Feeding the Neurologically Impaired Child

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Disclosure

- Abbott Laboratories provided an unrestricted educational grant for grand rounds.
- I have had no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.
- I do not intend to discuss an unapproved or investigative use of a commercial product or device in my presentation.

Objectives

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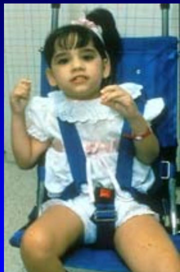
  - 1) perform a nutritional assessment
  - 2) recognize warning signs that prompt alternative feeding modalities
  - 3) establish dietary goals for refeeding neurologically impaired child
- Measures
  - 1) identify 3 determinants of nutritional status
  - 2) list two indications for nasogastric or gastrostomy tube feedings
  - 3) calculate dietary energy needs for catch-up growth in neurologically impaired child

Prevalence

- Prevalence of nutritional disorders in children with neurological disabilities unknown
- Common nutritional disorders
  - 29-46% undernutrition (BMI <5th %ile NCHS)
  - 23% linear stunting (height <5th %ile NCHS)
  - 8-14% overweight (BMI > 85th %ile NCHS)

Clinical Significance



- Health consequences
  - Improved weight, length/height gains
  - Reduced frequency of infection
  - Increased physical/motor activity
- Quality of life
  - Alters behaviors associated with hunger/satiety
  - Improved alertness/cognitive function
  - Family values

Etiology

- Inappropriate dietary intake
  - Oral motor dysfunction
  - Gastrointestinal dysmotility
- Intrinsic metabolic abnormality
- Increased nutrient losses
  - Malabsorption
- Altered energy expenditure
  - Body composition
  - Physical activity
  - Infection

Case

- 5-yr-old female with Rett syndrome (*MECP2* mutation)
- Weight 28# (12 kg) for previous one year
- Parents state she has good appetite, consumes well-balanced diet of table foods and beverages, and eats very well
- She is small and thin; height 98 cm, weight 12 kg, and BMI 13 kg/m^2
- She has small head, typical hand stereotypies, mild scoliosis, and is ambulatory

Rett Syndrome

- Is this patient malnourished?
  - Yes
  - No
- How would you characterize this child's nutritional status?
  - The patient is 5 y of age; her brother is 3 y of age.

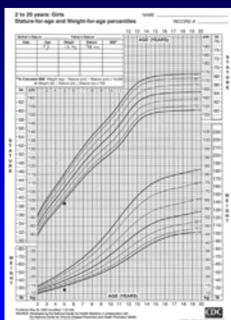
Nutritional Assessment

- Components of a nutritional assessment
  - Medical, medication, social history
  - Growth and anthropometric measures
  - Physical examination
  - Feeding pattern, meal observation
  - Laboratory and diagnostic studies
- Which is most useful to assess the nutritional status of the child?

History

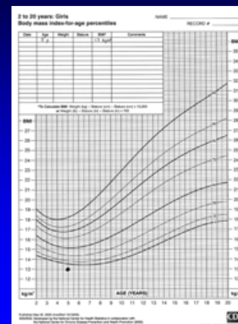
- Medical
  - Neurological diagnosis, severity, progression of disease
  - Other conditions: reflux, gastroparesis, constipation, cough, aspiration
- Medications
  - Anorexia (topiramate, valproic acid, carbamazepine, levetiracetam, risperdal)
  - Appetite stimulants (topiramate, levetiracetam)
- Social
  - School and parental work schedule

Growth Chart – Height and Weight



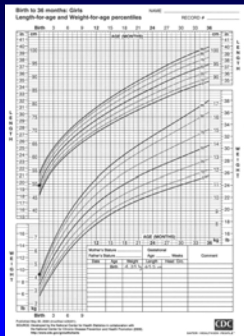
- Height and weight are essential determinants of nutritional status
- Based on height and weight measures, is this child undernourished?
  - Yes
  - Maybe
  - No

Growth Chart - BMI



- BMI is an essential determinant of nutritional status
- Based on BMI, is this child undernourished?
  - Yes
  - Maybe
  - No

Growth Chart – Birth Measures



- Birth length and weight, in absence of serial height and weight measurements, provide supportive evidence for undernutrition

Growth and Anthropometric Measures

- Obtain and plot accurate height and weight measurements at each encounter
  - Remove shoes, heavy clothing, AFOs, splints
  - Standing (4-point), lying on hard surface
  - Alternative upper arm or lower leg lengths
- Calculate and plot BMI ($\geq$ 2 y) or weight-for-height (< 2 y)
- Obtain and plot birth length and weight
- Head circumference limited usefulness
- Mid-upper arm circumference, triceps skinfold, arm muscle area reflect decreased body fat, muscle stores

