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Practical Issues in Pediatric Nutrition

Mark Corkins, MD, C.N.S.P., S.P.R., F.A.A.P.
Associate Professor of Pediatrics
Indiana University School of Medicine
Objectives

1. Discuss common myths, controversies and misconceptions
2. Provide evidence to support optimal approaches to common issues
3. Prompt discussion and insights for future exploration, refinement and optimization of nutritional care of children

Topic Areas

- Estimating needs
- Failure to Thrive (FTT)
- Catch-up growth
- Feeding intolerance
- Post-gastrostomy feeding
- Lactose intolerance
- Gastroesophageal Reflux Disease (GERD)
- Use of adult formulas in pediatrics
Estimating Needs

What method is best?
Indirect calorimetry is the gold standard
- Requires patient be at rest
- Connection to device to collect respirations
- Not accurate in certain cases
  - Weight <5 kg
  - \( \text{FiO}_2 >60\% \)
  - After general anesthesia
  - Endotracheal leakage >10%
- Maybe in a cooperative teenager!
Estimating Needs

- Second best are the predictive equations
  - **Harris-Benedict**: inappropriate
  - **RDA/DRI**: inappropriate for critically ill
  - **Schofield**: appropriate, especially if < 3 yrs and FTT
  - **White**: PICU-specific equation, ASPEN recommends
  - **Caldwell-Kennedy**: best in vented critically ill
  - **FAO/WHO**: appropriate with activity/stress factors as needed

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Estimating Needs

- Note the title is estimating needs
- Clinical educated guess—formulas give a starting place
- In children requires monitoring and adjusting
  - Daily weights are crucial
  - Infants should gain 20-30 gms a day if adequate nutrition
Failure to Thrive

- Overused term – should not include child with weight loss
- “Failure” has bad connotation for parents
- Criteria for FTT:
  - Weight for age <3rd or 5th percentile on CDC growth charts
  - Weight for length/height plotting <3rd or 5th percentile
  - Decreased growth velocity where weight falls more than 2 major percentiles over 3-6 months
  - Decrease of >2 standard deviations on the growth chart over a 3-6 month period
Failure to Thrive

- Three mechanisms
  - Inadequate intake
  - Excessive losses
  - Increased calorie needs
- History and physical exam usually gives a sense of direction for further evaluation

Failure to Thrive: Inadequate intake

- Especially in infants assessed by history
  - Formula fed can be accurately recorded
  - Breast fed more of a mystery
- Social difficulties
- Biological causes
  - Reflux
  - Aspiration
  - Delayed emptying
- Poor appetite drive
Failure to Thrive:  
**Excessive losses**

- **Top**
  - Vomiting or reflux

- **Bottom**
  - Malabsorption
  - Usually manifests as diarrhea (but not always)

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Failure to Thrive:  
**Increased calorie needs**

- Most difficult to assess
- Usually ruled out other causes
- Documented adequate intake but poor weight gain
- Variety of disorders
  - Oncologic
  - Metabolic
  - Infectious
Catch-up Growth

- Children who fall behind in growth may be able to make up lost ground
- Ability to “catch up” depends on age at which first insult appears, as well as duration & severity of the problem
- Disease states often associated with poor growth can respond to intervention (neurological disorders, IBD, CF, etc)
Wasting versus Stunting

- Wasted have decreased weight but normal length—look thin
- Stunted have decreased weight and height
- Infants who are wasted but not stunted catch up faster
- Stunted have risk of lost genetic potential

Catch-up Growth

- Goals should be realistic:

<table>
<thead>
<tr>
<th>Age</th>
<th>Gm/day</th>
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<tbody>
<tr>
<td>newborn</td>
<td>30</td>
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<tr>
<td>3-6 mos</td>
<td>20</td>
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<tr>
<td>10-13 mos</td>
<td>10</td>
</tr>
<tr>
<td>21-24 mos</td>
<td>7</td>
</tr>
</tbody>
</table>

Feeding Intolerance

- Manifested in many ways
  - Diarrhea
  - Constipation
  - Vomiting

- Need to differentiate from food allergies
  - Allergies may be IgE or non-IgE mediated
  - Non-IgE mediated milk allergy may also react to soy protein
  - An intolerance is NOT a food allergy
Feeding Intolerance

- Diarrhea
  - One loose stool does not equal diarrhea
  - Need to consider frequency and/or volume
    - e.g. 3+ loose/liquid stools in a 24-hour period
  - Don’t blame the tube feeding, rarely the cause
    - Medications
    - Viruses (Rotavirus, gastroenteritis)
    - Altered micro flora: consider pre- and probiotics

Feeding Intolerance

- Diarrhea
  - Rehydration or diluted formulas rarely indicated
    - Increased manipulation, increased contamination
    - Enterocytes nourished from lumen
    - Limits caloric intake

- Feed through, feed through, feed through,....
Feeding Intolerance

- Constipation
  - Role of fluids
    - Young et al. - the fallacy of extra fluids
      Gastroenterology Nurs 1998; 21:156-161
    - Be certain needs are met, but more may not be better
  - Fiber
    - Insoluble: adds bulk, assists with peristalsis
    - Soluble: hydrates the stool/binds with water

Feeding Intolerance

- Constipation
  - Other methods
    - Prune juice/Fruit juices—osmotic effects limited efficacy
    - Glycerin suppositories—negative interaction for parent and child
    - Activity—Tough to make toddlers jog
    - Softeners (Miralax, Lactulose, etc)
  - Don’t reduce dairy intake
Formula Intolerance

