Hypothyroidism and the Auditory System: A Case Study

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Hypothyroidism
Thyroid Gland

• Location:
  • The thyroid gland is located just below the larynx at the front of the neck.

• Function:
  • The thyroid gland is part of the endocrine system and functions to control the speed of metabolism through the release of hormones.
  • Iodine essential to thyroid function.

(Garber, 2010)
Hypothyroidism

• A condition in which the thyroid does not produce enough thyroid hormone.

• Incidence:
  • Affects over 5 million Americans
  • 9-16% of people over the age of 60
  • Women are 8 times more than men
  • 0.135% of population under age 22
  • 0.113% of children ages 8-11

(Vanderpump, et al., 1995; Hunter, Greene, MacDonald, & Morris, 2000)
Incidence of Hypothyroidism

- Increased incidence in people with:
  
  1) Autoimmune diseases:
     
     • Addison’s disease
     
     • Pernicious anemia
  
  2) Insulin-dependent diabetes

(Garber, 2010)
Causes of Hypothyroidism

- Inflammation of the thyroid gland
- Treatment for hyperthyroidism
- Treatment of thyroid tumor
- Radiation treatment of head and neck tumors
- Insufficient iodine in diet
- Failure of the pituitary gland to produce TSH hormone
- Congenital defect of thyroid gland
- Medication for non-thyroid conditions
- Hashimoto's Thyroiditis

(Brent & Davies, 2011; Kim & Ladenson, 2011)
Symptoms of Hypothyroidism

• Common Symptoms:
  • Fatigue
  • Muscle stiffness, tenderness, weakness, aches
  • Joint stiffness, swelling, pain
  • Depression

• Later Developing Symptoms:
  • Hoarse vocal quality
  • Numb sensation in extremities
  • Poor memory
  • Difficulty thinking
  • Hearing Loss

(Brent & Davies, 2011; Kim & Ladenson, 2011)
Pediatric Acquired Hypothyroidism

• Signs:
  • Poor growth, resulting in short stature
  • Delayed development of permanent teeth
  • Delayed puberty

• Poor mental development
  • Lower IQ
  • Increased anxiety
  • Social withdrawal
  • Poor concentration

(Derksen-Lubsen & Verkerk, 1996; Rovet & Ehrlich, 1995)
Patient History

• 9 year old female

• Hispanic bilingual

• 4\textsuperscript{th} grader at a private school

• Diagnosis of (acquired) hypothyroidism

• Mother’s concerns:
  • Possible hearing loss
    • Often asks for repetition
    • Difficulty following directions
    • Difficulty understanding speech
  • Difficulty explaining things
Psycho-Educational Evaluation

- Extensive test battery completed prior to audiologic assessment which evaluated:
  - Cognition
  - Academic achievement
  - Reading and spelling
  - Phonological processing
  - Attention/executive functioning
Psycho-Educational Evaluation

• Findings:
  • Significant problems with visual perception processing and auditory processing
  • Concerns for phonemic awareness were also noted
  • Reduced ability of listening comprehension
Hypothyroidism and Hearing Loss

• Approximately 10-55% of all people with hypothyroidism have some hearing loss.

• Congenital or **acquired**

• Site of Lesion:
  • Cochlea
  • Central auditory pathway

(Musiek & Gollegly, 1985; Ng et al., 2004; Knipper, 2000; Santos, et al. 2010)
Khechinaschvili, Metreveli, Svanidze, Knothe, & Kevanishvili (2007) found the following:

- SNHL in 74% of cases.
- Absent TEOAEs in 52% of cases
- ABR abnormality in 30% of cases
- Acoustic Reflexes abnormality in 26% of cases.
Patient’s Audiologic Findings

<table>
<thead>
<tr>
<th>dB HL</th>
<th>WRS</th>
</tr>
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<tbody>
<tr>
<td>Right</td>
<td>40</td>
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<td>Left</td>
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| Middle Ear Pressure daPa | 15 | 5 |
| ECV CM³                  | 0.6 | 0.6 |
| Mobility                | Normal | Normal |
Recommendations

• ABR

• SLP evaluation and CAPD evaluation may be appropriate pending review of psycho-educational evaluation by the experts.

