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Failure To Thrive: A General Pediatrician's Perspective

Joseph A. Zenel, Jr, MD*

IMPORTANT POINTS

1. Failure to thrive is a sign of unexplained weight loss or poor weight gain in an infant or child.
2. If results of the history and physical examination do not indicate the etiology of failure to thrive, it is unlikely that laboratory testing will reveal the diagnosis.
3. The division of failure to thrive into the categories of organic and nonorganic is too simplistic and overlooks the complex interaction among psychosocial, environmental, neurologic, and anatomic factors.
4. Undernutrition is the immediate underlying cause of failure to thrive; the child must be fed.

Most primary care pediatricians will encounter the infant or toddler who, without apparent medical reason, fails to gain weight and possibly height. Efforts to evaluate and treat such patients are time-consuming, expensive, and frustrating if the clinician does not appreciate the idiosyncrasies of failure to thrive (FTT). These include the history of the definition of FTT, its traditional categorization into organic and nonorganic causes, the diagnostic approach, and current thought on its treatment and outcome.

Older review articles state that FTT accounts for 1% to 5% of pediatric hospital admissions. National and state surveys suggest that as many as 10% of children seen for primary care show signs of growth failure. In inner-city emergency departments, 15% to 30% of young children receiving acute care show growth deficits. Even though current population-based data are not available, FTT appears to be a common diagnostic challenge.

Definition

In 1968, Glaser defined FTT as a syndrome characterized by failure of physical growth, malnutrition, and retardation of motor and social

development. Frank and Zeisel, in 1988, stated that FTT referred to infants and children whose growth deviated from the norms for their age and gender. As Mathisen noted in 1989, the pattern of growth retardation usually is characterized by low weight and/or length for age or, as Casey stated in 1992, FTT describes a growth rate that is less than expected for children of similar age and gender. Overall, FTT is used to describe instances of growth failure based primarily on attained weight or rate of weight gain. In more severe cases, head circumference and length may be affected.

Criteria for FTT have become more specific. Studies of FTT have selected children whose weight was less than the 3rd percentile compared with standard growth charts or whose weight decreased over two major percentiles. Skuse, in 1985, argued for determining and comparing the patient's "height age" and "weight age"—the ages at which measured height and weight would be at the 50th percentile. Children who exhibit FTT usually have a weight age less than the height age, whereas children who have growth hormone deficiency usually have a weight age equal to or greater than the height age. Today, there are three distinct criteria to describe a child who has FTT, using the standard growth charts of the National Center of Health Statistics:

- 1) A child younger than 2 years of age whose weight is below the 3rd or 5th percentile for age on more than one occasion.
- 2) A child younger than 2 years of age whose weight is less than 80% of the ideal weight for age.
- 3) A child younger than 2 years of age whose weight crosses two major percentiles downward on a standardized growth grid, using the 90th, 75th, 50th, 25th, 10th, and 5th percentiles as the major percentiles.

These criteria imply a disproportionately decreasing rate of weight gain compared with height growth, but in certain circumstances of FTT, height and head circumference as well as developmental skills may be affected.

There are several exceptions to the previously noted criteria:

- 1) Children of genetically short stature.
- 2) Small-for-gestational age infants.
- 3) Preterm infants.
- 4) "Overweight" infants whose rate of height gain increases while the rate of weight gain decreases.
- 5) Infants who are normally lean.

FTT As A Sign

Authors may disagree over the definition of FTT, but all agree that it describes a sign, not a diagnosis. Labeling a child with FTT has little value because the etiology of the sign has not been determined, and therapeutic efforts to correct it would be similar to that of administering acetaminophen for a fever or performing phototherapy for hyperbilirubinemia—the condition may persist if the underlying cause remains unknown.

Consequences Of FTT

In 1908, Chapin was disheartened by hospitalized sick and wasted infants of the poor regressing to their former state when they returned to their wretched environ-

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ment. He observed that although the wasting was due primarily to a faulty diet, if the atrophy continued long enough, changing to a proper diet did not check the downward trend to death. Chapin believed that these children required an altered environment that included good hygiene and individual care. In 1945, Spitz noted that institutionalized children, even if placed into a better environment, showed severe developmental retardation as well as evidence of weight and height retardation. Spitz concluded that unfavorable environmental conditions, such as lack of stimulation and maternal absence, during a child's first year of life produced psychosomatic damage that could not be repaired by normal measures. In 1968, in a follow-up of 40 children diagnosed with "FTT of nonorganic etiology," Glaser reported that the group exhibited a higher incidence of continued growth deficits, mild mental retardation, emotional disturbance, and family dysfunction.

In 1985, Oates reported a follow-up of 14 children (mean age, 13.8 years) who were hospitalized approximately 12.5 years earlier for a history of nonorganic failure to thrive. When compared with a matched control group, the 14 children showed lower height and weight, lower verbal intelligence, poorer language development, less developed reading skills, lower social maturity, and a higher incidence of behavioral disturbances. Clearly, all of these reports suggest that, if left untreated, the child who has FTT faces future cognitive, behavioral, and constitutional deficits.