Gastric Residuals

- No standards
- Adult study comparing small-bore feeding tube verses a large-bore sump tube found large residuals 2 to 3 times more often in large-bore tubes (JPEN 2005; 29:192-197)
- Do not correlate well with exam findings in adults
- No relationship shown between volume of enteral feeding and residuals

Gastric Residuals (continued)

- Does not correlate with volume in stomach or incidence of aspiration
- One small study in critically ill children found residuals were significant if the residual was more than 125% of the feeding four hours after given (Mayer et al. Intensive Care Med 2002; 28:336-340)
- Holding feeds can result in delays in reaching nutritional goal and contribute to poor weight gain and delayed growth
Feeding Intolerance

- Volume Sensitivity
  - Usually a result of motility issues
  - Increase formula calorie concentration
    - Nutrient dense formulations vs modulars
    - Less risk of contamination with high-calorie formulas
    - Nutrient dense formulas more reliable
      - Modular may be forgotten
      - Modulars may adhere to bag/tubing and not get into the patient

- Continuous drip or combination
  - Use the motility you have--drip if necessary
  - Usually start at continuous and then try to create time off of drip by increasing the rate
  - When possible try to do at night with daytime boluses
Feeding Intolerance

- Osmolality
  - Most children can tolerate hyperosmolar formulas
  - Small percentage of children may require isotonic formulas
    - Likely those that require specialized feedings anyway due to altered GI function
  - Dilution is not recommended
    - Risk of hyponatremia with infants
    - Longer time to reach goal feedings
    - Little evidence of benefit

Feeding Intolerance

- Cough or sputtering with feeds
- Recurrent pulmonary difficulties
- Aspiration Risk
  - Requires careful assessment, including a formal video feeding study, not just standard swallow
  - Take time to assess – some children aspirate with fatigue
  - If aspirate liquids often require gastrostomy
Post-Gastrostomy Feeding

- Dilute? Wait 24 hours?
- Why wait?
  - Surgical literature feeds post-op in first 24 hr
  - Pediatric studies on 6 hr
  - Complications will not change
Post-Gastrostomy

- Initiation and progression:
  - **Continuous**: start at 10-20 mL/hr; advance every 8-24 hrs, as tolerated, by 0.5-1 mL/kg/hr
  - **Bolus**: start at 5-10 mL/kg every 2-3 hrs; advance every 8-24 hrs as tolerated, by age:
    - 0-12 months: 10-30 mL/feed
    - 1-6 years: 30-45 mL/feed
    - >7 years: 60-90 mL/feed
  - Give bolus feeding by gravity over 15-20 minutes

Lactose Intolerance
Lactose Intolerance

- Congenital lactase deficiency
  - Rare disorder
  - Only reported in a few infants
  - Main carbohydrate in human breast milk is lactose
  - Allergies are to proteins!

- Primary lactase deficiency
  - Relative lack of lactase, levels fall after weaning
  - Develops in childhood at various ages in different racial groups,
    - 2% of northern Europeans, 50-80% of Hispanics, 60-80% of black and Ashkenazi Jewish, 100% of Asian and American Indians
    - 20% of Hispanic, Asian and black children under 5
    - White children generally do not develop until after 4-5 years of age
Lactose Intolerance

- Secondary lactase deficiency
  - Due to diarrheal illness or other underlying pathophysiologic condition
  - May wish to temporarily avoid lactose, or consider probiotics
  - Treatment of the underlying condition is all that is typically necessary—temporary condition

Lactose Intolerance

- Bottom line on lactose
  - Lactose intolerance in infants and young children is rare in Caucasians, and has a low incidence even in highly affected groups
  - Lactose-free formulations may not be truly necessary and may perpetuate long-term lactase deficiency
Gastroesophageal Reflux

- Extremely common in infants
- Higher levels expected—norms for pH probe studies set at a higher level
- Due to transient relaxations of the lower esophageal sphincter
  - Neurologic immaturity
  - Improves with time
Gastroesophageal Reflux

- Improves before a year of age normally
- Since self-limited process careful with therapy

Positioning
- Works
- Elevate the head of the bed to at least 30 degrees

Medications
- H₂ Blockers
- Proton Pump Inhibitors
- Prokinetics (e.g., Reglan)
Gastroesophageal Reflux

- Diet/nutritional modifications
  - Continuous versus bolus feedings
  - Higher calorie feedings = smaller volumes
  - Whey protein
    - Faster gastric emptying
  - Small bowel/transpyloric feeding tube

Gastroesophageal Reflux

- Surgery (Nissen fundoplication most common)
  - Done with intractable reflux—neurologic issues
  - Complications if motility issues
    - Gas-bloat
    - Dumping syndrome
  - May come undone and result in repeat surgeries (4-19%)
Adult Formulas in Pediatrics

Major concern is excess protein
- Consider <4g/kg/d for children <3 years
- AAP-CON recommends ≤18% of energy as protein for children <4 years of age
- DRIs suggest 5-20% protein for 1-3 years, 10-30% for 4-18 years
- Higher protein adult formulas may benefit children with lower calorie requirements
**Adult Formulas**

- Micronutrients may need to be supplemented
  - Typically lower in calcium, phosphorus and iron
  - Designed to meet needs for individuals over 10 years

**Summary**

- Calorie needs can be estimated but must be adjusted on clinical response
- One of the best and cheapest tests of nutrition in a child is a growth chart
- Stunted children may have lost growth potential
- Feeding intolerance is usually not the formula but a motility issue or external issue
- Residuals are worthless
Summary

- Feedings after gastrostomy should be within several hrs
- Lactose-intolerance is rare in children
- Reflux is temporary in most children and should use minimal therapy needed
- Adult formulas can be used in older pediatric patients but must be aware of micronutrients and protein intake

Thank you!

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