• Yearly audiologic evaluation to monitor hearing or if a change in hearing is suspected.
Patient’s ABR Results
Chandrasekhar, Kowsalya & Vijayalakshmi (2011) found the following in their study of hypothyroidism and ABR:

- Control group: Normal ABR
- Untreated acquired hypothyroidism:
  - Prolonged absolute latencies of waves III and V
  - Prolonged waves I-V interpeak latency
- Treated acquired hypothyroidism: Normal ABR
Speech-Language Evaluation

- The following tests were completed:

  1) Clinical Evaluation of Language Fundamentals Fourth Edition (CELF-4)

  2) Peabody Picture Vocabulary Tests, 4th Edition (PPVT-4)

  3) Expressive Vocabulary Test, Second Edition (EVT-2)

  4) Test for Reception of Grammar-Version 2 (TROG-2)

  5) The Token Test for Children, Second Edition (TTFC-2)

  6) Woodcock Reading Mastery Tests – Revised (WRMT-R)

  7) Test of Written Language, Fourth Edition (TOWL-4)
• Findings:
  
  • Demonstrated poor word recognition with generally intact (oral) language comprehension consistent with specific developmental dyslexia.
Specific Developmental Dyslexia

• Definition:

  • "a disorder of constitutional origin manifested by a difficulty in learning to read, write or spell, despite conventional instruction, adequate intelligence, and sociocultural opportunity“
  -World Federation of Neurology (1968).

• Recommendations:

  • Language therapy:
    • To develop stronger spelling abilities
  
  • To improve reading accuracy, expression, and comprehension abilities
Central Auditory Processing Disorder

- An auditory deficit of the central auditory system that is not the result of other higher-order cognitive, language or related disorder.

- Central auditory processes are responsible for localization/lateralization, auditory discrimination, auditory pattern recognition, temporal aspects of audition, and performance with competing or degraded acoustic signals.

(Bellis, 2003)
Tests Performed:
1) Low-Pass Filtered Speech Test (LPFS)
2) Time Compressed Speech Test (TCR)
3) Dichotic Digits Test (DD)
4) Dichotic Rhyme Test (DR)
5) Competing Sentences Test (CST)
6) Pitch Patterns Sequence Test (PPS)
CAPD Evaluation

• Findings:
  
  • Below normal scores on Low-Pass Filtered Speech, Time Compressed Speech Test, and Dichotic Rhyme Test

• Auditory Closure/Discrimination Deficit:
  
  • An inability to analyze and extract fine acoustic differences in the speech spectrum
CAPD Evaluation

• Deficits in this area may negatively impact:
  • Language development in areas of vocabulary, grammar and semantics
  • Reading decoding and comprehension
  • Spelling in everyday use but not on tests
  • Direction following
• Recommendations:
  • Reduce auditory distractions while maximizing other cues
  • Allow the patient to take exams in a separate quiet room with extended testing time
  • Limit oral exams as much as possible
Take Home Points

• Acquired hypothyroidism is often under- or misdiagnosed.

• Up to 50% of patients with acquired hypothyroidism can have an associated sensorineural hearing loss.
Take Home Points

- Children with hypothyroidism may have educational problems requiring specific targeted strategies and accommodations.

- Monitor these children audiologically as this disease has been found to have an effect on multiple sites of the auditory system.

- Interprofessional approach is essential to the assessment and management of pediatric patients with hypothyroidism.
Resources


Hunter, I., Greene, S., MacDonald, T., & Morris, A. (2000) Prevalence and aetiology of hypothyroidism in the young. Archives of Disease in Childhood, 83(3), 207-210. doi: 10.1136/adc.83.3.207


Resources
