Pennington (1991) – Rourke took 2 different groups & conflated them
  - 1 group problems with spatial cognition
  - 1 group problem with social emotional
  - only first group should be called NLD
  - Second group should be on autistic spectrum
- Pennington (2009) reviewed NLD again
  - “in sum, we do not have sufficient evidence to accept it as a valid learning disorder apart from either autism spectrum disorder (ASD), mathematics disorder (MD) or developmental coordination disorder (DCD) all of which are covered in the DSM-IV-TR (ASD in the category of PDDs)” (p. 248).
NLD vs. AS

- Palumbo (2001) hypothesized that AS & NLD could be 2 different subtypes of the same syndrome.

- Children with Asperger’s Syndrome have more profound social difficulties than children with developmental NLD (Thompson 1997).

- NLD & AS could be on a continuum of severity ranging from NLD to Asperger’s and finally autism (Roman, 1998).
NLD & AS (Klin, Sparrow, Cicchetti, & Rourke, 1995).

- NLD & AD profiles share many characteristics
- Strong verbal skills
- Poor visual spatial ability
- Problems with executive functioning.
- NLD is evident in many with AS, but not in HFA
- The NLD profile is “an adequate model of neuropsychological assets and deficits encountered in individuals with AS (p. 1133)
- AS is one of several pathways including hydrocephalus, acquired brain injury and Williams Syndrome to the manifestation of NLD
NLD vs. AS

- Children with Asperger’s Syndrome typically have “restricted interests,” where they become obsessed with unusual interests (Stein, Klin, & Miller 2004).
- The presence of stereotyped and restricted patterns of interest and the need to adhere to routines present in children with AS but not NLD (Semrud-Clikeman, 2007).
NLD vs. AS

- Semrud-Clikeman, Walkowiak, Wilkinson, & Minne, 2010
- Compared 24 NLD, 52 AS, 27 ADHD 9- to 15-year-old children
- Found no significant differences in social perception between the NLD & AS groups (both lower than controls)
- Differences between AS & NLD groups on calculations
- Differences on the Autism Diagnostic Interview–Revised, particularly in the area of stereotyped and restricted behaviors.
- No significant difference for AS & NLD on Rey-Ostereith Complex Figure test. Both lower than norms
NLD, AS & ADHD

- Semrud-Clikeman, Walkowiak, Wilkinson, & Christopher, 2010
- Compared NLD, AS, & ADHD-C & ADHD – PI
NLD & AS – No significant differences

- Semi-structured interview (SIDAC)
- Behavioral Measures – BASC-2 Hyperactivity & Attention
- Social Skills – (SSRS)
- Math calculations
- Mathematics reasoning
- Reading recognition
- Fluid Reasoning (WJCOG-III) (Concept formation & Analysis & Synthesis)
- Motor Skills (Grooved Pegboard)
NLD & AS

- Visual-Spatial – NLD group significantly lower on VMI than AS (Rey-Osterreith)
- Judgment of Line Orientation test (JLO) – NLD lower than AS
- AS screener – AS group scored higher
- WASI –
- PIQ – NLD lower than AS
- VIQ - no significant difference among groups
- NLD group showing the largest split between VIQ & PIQ
74% of NLDs had a V > P split of more than 15 SS points & 40% had a split of 25 SS points or higher (15-55)

63% of AS group had BIQ & PIQs within 15pts.

But 37% of AS showed VIQ > PIQ in the AS group.

While children with NLD are more likely to show a VIQ > PIQ split; there is a sizable minority of children who do not.

Finding is not sufficient to provide a distinction between NLD & AS

also found in Pelletier. Ahmad. & Rourke. 2001)
NLD vs. AS

NLD
- diagnosed from neuropsychological perspective
- Psychological test scores
- learning disability, discussion of how children learn

Asperger’s
- diagnosed from psychiatric perspective
- observations
- developmental disorder
# Prevalence

## NLD
- .1 – 1%
- 10% (Ozols & Rourke, 1991)
- 25% (Bender & Golden, 1990)
- 29% (Van der Vluat, 1989)
- Higher or equal rates in females
- 1:1
- Recognized in 4<sup>th</sup> & 5<sup>th</sup> grades

