Attention Deficit Hyperactivity Disorder in Neurofibromatosis

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Objectives

- Compare the rates of ADHD in neurofibromatosis type 1 to the general population
- Address potential reasons for ADHD to develop in neurofibromatosis
- Review ADHD symptoms and diagnosis
- Discuss treatment options for ADHD in neurofibromatosis

Prevalence of ADHD

- General population: 11% in children ages 5 to 17 years

  Reuben C, Elgaddal N. Attention-deficit/hyperactivity disorder in children ages 5–17 years: United States, 2020–2022. NCHS Data Brief, no 499. Hyattsville, MD: National Center for Health Statistics. 2024

- In neurofibromatosis type 1:
  - Up to 60% of individuals meet diagnostic criteria for ADHD
  - More likely to be diagnosed with either inattentive-type or combined type

  Lidzba K, Granstrom S, Lindenau J, Mautner V. The adverse influence of attention deficit disorder with or without hyperactivity on cognition in neurofibromatosis type 1. Dev Med Child Neurol 2012; 54: 892–7.

Children's National

Why does ADHD happen in NF?

- Theories about development of ADHD
  - Changes in dopamine function seen in animal models of NF
  - Changes in neural network systems
    - Attention
    - Internal reflection
    - Future projection

Symptoms/features

- Difficulties with:
  - Sustained attention
  - Distractibility
  - Impulsivity
  - Hyperactivity

Executive function

- Processes that contribute to maintaining an appropriate problem-solving set to attain a future goal
  - Response inhibition
  - Vigilance
  - Set-shifting
  - Planning and organization

Diagnosing ADHD

- Symptoms should be seen in different environments
  - Typically at school and at home
- Interfere with the child's ability to get through the day successfully
  - Or with family function
- History, child interview, behavioral observations
- Rating scales
- Neuropsychological evaluation
  - Especially if concerns exist about co-occurring conditions

Associated conditions

- Learning disorders
- Developmental coordination disorder
- Anxiety
- Autism spectrum disorder
- Global developmental delay
- Intellectual disability
- Tics

Treatments

- Triad of approaches to support ADHD in individuals with NF
  - Educational
    - 504 Plan or Individualized Education Program (IEP)
  - Child behavior therapy
    - Parent-directed for younger children
    - Cognitive behavioral approach for older children
    - More intensive behavioral intervention for some individuals
      - Applied behavior analysis (ABA)
      - More significant needs, safety concerns
  - Medications

Stimulant medications

- Methylphenidate (brand = Ritalin) and associated compounds and formulations
- Amphetamine (brand = Adderall) and associated compounds and formulations
- High rate of effectiveness for ADHD symptoms in patients without co-occurring conditions

Stimulants (continued)

- Side effects
  - Decreased appetite
  - Stomach ache
  - Headache
  - Anxiety
  - Irritability

Stimulants (continued)

- Short-acting and extended release formulations
- Different formulation options:
  - Pills
  - Sprinkle capsules
  - Liquids
  - Patch
  - Delayed release (can be given the night before)

Nonstimulants

- Guanfacine and clonidine
  - Alpha-adrenergic agonists
  - Short-acting
  - Extended release (Intuniv and Kapvay respectively)
  - Side effects:
    - Sedation
    - Dizziness/lightheadedness
    - Constipation
    - Headache
    - Irritability

Nonstimulants (continued)

- Atomoxetine (Strattera) and Viloxazine (Qelbree)
  - Selective norepinephrine reuptake inhibitors (SNRI)
  - Side effects:
    - Sedation
    - Dizziness
    - Nausea, decreased appetite
    - Constipation
    - Headache
    - Irritability

Lifestyle factors

- Always support:
  - Good sleep hygiene, schedule, routines
  - Diet – varied, healthy choices
  - Physical activity – play, organized activities and sports

Thank You!