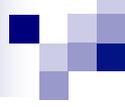
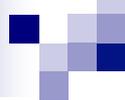


Neuropsychological Assessment of Developmental Disorders

**Amy K. Morgan, Ph.D., APBB
Psychology Assessment Center
Massachusetts General Hospital
Harvard Medical School
Child Neurology Course
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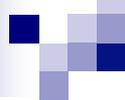
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- What is Pediatric Neuropsychology
 - Considerations when evaluating effects of CNS injury
 - When to refer patients for evaluation
 - Intelligence
 - Regulation / Attention / Executive Functioning
 - Neuropsychology of Epilepsy, Stroke, Prematurity



What is Pediatric Neuropsychology?

“The study of brain-behavior relationships ***within the dynamic context*** of a developing brain” (Anderson, Northam, Hendy & Wrennel 2001)

- Children are not “little adults”
- Lesion location is not always associated with a specific kind of deficit – focal disorders are rare
- The child is developing thus the functional relationship between location and behavior is still developing



Three primary considerations when evaluating effects of CNS injury in Children

1. Age at time of injury

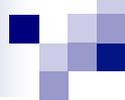
- Prenatal – disruption of structure
- Early childhood – disruption often more diffuse
- Later childhood – risk may be lower
- At younger ages brain is more ‘plastic’ and so capable of transfer of function, but
 - increased vulnerability of skill development
 - ‘crowding’

...three primary considerations

2. Time since injury

■ Acute versus chronic effects

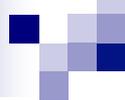
- Head injury associated with increased cerebral atrophy over time
- Radiation associated with white matter pathology (e.g. cerebral calcifications), which increases over time
- Posterior to anterior brain maturation – executive functions last to reach maturity so child's inability to effectively *use skills* may become more apparent over time
- Regression associated with some disorders
- Effect of limitations in skill and psychosocial development on child's sense of competency



...three primary considerations

3. Context

- Cognitive status at time of insult
- Physical health
- Family resources and support
- Quality of peer relationships
- Educational interventions



Why Refer a Child for Assessment?

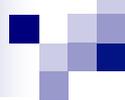
To establish the functional consequences of any acquired or developmental neurological disorder

- Epilepsy
- Traumatic Head Injury
- Brain Tumor
- Stroke
- Prematurity
- Genetic Disorders (e.g. Turner's, NF)
- Learning Disability
- Autism
- Toxin Exposure
- Neuropsychiatric disorder
 - e.g. depression, anxiety

...why refer for assessment

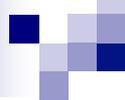
“..children with chronic physical illness are at risk for difficulties in social adjustment and peer relationships as well as school adjustment and performance..... children with CNS involvement are at particular risk”
(Thompson & Gustafson, 1996)

- Even seemingly small cognitive effects can cause significant perturbation in a child's development
- The sooner and more effectively the difficulties are addressed, the better the child's outcome
- Coping style and self concept are central to a child's psychological adjustment



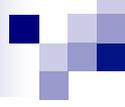
Why do neuropsychologists make referrals to neurologists?

- Rule in or out a medical or neurological dysfunction underlying child's cognitive / behavioral difficulties
- Symptoms of concern may include
 - Slowed processing
 - Lateralized sensorimotor dysfunction
 - Marked lapses in attention / consciousness
 - Unusual levels of behavioral dysregulation
 - Dymorphic features
 - Regression



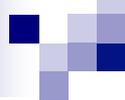
Goals of an Assessment

- Determine integrity of the central nervous system
 - Are cognitive development and learning progressing at a normal rate?
 - If not, are deficits due to brain dysfunction, an unknown developmental disorder, unidentified learning or psychiatric disorder, etc?
 - What might be expected later in development based on current 'subtle' cognitive difficulties



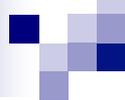
...goals of assessment

- Optimize the child's development
- Provide appropriate recommendations to address child's individual needs
 - Knowing child's strengths and weaknesses is important to accurately characterize the 'whole' child
- Monitor child's functioning over time and response to treatment



Specific Areas of Functioning Assessed

- General Intelligence
- Attention
- Executive Functioning/Problem Solving
- Language
- Visual-Spatial / Visual-Motor
- Learning and Memory
- Adaptive Abilities
- Emotional and Behavioral
- Academic Achievement

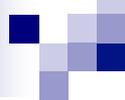


Why intelligence testing?

