Abnormal Growth in Pediatrics

Cydney Fenton, MD
Pediatric Endocrinology
Anchorage, AK
Pre-test Question

• All of the following are associated with short stature except:
  A. Optic Nerve Hypoplasia
  B. Silver-Russel Syndrome
  C. Fetal Alcohol Syndrome
  D. Turner Syndrome
  E. Klinefelter’s Syndrome
Pre-test Question

• True or False:
  • Unilateral Optic Nerve Hypoplasia is not associated with pituitary deficiencies.
  • A. True
  • B. False
Pre-test Question

• If the height is greater than the 3rd percentile or greater but the weight is less than the 3rd percentile – which of the following is the most appropriate subspecialty to refer to:
  • A. Pediatric Endocrinology
  • B. Pediatric Neurology
  • C. Pediatric Gastroenterology
  • D. Pediatric Pulmonology
  • E. Infectious Disease
Objectives

• Recognize the association between CNS abnormalities and pituitary deficiencies
• Become familiar with screening labs for endocrine causes of poor linear growth
• Be able to distinguish failure to thrive from short stature
Overview

- Normal linear growth is a sign of good health
- Abnormal growth may indicate underlying disease in the apparently normal child.
- Early detection and diagnosis of short stature can minimize the impact of the condition and allows for optimization of final adult height.
Height/Length

- Height results from initial length at birth and the rate of growth over time (growth velocity).
- Rate of growth varies with age
Assessment of short stature

• A single height measurement only identifies children whose height is outside the normal range

• Repeated height measurements over time allow for calculation of a growth velocity that can be used to define abnormal growth
General Facts about Short Stature

• FDA criteria for growth home treatment in idiopathic short stature is a predicted adult height of less than 4’ 11” for girls or 5’ 4” for boys
• Random growth hormone levels are NOT useful
• If the bone age shows fused growth plates $\geq$ 14 in girls or $\geq$ 16 in boys, there are no treatment options to increase height once growth plates are fused.
General Facts about Short Stature (cont.)

• Consider genetics referral if dysmorphic features are present
• Mid-parental target height (MPH) equation is different for boys and girls:
  • MPH (boys) = [(mom’s height + 5”) + (dad’s height)] / 2
  • MPH (girls) = [(mom’s height) + (dad’s height – 5”)] / 2
• MPH is the average genetic target, but normal children can be 2 to 4 inches shorter or taller than their target
General Facts about Short Stature (cont.)

- Key to evaluation of growth requires comparison of weight and length / height curves
- If weight is decreasing more than length / height, unlikely to be endocrine and a referral to gastroenterology may be the appropriate first referral
- Insulin like growth factor – 1 (IGF-1) levels will often be low in patients with low weight and may not be indicative of growth hormone deficiency
Normal Variant Short Stature

• Genetic (familial) short stature
  • Predicted adult height (PAH) (based on bone age and height at time of bone age) within 2 SD of MPH
  • Bone age is equal to chronological age
  • Growth velocity after age 2 is normal

• Constitutional Delay of Growth and Puberty (late bloomers)
  • Most common cause of short stature
  • PAH also within 2 SD of MPH
  • Bone age is less than chronological age
  • Growth velocity after age 2 is normal
  • Often there is a positive family history
Urgent Referrals

• Poor height velocity with severe headaches and/or blurry vision
  • May need urgent MIR of brain and pituitary to rule out tumor

• Hypoglycemia and poor growth
  • Reach out to your endocrinologist to see which labs to order
Urgent Referrals

• Poor height velocity with severe headaches and/or blurry vision
  • May need urgent MIR of brain and pituitary to rule out tumor

• Hypoglycemia and poor growth
  • Reach out to your endocrinologist to see which labs to order
Routine Referrals

• Growth Height less than 3% for age OR crossing percentiles on repeated measures
• Current Height greater than 3% but still concerns for growth
• Height less than 3% AND weight less than 3%
Pre-Referral Workup

• Thyroid function tests
  • Thyroid Stimulating Hormone (TSH)
  • Free Thyroxine (FT4)
• IGF-1 and Insulin Like Growth Factor Binding Protein 3 (IGF-BP3)
• Celiac screen
  • Serum immunoglobulin A and Anti-Tissue Transglutaminase IGA
• CBC and CMP
• Bone Age
Case 1 - Abygail

Dear Cydney,

Thank you for allowing me to share in Abygail's care. Abygail is 4 years old and was seen on 10/14/2019.

Diagnoses: 10/14/2019 Optic nerve hypoplasia, right eye
10/14/2019 Hyperopia of both eyes
10/14/2019 Monocular esotropia, right eye

Assessment and Plan: Abygail has small stature and has optic nerve hypoplasia in the right eye. I would appreciate your evaluation of her pituitary function prior to her getting an MRI of her pituitary. Thank you for seeing her.

