Autism: A Neurodevelopmental Disorder

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Disclosures

• Financial relationships with industry within the last 12 months:
  - None

• Off label uses:
  - Methylphenidate as a treatment for hyperactivity in children with autism
Case

• A 24-month old boy whose last health maintenance visit was when he was 9 months old presents to your office with a 5 day history of URI symptoms and a 2 day history of ear tugging.
Case

• Before you enter the exam room, your medical assistant alerts you that he failed an Ages and Stages Questionnaire developmental screen completed by his mother in the waiting room
What Do You Do???

• **Hint:** CHILD DEVELOPMENT IS THE BASIC SCIENCE OF PEDIATRICS!
What Do You Do?

A. Reassure parents that there is a wide range of variability in normal child development

B. Have child return in one month when he is well to be re-screened to confirm findings from today

C. Perform a developmental evaluation to confirm parents’ concerns and make a developmental diagnosis

D. Refer child to local early intervention program
Pediatric Developmental Assessment Framework

• Chief complaint
  - Failed developmental screen

• Developmental history
  - Identify delay, dissociation, deviation
  - Identify pattern of developmental delay to guide etiologic workup and therapeutic recommendations

• Neurodevelopmental exam
  - Confirm developmental history
  - Make a developmental diagnosis
Case 3: Developmental History – Identify delay, dissociation, deviation and pattern of developmental delay

• **Motor:** Walked at 12 months; Began running at 18 months of age; Jumps and walks up and down stairs independently.

• **Nonverbal/visual-motor:** Uncovered hidden toys at 18 months; Intentional release at 18 months; Just began scribbling; Does not copy strokes; Recognizes letters of the alphabet.

• **Language:** Babbles consonant sounds, but not yet using a specific “Mama” or “Dada”; Recently developed multiword vocabulary by repeating words said to him; Does not wave “bye-bye”; Does not follow single step gestured commands
Case: Developmental Exam – Confirm developmental history and make diagnosis

• **CAT** (nonverbal visual problem solving) age = 18 months
  • CAT DQ = 18/24 = 75%

• **CLAMS** (language) age = 8 months
  • CLAMS DQ = 8/24 = 33%

• **Gross Motor**
  • Jumps up
  • Walks up and down stairs marking time
  • GM age = 24 months; DQ = 100%
Case: Developmental Diagnosis

• What is the most likely developmental diagnosis within the spectrum and continuum of developmental-behavioral disorders for this patient?
Case: Developmental Diagnosis

**Hint:** The more delayed, dissociated, and deviant the development, the more atypical the behavior is expected to be.
Case: Developmental Diagnosis

• What is the most likely developmental diagnosis within the spectrum and continuum of developmental-behavioral disorders for this patient?
  - A. Cerebral Palsy
  - B. Intellectual disability without autism
  - C. Autism without intellectual disability
  - D. Autism with intellectual disability
  - E. None of the above
In the DSM Era, Autism is a Checklist

• At least 6 of 12 items
  - 2 from column A (impairment in social interaction)
  - 1 from column B (impairment in communication)
  - 1 from column C (repetitive/stereotypic behaviors)
Goal

• After today, I hope you understand autism within the spectrum and continuum of neurodevelopmental disabilities, NOT AS A CHECKLIST
Objectives

• Identify children with autism spectrum disorders based on their presenting neurodevelopmental and behavioral profiles

• Recommend evidence-based behavioral, educational, therapeutic, and medical interventions for children with autism spectrum disorders

• Apply a cost-effective, yet comprehensive approach to laboratory workup of children with autism spectrum disorders
AAP Developmental Screening Recommendations

• Standardized screening at well child visits at:
  - 9-months
  - 18-months
  - 24- or 30-months

• Add autism specific screening at 18 months

• Standardized screening whenever developmental surveillance indicates a concern
AAP Algorithm for Autism Screening