- Provides essential information regarding child's overall level of ability
 - Do deficits in test performance reflect a specific cognitive deficit or are impairments indicative of a more global impairment in cognitive functioning?
- Provides important information in formulating hypotheses regarding the child's areas of strength and weakness

Limitations to Assessment of Intelligence

- Intelligence is a broad concept, based largely on multi-determined activities
- In interpreting child's performance on any one subtest of an IQ test, must recognize that there are multiple factors that can possibly contribute to child's performance
- Implications of split between VIQ and PIQ
 - Not pathognomonic of brain injury; approximately 20% of normal children display such a split
- Insensitivity to subtle neuropsychological deficits
 - IQ often falls within the average range for children with CNS disorders



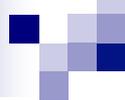
Regulation, Attention and Executive Functions

- Self-Regulation: a child's ability to gain control of bodily functions, manage powerful emotions, maintain focus and attention*
 - Attention: selectively concentrating on one aspect of one's environment or thought processes while ignoring other things
 - Executive Functions
- *From Neurons to Neighborhoods: The Science of Early Childhood Development*, Shonkoff and Phillips (2000)



...executive functions

- Executive Function's include the ability to:
 - anticipate consequences
 - generate novel solutions
 - initiate appropriate actions or responses to situations
 - monitor ongoing success or failure of one's behavior
 - and modify one's performance based on unexpected changes



CNS Disorders during development are frequently associated with regulation / attention / executive functioning difficulties due to disruptions as:

- Growth occurs: connections are made and efficiency improves
- Pruning: connections that are not used are eliminated
- As frontal systems function more efficiently fewer cells or networks are recruited to perform and so not as much 'brain energy' is required
- Often children can have well developed cognitive skills but **may be unable to effectively organize and use the skills** 'on line' or as they are working.

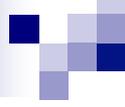
Example: Pediatric Epilepsy



....pediatric epilepsy

The most common neurological disorder of childhood

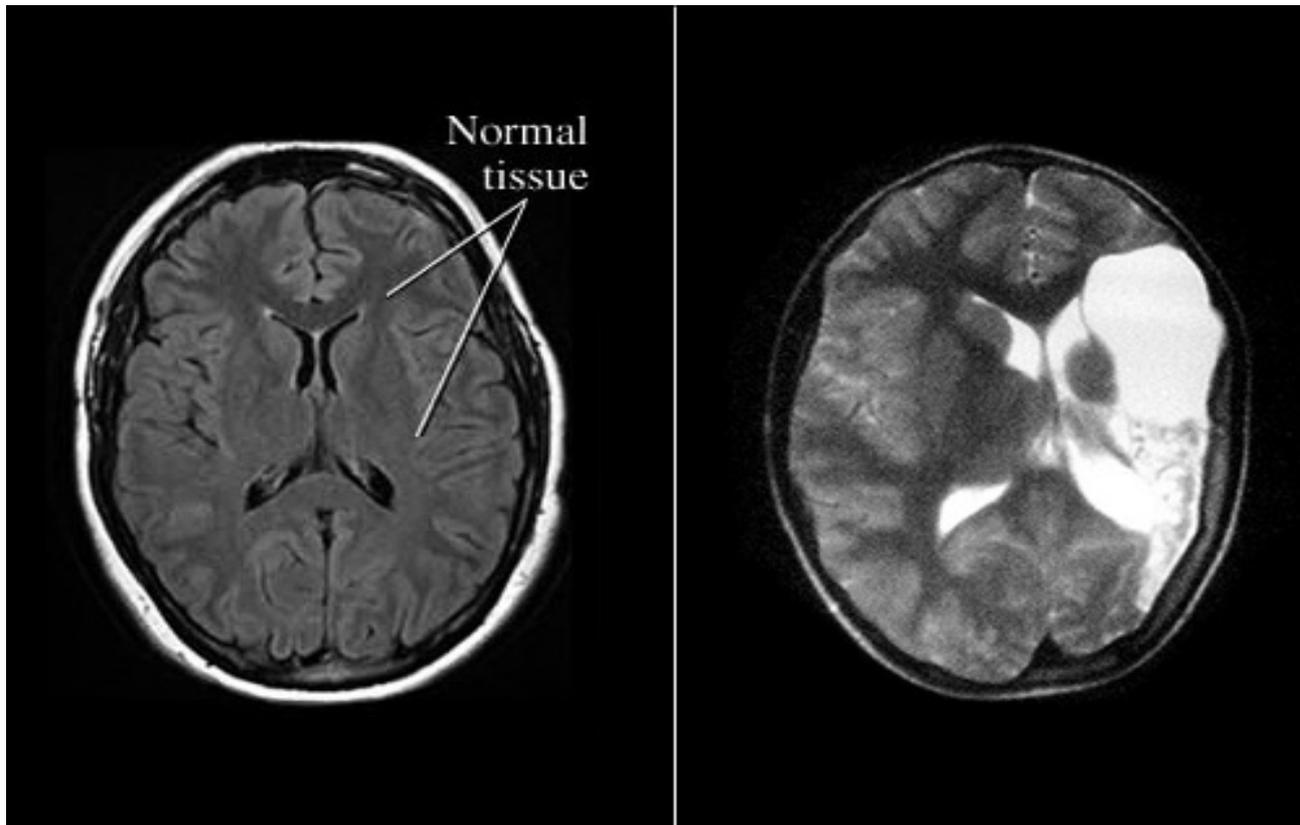
- A broad range - e.g. approx 85% of children w/idiopathic origin are 'normal' although still at risk for cognitive, psychological, social difficulties
- Epilepsy can affect virtually all areas of cognitive functioning and often based on age of onset, etiology, frequency and severity of seizures, treatment effects
 - Attention, executive function, language processing very commonly affected
 - The child has lost the sense of predictability and control important for development.