## AS
- 1-10 in 10,000
- Higher rates in Males
- Recognized around 3-4 yrs. of age
### Neuropsychological

#### NLD
- VIQ > PIQ
- Weak visuospatial skills,
- Visual motor integration
- Right left confusion
- Visual memory deficits
- Attentional problems
- Hyperactivity as child)
- May have Theory of Mind deficits

#### AS
- VIQ > PIQ ($x = 23.8$ pts.)
  Ghaziuddin & Mountain-Kimchi (2004) found that only 82% of their AS group had VIQ > PIQ
- Weak visuospatial skills
- Visual motor integration
- Visual-spatial perception
- Nonverbal concept formation
- Visual memory deficits
- Attentional problems
- More likely to have Theory of Mind deficits
## Visual Motor

### NLD
- Psychomotor coordination problems
- Clumsy, poor at sports
- Delayed Gross Motor Milestones
- Fine Motor difficulties, drawing, handwriting (Frankenberger, 2005)
- Avoidance of graphomotor tasks
- Difficulties dressing, problems with fasteners
- Poor organizational skills
- May not learn from diagrams, need verbal explanations (Fast, 2004)

### AS
- Psychomotor coordination problems
- Clumsy
- Fine and Gross Motor delays (Tantam, 1988; Gillberg, 1990)
- Stereotypic motor mannerisms (Mamen, 2007)
- Do not have visual issues & may be visual learners (Fast, 2004)
# Language

## NLD
- Generally appropriate language skills
- Verbal > performance
- Pragmatic language deficits
- Poor prosody
- Verbose, verbal with little content
- Lack of appreciation of incongruities and humor
- Poor nonverbal communication
- Difficulty understanding and using facial expressions, gestures

## AS
- Generally appropriate language skills
- More verbose than NLD
- Verbal > Performance
- Pragmatic language deficits
- May have early language delays
- Poor prosody
- Monologues
- Verbose, large vocabulary
- Pedantic conversation, concrete speech
- Literal interpretation
- Poor nonverbal communication
- Difficulty understanding and using facial expressions, gestures, vocal intonation
- Repetitive speech patterns
Academics

**NLD**
- Significant delay in arithmetic skills (Rourke, 1989; 1995; Rourke & Conway, 1997)
- Average or above word reading
- Delays in reading comprehension
- Difficulties in written expression

**AS**
- Inconsistent reports of arithmetic performance (some show good math skills (Kuipers, 1962)
- Reading relatively intact, may be voracious readers
## Social

<table>
<thead>
<tr>
<th>NLD</th>
<th>AS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social delays</td>
<td>Social delays</td>
</tr>
<tr>
<td>Problems developing friendships</td>
<td>Problems developing friendships</td>
</tr>
<tr>
<td>At risk for peer rejection (Little, 2001)</td>
<td>At risk for peer rejection (Little, 2001)</td>
</tr>
<tr>
<td>Poor social perception, judgment &amp; interaction</td>
<td>Poor social perception, judgment and interaction</td>
</tr>
<tr>
<td>Problems in empathy</td>
<td>Problems in empathy</td>
</tr>
<tr>
<td>Automated</td>
<td>Lack of spontaneous sharing of enjoyment</td>
</tr>
</tbody>
</table>

- Poor social perception, judgment and interaction
- Problems in empathy
- Lack of spontaneous sharing of enjoyment
- Failure to develop friendships
- Social problems more severe
- Poor social perception, judgment, and interaction
- Problems in empathy
- Lack of spontaneous sharing of enjoyment
- Failure to develop friendships
- Social problems more severe

(Little, 2001)
Social -- NLD Vs. AS

- Children with NLD are easier to make a social connection with (Palumbo, 1991)
- Withdrawal in NLD is reactive
  Primary in Asperger’s
- NLD children crave social contact more than do children with Asperger’s
- Children with NLD may ineptly reach out to other people
Emotional

NLD

- MMPI - NLD group had no scores above 70 on clinical scales, (Waldo et al., 1999)
- High risk for suicide (Bigler, 1989; Fletcher, 1989; Rourke, Young, & Lennars, 1989)
- Have normal emotions, but can’t express them or recognizing them in others (Fast, 2004)