- Recommends autism-specific screening at 18 months
  - Study of M-CHAT screening of 3793 children at 16-30 months*
  - Positive predictive value only 0.36

Child Neurology Society Autism Practice Parameter¹

• Recommends general developmental screening followed by autism-specific screening

• Study of PEDS followed by M-CHAT screening of 152 children at 18-30 months²

  • PEDS (+) for developmental/behavioral concern → 16% (+) on M-CHAT
  
  • PEDS (-) for developmental/behavioral concern → 14% (+) on M-CHAT

Developmental/Behavioral Screening Questionnaires/Checklists

• “Are better than nothing”

• “However, that is probably the only thing they are better than”

• “They have all the limitations inherent in instruments that rely on untrained, biased observers to make difficult judgments on complex behaviors”

If Not Checklists, Then What?

- Pediatric Neurodevelopmental Assessment
  - Developmental History
  - Neurodevelopmental Exam
    - Confirm developmental history
Developmental History

• Elicitation of temporal sequence of developmental milestone acquisition across developmental streams
  - Gross motor
  - Visual Perceptual/Fine Motor/Adaptive
  - Speech and Language
  - Social/Behavioral

• Identify delay, dissociation, deviation

• Identify pattern of developmental delay
Developmental Delay

• Significant lag in one or more streams of development

• Most commonly represented by a more global delay affecting all streams of development
Developmental Delay

DQ < 70 in any stream
DQ < 85 in more than 1 stream
Patterns of Developmental Delay Established Through Developmental History

- **Static**
  - Most common pattern
    - Genetic disorders, structural brain anomalies

- **Acute**
  - Best rehabilitative potential (OT/PT/Speech)
    - Traumatic brain injury, meningitis/encephalitis

- **Progressive**
  - Need for most aggressive lab workup
    - Inherited metabolic disorders
Developmental Dissociation

• Difference between developmental rates of two streams of development, with one stream significantly more delayed

  - Cognitive-Motor dissociation
    • CP

  - Language-Visual Problem Solving dissociation
    • Mild: Learning Disability
    • Severe: Communication disorder

  - IQ-Achievement dissociation
    • LD
Developmental Deviation

• Nonsequential unevenness in the achievement of milestones within one or more streams of development

- Motor deviation: Standing before sitting

- Visual-motor problem solving deviation: Recognizing all letters of alphabet before able to draw a circle

- Language deviation: Lack of specific “MaMa” and “DaDa” in setting of multi-word vocabulary
Neurodevelopmental Exam: Confirm Developmental History

• AAP: Developmental evaluation to be performed on all children who fail screening
  - Can be performed by primary care provider in partnership with Early Intervention evaluation team (ADOS, CARS, ADI)

• Child Neurology Society: Gold standard for making an autism spectrum disorder diagnosis is clinical judgment of experienced clinician*

• Medical component: Attempt to establish etiologic diagnosis

Developmental Diagnoses: Capute’s Triangle

• 3 primary “streams” of development


Key Neurodevelopmental Principles

• Spectrum of disability within each stream
  - Mild disabilities predominate over severe disabilities within each stream

• Continuum of disability across streams
  - More diffuse/global developmental-behavioral dysfunction predominates over more isolated/focal dysfunction (co-morbidities are the rule rather than the exception)

• Delay, dissociation, and deviation reflect atypical CNS processing
  - The more delayed, dissociated, and deviated the development, the more atypical the behavior
Spectrum of Motor Disability

**Mild** → → → → → → → → **Severe**

- **Gross Motor**
  - DCD
  - Dyspraxia
  - Clumsy Child

- **Fine Motor**
  - Dysgraphia

- **Oral Motor**
  - Speech articulation disorder

- Cerebral Palsy
  - Dysarthria
  - Dysphagia
Spectrum of Global Cognitive Disability