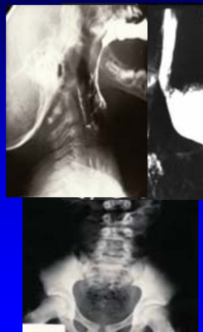
Physical Examination

- General: wasted, short stature
- HEENT: gag reflex, tongue movement, oral hygiene
- Chest: abnormal breath sounds
- Abdomen: distension, rectal impaction
- Extremities: decreased muscle mass, body fat
- Skin: decubitus ulcers, edema
- CNS: irritability, apathy

Feeding Pattern/Meal Observation

- Feeding pattern
  - Hand use, self-feeding ability
  - Chewing skills, swallowing difficulty
  - Food and beverage vs. formula consumption, amount, texture
  - Parental perceptions, duration of meals
- Meal observation
  - Ability to get spoon, bottle into mouth, food or beverage spillage
  - Lip closure, rotary chewing motion, tongue coordination
  - Coughing, choking with liquids, solids
  - Irritability, arching with feeding

Laboratory and Diagnostic Tests



- Lab—limited usefulness
  - CBC, indices, ferritin
  - Albumin, prealbumin, BUN, electrolytes
  - [25-OH]vitamin D, vitamin E
- Diagnostic imaging—assists therapeutic interventions
  - Swallowing function study
  - KUB, UGI series
  - Gastric emptying scan

Anticipatory Guidance

- What approach would you choose to refeed this child?
  - Oral?
  - Enteral?
    - Nasogastric tube?
    - Gastrostomy?
- Why?

Methods for Refeeding

- Oral
  - Almost always first choice
  - Allow 6-month trial period
  - Calculate goal weight gain: ½ to 1-½ lb/month
  - Critical BMI $\leq$ 12 kg/m^2
- Enteral
  - Introduce concepts of nasogastric, gastrostomy tube feedings
  - Discuss pros and cons of both methods

Oral Refeeding

- No need to obtain calorie count
- Use table foods and beverages to tolerance
- Texture: chopped, pureed foods
- Cup vs. bottle
- High calorie density supplements (margarine, honey, peanut butter)
- Commercial formula supplements (school setting)
- Multivitamin and mineral supplement (vitaminD)
- Thickening agent for liquids (nectar)
- Weigh q 3-6 mo to confirm goal

Indications for Tube Feedings

- Poor weight gain, weight loss for 6 months or more
  - BMI < 5th %ile
  - Flat weight curve with/without linear stunting
- Oral-pharyngeal dysfunction
  - Aspiration (SFS), pneumonia
- Parental request
  - Feeding refusal behavior (meal time >30-45 min)
  - Medication administration

Methods for Tube Feeding

- Short term
  - Nasogastric
  - Nasojejunal
- Long term
  - Gastrostomy with/without fundoplication
    - PEG
    - Laparoscopic
    - Open surgical
  - Gastrojejunostomy

Nutrient Sources for Tube Feeding

- Commercial formulas
  - Whole milk protein, hydrolysate, amino acid
  - Lactose absent in all formulas
  - Vitamins, minerals usually adequate; check vitamin D
  - Fiber helps constipation; may increase gas
- Homemade blender preparations
  - Cost approximates commercial formulas

Nutrient Needs for Refeeding

- Fluid first limiting nutrient
  - Calculate fluid needs based on body weight
  - Minimum 80% of estimate
- Daily energy estimates
  - 1-3 y 100 kcal/kg IBW-for-HT
  - 4-6 y 90 kcal/kg IBW-for-HT
  - 7-10 y 70 kcal/kg IBW-for-HT
- Provide ½ formula volume as continuous nighttime drip and ½ formula volume as multiple daytime bolus feeds
- Continue ad lib oral feedings

Complications of Refeeding

- Refeeding syndrome (metabolic disturbances 2° shift from fat to CHO metabolism, increased insulin output, cellular uptake of fluid and nutrients)
  - Decreased serum phosphate, potassium, magnesium, glucose, thiamine
  - CHF, arrythmias, hemolysis, myopathy, rhabdomyolysis, seizures, coma, death
- Aspiration pneumonia
- Hypermetabolism
  - Hyperthermia, sweating
  - Increased sleep, hair loss
  - Hepatomegaly
- Obesity

Maintenance Feeding

- Energy approximates RMR (1000-1300 kcal/day)
  - Assess physical activity
  - Monitor weight
  - Set goal BMI 25-50th %ile
- May need to supplement
  - Protein 1.5 g/kg/day
  - Calcium 800-1300 mg/day
  - Vitamin/mineral supplement
- Set goal weight based on height and age-appropriate BMI

Summary

- Growth measures (height, weight, BMI) most important components of nutritional assessment
- Dietary energy estimates based on RMR and energy cost of catch-up growth (IBW-for-HT)
- Alternative feeding modalities indicated for persistent poor weight gain or loss, linear stunting, oral/pharyngeal motor dysfunction, feeding refusal
- Ultimately, favorable nutritional status of child constitutes basis for all other medical therapies

Reference Citation

- For further information see the following citation:

- Marchand V, Motil KJ. Nutrition support for neurologically impaired children: a clinical report of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition. J Pediatr Gastroenterol Nutr 2006; 43:123-135.