Follow Up: (Choose follow up)

If you need further information, please do not hesitate to contact me personally.
October 2, 2018

Dear Providence Pediatric Endocrinology

I am referring to you Jed for evaluation and possible treatment options for his short stature (see attached growth curves) He has always been on lower end but currently has flatlined. Also has always been slow on weight gain even though he eats svrl x day and is an active guy. He has some allergies and occasional bronchospasm (tx albuterol pm) also being treated for tinea corporus (ketoconazole) He has no drug allergies.

Let me know if you require further information or have questions or concerns. Thanks for your help in this patient's care.
Dear Dr. Fenton:

I would like to refer the following patient to your service:

Donovan was last seen in my office on 10/01/2019 complaining of Delayed maturity. This chronological age is 14 yrs and 8 months old, and his skeletal maturation is 12 yrs and 6 months, SD is 13 months. So he is borderline by bone age. His Tanner stages I put at 2 for genitals and 2 for pubic hair. The hair is a mixed coarse black hair with a finer hair, on the pubis only and looks to have recently evolved to Tanner 2. His height has decreased in percentile from 23 to 5.39 in 30 months. It’s a bit confusing of a picture, and would ask you evaluate and treat, or, if you think, I can follow up with him in 2-3 months and recheck his Tanner staging. I also did not draw labs, I am happy to do so to deepen the picture. Let me know if you wish me to do that. I would draw the TSH reflex to Free T4, CBC, CMP.

<table>
<thead>
<tr>
<th>Date</th>
<th>Height inches</th>
<th>Percentile</th>
<th>Weight pounds</th>
<th>percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/15/14</td>
<td>51</td>
<td>21</td>
<td>75</td>
<td>78</td>
</tr>
<tr>
<td>2/17/15</td>
<td>53</td>
<td>22.5</td>
<td>78</td>
<td>69</td>
</tr>
<tr>
<td>7/29/15</td>
<td>54</td>
<td>26</td>
<td>83</td>
<td>70</td>
</tr>
<tr>
<td>8/29/16</td>
<td>56</td>
<td>27</td>
<td>90</td>
<td>62</td>
</tr>
<tr>
<td>1/24/17</td>
<td>56</td>
<td>17.5</td>
<td>91</td>
<td>55</td>
</tr>
<tr>
<td>7/20/17</td>
<td>58</td>
<td>23</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>3/19/18</td>
<td>59</td>
<td>15</td>
<td>95</td>
<td>35</td>
</tr>
<tr>
<td>10/1/19</td>
<td>61</td>
<td>5.39</td>
<td>111</td>
<td>33</td>
</tr>
</tbody>
</table>

Please contact me if you require any additional information.
Case #4 - Kendall

<table>
<thead>
<tr>
<th>Referral Order Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnosis</strong></td>
</tr>
<tr>
<td>- Short stature for age</td>
</tr>
<tr>
<td>ICD-10: R62.52: Short stature (child)</td>
</tr>
<tr>
<td><strong>Order Name</strong></td>
</tr>
<tr>
<td>Orders included: 1</td>
</tr>
<tr>
<td>Short stature for age</td>
</tr>
<tr>
<td>ICD-10: R62.52: Short stature (child)</td>
</tr>
<tr>
<td>- PEDIATRIC ENDOCRINOLOGY REFERRAL</td>
</tr>
<tr>
<td>Schedule Within: provider's discretion Note to Provider: 11 yr female with concern of Turner's syndrome, elevated bp, short stature</td>
</tr>
<tr>
<td><strong>Reason for Referral</strong>: short stature</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
</tr>
</tbody>
</table>
A child’s height and rate of growth are important indicators of overall health.

Recognizing patterns of growth that are abnormal can help identify treatable causes of short stature.

Children with poor weight gain but preserved linear growth rarely have endocrinopathies.
Questions
Pre-test Question

• All of the following are associated with short stature except:
  A. Optic Nerve Hypoplasia
  B. Silver-Russel Syndrome
  C. Fetal Alcohol Syndrome
  D. Turner Syndrome
  E. Klinefelter’s Syndrome
Pre-test Question

• True or False:
  • Unilateral Optic Nerve Hypoplasia is not associated with pituitary deficiencies.
Pre-test Question

• If the height is greater than the 3rd percentile or greater but the weight is less than the 3rd percentile – which of the following is the most appropriate subspecialty to refer to:
  • A. Pediatric Endocrinology
  • B. Pediatric Neurology
  • C. Pediatric Gastroenterology
  • D. Pediatric Pulmonology
  • E. Infectious Disease