Mild → Borderline → Intellectual Disability

Slow Learning IQ 80-90 → Borderline IQ 70-79 → Intellectual Disability IQ < 70

Severe
Spectrum of Dissociated/Deviated Language Development

**Mild** → **→** → **→** → **→** → **→** → **→** → **→** → **→** → **Severe**

*Increasing dissociation/deviation from Mild to Severe*

| Preschool | Developmental Language Disorder | Developmental Dysphasia | Specific Language Impairment |

| School Age | Dyslexia | Phonologic Processing Disorder |

| | LLD (VIQ<NVIQ) | Social Communication Disorder |

| | Social Communication Disorder |
Spectrum of Dissociated/Deviated Nonverbal Disorders

**Mild** → → → → → → → → → → → → → → → → → **Severe**

*Increasing dissociation/deviation from Mild to Severe*

Orthographic processing disorder → NVLD (VIQ>NVIQ) → Social Communication Disorder
Spectrum of Neurobehavioral Disability

Normal Variation → Mild Disability → Severe Disability

Difficult Temperament → Inattention → Atypical Attention

Behavior Problem → Impulsivity → Limited Eye Contact

Problem → Hyperactivity → Perseveration

Spectrum of Neurobehavioral Disability → Repetitive Play/Rituals → Sensory hypo/hyper

Responsiveness → Disinhibition → Sensory hypo/hyper

Responsiveness → Stereotypic Motor Activity

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Continuum of Developmental Disabilities: Cognitive and Behavioral Streams

MBD

Mild

LD

ADHD

PDD

Severe

Social Communication Disorder

Atypical Attention Perseveration

Repetitive/Rituals

Motor Stereotypies

Cognitive

Behavioral
Continuum of Developmental Disabilities: Cognitive and Behavioral Streams

- Mild
- Severe

MBD

Cognitive

Language-based LD

Behavioral

ADHD

Autism

Language-based Social Communication Disorder

Atypical Attention Perseveration
Repetitive/Rituals
Motor Stereotypies
Continuum of Developmental Disabilities: Cognitive and Behavioral Streams

Mild

MBD

NVLD

ADHD

Severe

Asperger

Nonverbal-based Social Communication Disorder

Atypical Attention Perseveration
Repetitive/Rituals
Motor Stereotypies

Cognitive

Behavioral
Autism Spectrum Disorders

- Autism
  - Asperger
  - Nonverbal-based Social Communication Disorder
  - Developmental Language Disorder/SLI

SCD (Language-based)

Social Communication (Pragmatic Language Use)

- Ritualistic, Stereotypic, Repetitive Behavior
- Stereotyped Behavior/Restricted Interests

Early Intervention


• [www.nap.edu](http://www.nap.edu) - Search “autism”
Early Intervention

• Refer to EI as soon as a diagnosis of autism is suspected

• Services should include intensive direct and consultative language, behavioral, and social skills interventions

• Provide a minimum of 20 to 25 hours per week
  - Individualized
  - Highly structured
  - Systematically planned
  - Developmentally appropriate
Early Intervention

• Priorities of focus:
  - Functional spontaneous communication
  - Social instruction delivered throughout the day in various settings (typical peers, home)
  - Cognitive development
  - Play skills
  - Proactive approaches to atypical and challenging behaviors.

• Generalization and maintenance of newly learned skills in natural environments should be considered as important as the acquisition of new skills.
Educational/Habilitative Methods*

• Applied Behavioral Analysis (ABA)
  - Strongest empirical support in the published, peer-reviewed research literature
  - Method to teach and maintain new skills and desirable behaviors
  - Primary treatment for problematic maladaptive behaviors (self-injury; aggression)

Educational/Habilitative Methods

• Structured teaching
  - TEACCH
  - Focus on improving skills and modifying environment to accommodate deficits
  - Emphasis on visual schedules, physical/task organization

• Developmental models
  - Focus on remediation of fundamental deficits in pivotal developmental skills
Educational/Habilitative Methods