AS

- Anxiety (esp. in adolescence) (Klin, 2004)
- Potential of mood disorders is high (Ellis, Ellis, Fraser, & Deb, 1994; Gujikawa, Kobayashi, Koga, & Murata, 1987)
- MMPI -2 study with adults elevations on L and Depression, social introversion, social discomfort (Ozonoff, Garcia, Clark & Lainhart, 2005)
- Have flatter affects (Fast, 2004)
Repetitive Behaviors

Inability to adapt to change/novelty
Preoccupation with stereotyped and established routines
Ritualistic
Focus on special interest Amass factual information

NLD
AS
21 students with AS (x= 16.11 yrs.) & 19 persons with HFA (X = 15.36 yrs.) were compared
18 of 21 with AS presented with NLD profile

found that only 51% of AS subjects met criteria for NLD

NLD group did more poorly on PIQ than AS group using the WASI
Model

AS
Preoccupations
Special Interests
Facts
Ritualistic

Social
Communication
Nonverbal
Communication
Psychomotor
Emotional
Visual Motor
Executive
Functioning
Theory of Mind
Attention
Novelty
Problems

NLD
Neuropsychological
Difficulties
Math
Reading
Comprehension
Written Expression &
Organizational
Problems
Assessment

- Cognitive Assessment
- Thinking & reasoning skills must be at least average
- Although IQ does not have to be average (e.g., average WJIII Thinking ability or Cognitive Efficiency)
- There must be an impairment in at least one psychological process related to learning
Neuropsychological Assessment

- Impairment in at least one psychological process related to learning
- Visual/motor/spatial/tactile memory and attention
- Visual motor or fine motor processing
- Speed
- Pragmatic language
- Executive functioning (e.g., planning, monitoring, selective focusing, organization)
Possible Assessment Measures

- WISC-IV
- KABC-2 (Chow & Skuy, 1999) found that NLD children showed significantly higher successive than simultaneous processing
- WASI
Possible Assessment Measures

- NEPSY (e.g., Design copying, Arrows)
- Delis-Kaplan Visual Motor Integration (Beery)
- Wisconsin Card Sort (Jing, Wang, Yang, & Chen, 2004)
- Category Test (Strang & Rourke, 1983)
- The Children’s Category Test (Boll, 1993)
  Ris et al. (2007) - good predictor of the NLD group (Ris et al., 2007)
Possible Assessment Instruments

- Rey-Osterreith Complex Figure (Osterreith, 1944)
- Grooved Pegboard (Klove, 1963).
- Finger Tapping Test (Reitan & Wolfson, 1985).
- Purdue Pegboard
- Judgment of Line Orientation (JLO) (Benton, Sivan, Hamsher, Varney, & Spreen, 2004)- (Semrud-Clikeman, yes, not Benton, Varney, & Hamsher, 1978)
- VMI (Beery et al., 2006).
Possible Assessment Instruments

- Children’s Auditory Verbal Learning Test – 2 (CAVLT-2)
- Children’s Memory Scale
Possible Assessment Instruments

- AS Screener (AS screener based on DSM-IV-TR Asperger syndrome criteria)
- ADI-R
- Asperger Syndrome Diagnostic Scale (ASDS)
- Autism Spectrum Rating Scales (ASRS)
- Social Skills Rating Scale (SSRS) (Gresham & Elliott, 1990)/SSIS
- CBCL
- Conners Parent/Teacher Rating Scales
- Behavior Rating Inventory of Executive Function (BRIEF)
- Children’s Depression Inventory
Possible Assessment Instruments

- WJ-Ach III (Woodcock et al., 2001b) Math calculations & Math reasoning (Forrest, 2004) didn’t find that poor mathematical reasoning predicted NLD
- WIAT-III
- Key Math
- Gray Oral Reading-4
Is NLD a Valid Diagnosis?

- Spreen (2011) NLD remains a hypothesis, but it should not be used in clinical practice unless it is supported by solid research findings.


Selected References

Hain, & Hale, J. B. (2010). "Nonverbal” learning disabilities or Asperger’s Syndrome? Clarification through cognitive hypothesis testing. (pp. 372-387). In N. Mather & L. Jaffe (Eds.) Comprehensive Evaluations: Case Reports for Psychologists, Diagnosticians. Hoboken, NJ.


Selected References