...pediatric epilepsy

- Abnormal EEG (subclinical discharges) may more dramatically affect learning
 - **Transient Cognitive Impairment**
 - Momentary disruption of adaptive brain functioning
 - **As a result:**
 - Reaction times may be longer
 - Working memory may be disrupted
 - Reading is affected in those with left-sided discharges
 - Poor visual spatial functioning associated with right sided discharges

Example: Pediatric Stroke



.... pediatric stroke

- Approximately 40% of affected children have some degree of neuropsychological deficit
- Language difficulties often do not correlate with lesion site – re-organization of language functions resulting in either left, right or bilateral representation of language
- Even with ‘preserved’ language, difficulties with ‘higher order’ language skills often emerge later including morphology, syntax, detailed information
- Behavioral problems in childhood versus neonatal stroke evident in hyperactivity, anxiety, irritability.
- ‘Snowball’ effect: subtle difficulties may go unnoticed but may then develop into significant problems as small difficulties interfere with mastery of successive cognitive abilities.

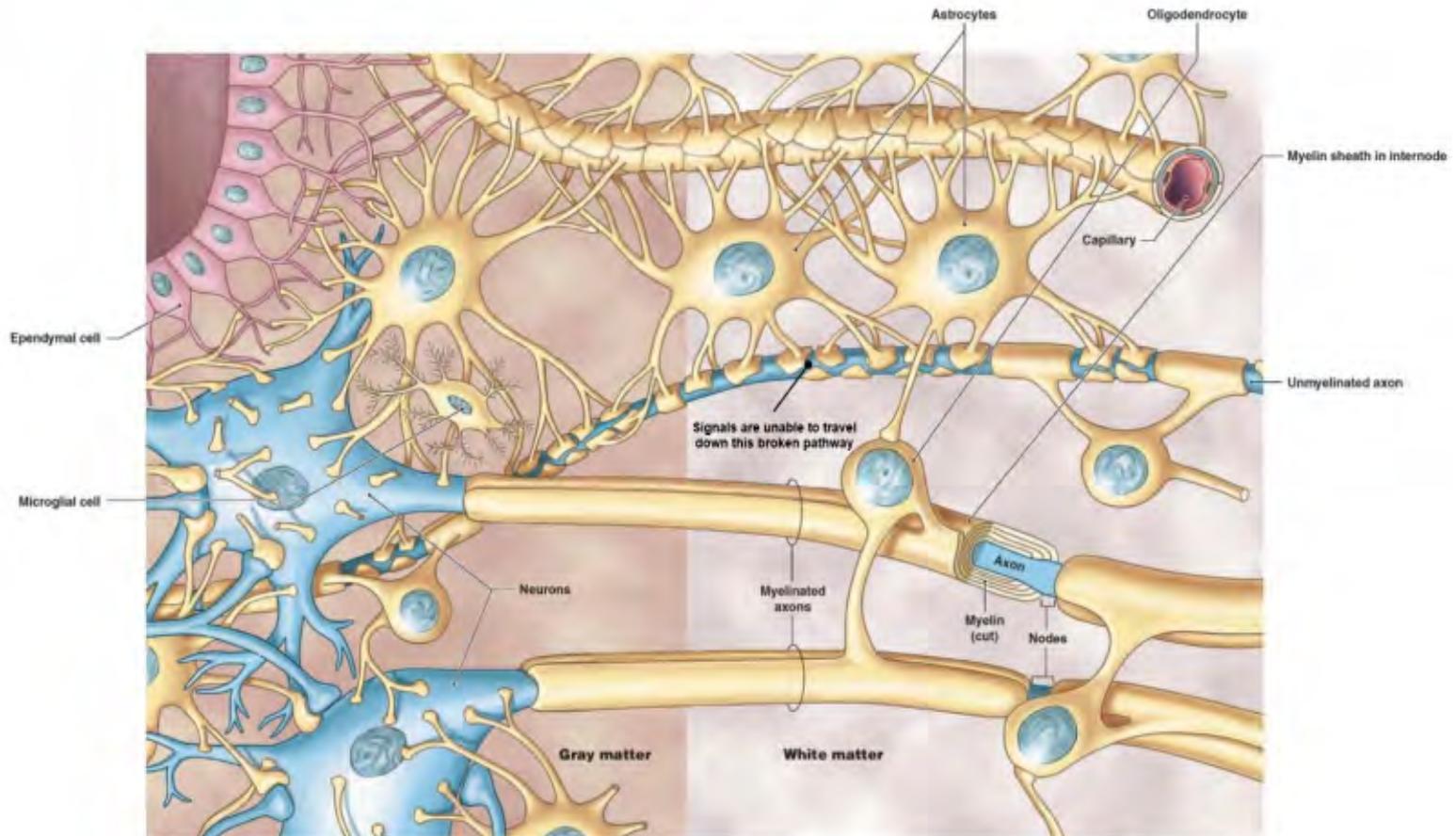
Example: Prematurity



....prematurity

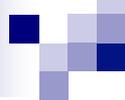
- Rapid brain growth occurs late in fetal development
- Disruption can cause neuronal cell death (meta-analysis in 2002):
 - Children at significant risk for reduced cognitive skills
 - Directly proportional to GA and BW
- Volume losses in 8yo children born prematurely
 - Associated with lowered cognitive scores and behavioral difficulties (ADHD)
- Differences in Threshold for arousal
- So less able to direct attention to optimize learning and behavior
- *However: at least 1/3 of very premature/low birth weight children function within normal limits*

Leukodystrophies



...leukodystrophies

- Weaknesses in attention, executive functions and visual spatial skills are among first cognitive symptoms associated with leukodystrophies.
- Apraxia (problems planning the movement of muscles used for speech)
- Visual and Auditory functioning / Sensory dysfunction
- Motor Skills
- Quality of Life
 - Peer relationships
 - Self care and ability to manage environment
 - Confidence / Self concept
- Behavioral
 - Issues related to ADHD
 - Issues related to Inability to make sense of and negotiate the environment



Conclusion: Pediatric Neuropsychological Assessments

- Determine how a **neurological** or **neurodevelopmental** disorder manifests in the child's behavior/cognition.
- Identify **pattern of impairment** associated with child's neurological condition.
- Understand child's **cognitive strengths and weaknesses** in order to determine need and type of intervention appropriate
 - Currently and later in development
- Re-evaluate to **monitor progress** in response to treatment and time