• Social Skills Instruction (e.g. “Social Stories”)
  - Address initiating social interactions, responding to social overtures, minimizing stereotyped behavior

• Speech and Language Therapy
  - Variety of methods to promote verbal and nonverbal communication
  - PECS
Educational/Habilitative Methods

- Occupational Therapy
  - Address associated fine motor deficits

- Physical Therapy
  - Address associated gross motor deficits
Response to Intervention

• Outcomes extremely variable

• Some children make substantial progress (~10% no longer ASD); others show very slow gains

• Predictors of improved outcomes
  - Higher IQ and receptive language scores
  - Better imitation skills
  - PDD-NOS vs autism diagnosis
  - Better educational, vocational, behavioral, and social support provided
Medical Workup

• Consider in all children with autism spectrum disorders
  - Audiology assessment
  - Whole genome microarray comparative genomic hybridization (aCGH)
  - Fragile X DNA analysis
Medical Workup

• Consider with specific indications
  - Neurocutaneous findings: Tuberous Sclerosis, NF1 (MRI)
  - Cleft palate, toe syndactyly: SLO (↑7-dehydrocholesterol)
  - Marked macrocephaly, skin hamartomas: PTEN hamartoma syndromes
  - Deceleration of head growth, hand wringing: Rett (MECP2)
  - Regression, decompensation with mild illness, hypotonia, ataxia, nystagmus, epilepsy, severe/profound intellectual disability: Metabolic studies
  - Concern about seizures (20-35%): EEG
## Medical Conditions That May Exacerbate Maladaptive Behaviors*

<table>
<thead>
<tr>
<th>Conditions</th>
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</thead>
<tbody>
<tr>
<td>• GI: constipation, esophagitis</td>
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<tr>
<td>• Sleep disorders</td>
</tr>
<tr>
<td>• Anxiety/depression</td>
</tr>
<tr>
<td>• Malnutrition/side effects of dietary supplements</td>
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<tr>
<td>• Allergies: atopic dermatitis, conjunctivitis</td>
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<tr>
<td>• Headaches</td>
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<tr>
<td>• Corneal abrasion</td>
</tr>
<tr>
<td>• Dental: abscess, caries, impaction, trauma</td>
</tr>
<tr>
<td>• ID: OM, otitis externa, pharyngitis</td>
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<tr>
<td>• Sprains, occult fractures</td>
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Psychopharmacology

• Risperidone (Risperdal)/Aripiprazole (Abilify)
  - Only meds with FDA-approved labeling specific to autism (Risperdal > 5 yr and Abilify > 6 years)
  - For treatment of irritability, including aggressive behavior, deliberate self injury, and temper tantrums

• Hyperactivity/impulsivity*
  - Methylphenidate

Psychopharmacology

• Psychotropic meds typically not as effective and more side effects than when treating same target behaviors in children without ASD’s

• “Start low, go slow”
Unproven Therapies

- Dietary/vitamin supplements
- Restrictive diets
- Chelating agents
- Facilitated Communication
- Auditory Integration Therapy
- Music Therapy
- Sensory Integration Therapy
- Antifungals
- Antivirals
- Antibiotics
- IVIG
- Craniosacral therapy
- Hyperbaric oxygen
- Interactive metronome
- Transcranial magnetic stimulation
- Secretin
Conclusions

• Child development is the basic science of pediatrics – it should be evaluated, not simply screened

• Developmental delay, dissociation, and deviation reflect atypical underlying CNS processing

• The more delayed, dissociated, and deviated the development, the more atypical the behavior should be expected to be
Autism is NOT a Checklist

• Autism sits at the severe end of a dissociated/deviated spectrum of language delay in continuum with atypical visually perseverative and stereotypic behaviors

• Asperger syndrome sits at the severe end of a dissociated/deviated spectrum of nonverbal delay in continuum with atypical verbally perseverative and stereotypic behaviors
References