FTT: Organic and Inorganic Causes

Over the years, a picture of FTT due to organic or nonorganic causes evolved. As mentioned earlier, Spitz concluded that unfavorable environmental conditions caused poor weight gain and developmental delay. This conclusion was carried further when Glaser commented in 1968 that an organic diagnosis could not be established in many cases of FTT despite repeated and detailed clinical investigations, but once social and psychological factors were

investigated, the cause of the child's growth failure was understood. It was logical to categorize FTT into "organic" and "nonorganic."

This traditional division helped physicians formulate an approach to diagnosis. If a patient who was determined to have FTT was hospitalized and did not gain weight despite a proper diet and nursing care, the underlying cause must be organic. On the other hand, if the patient gained weight, the home environment was the cause whether due to nutritional, emotional, or stimulatory deprivation. Hospitalization also provided an opportunity for laboratory evaluation if an organic cause was suspected.

PITFALLS TO DIAGNOSIS

Unfortunately, weight gain during hospitalization as an approach to diagnosing FTT is too simplistic. First, if the patient did not gain weight, the clinician might conduct an ever-increasing diagnostic search to rule out all possible causes of FTT. Second, extensive laboratory testing may be fruitless and expensive. In a retrospective investigation of 185 patients hospitalized for FTT, only 1.4% of laboratory studies were of diagnostic assistance, and even then the diagnosis already had been strongly indicated by findings on history and physical examination. Third, dividing the causes of FTT into two distinct, exclusive groups may be misleading. In a retrospective chart analysis of 82 patients hospitalized for FTT, a sizable number (19) had both psychosocial and organic causes for their condition, giving rise to the argument that there are three categories for FTT: organic disorders alone, pure psychosocial disorders, and a combination of organic and psychosocial causes. Diagnosing one cause for FTT does not preclude searching for another.

Fourth, hospitalization may be useless. In 1982, Berwick reviewed the records of 122 infants between the ages of 1 and 25 months who were hospitalized for FTT without a diagnosis. By the end of the hospital stay, one third of the patients still did not have a diagnosis. Each patient had received an average of 40 laboratory tests and radiographs, but only 0.8% of all tests showed

an abnormality that contributed to a diagnosis. Fifth, Berwick noted that children who have FTT of either organic or nonorganic etiology could gain or lose weight during hospitalization.

Bithoney compared the weight gain of children who had organic FTT and those who had nonorganic FTT when treated by a multidisciplinary team consisting of pediatricians, nutritionists, psychologists, psychiatrists, social workers, and nurse practitioners. The children in both groups gained weight extremely well, which led Bithoney to conclude that weight gain alone could not differentiate organic FTT from nonorganic FTT reliably. More importantly, though, he documented that children who had either type of FTT were undernourished, and regardless of the cause, the malnutrition should be addressed.

Because a significant number of children who have poor weight gain appear to have no underlying organic disease, a critical look at the classification of nonorganic FTT is in order.

NONORGANIC FTT . . . THEN

Spitz's research suggested that there were similarities between institutionalized children who showed delayed physical growth and children who met the criteria of FTT without organic cause, even though the mother was present. He believed that infants who failed to grow must experience a lack of mothering similar to that seen in institutionalized infants. This condition was labeled "maternal deprivation syndrome." Even though the validity of a link between maternal separation and physical development was questioned by others, and it was assumed that both groups of children were receiving adequate calories, inadequate maternal nurturing generally was accepted as the cause of nonorganic FTT.

In 1967, Barbero and Shaheen used the following criteria to describe a clinical syndrome of growth failure with lack of obvious organic causes, which helped identify and treat children at risk:

- 1) Weight below the 3rd percentile with subsequent weight gain after appropriate nurturing.

- 2) Developmental retardation with subsequent improvement following stimulation and feedings.
- 3) No evidence of systemic disease or abnormal laboratory findings to account for the growth failure.
- 4) Clinical signs of deprivation that improve with a more nurturing environment.
- 5) Significant environmental or psychosocial disruption within the family.

During this time, other studies described the characteristics of the mother and the environment of a child who had nonorganic FTT. The mother was believed to have a character disorder or depression, anxiety, narcissism, social isolation, or low intelligence. She frequently had a history of being poorly nurtured herself as a child. The parents of a child who had nonorganic FTT had a nonexistent or dysfunctional marital relationship. Family lifestyle could be chaotic, disorganized, and subject to increased life stressors. The general consensus that psychosocial problems in the mother were a cause of nonorganic FTT continued despite findings that the incidence of severe psychopathology in mothers of infants who had FTT was no greater than in mothers of normally thriving infants.

From the 1960s through the early 1980s, physicians began to question whether a child's inherent behavior might contribute to the mother's insufficient care. Such behaviors could include fussiness, easy distractibility, excessive reactivity, abnormal sleeping patterns, self-harming behaviors, and disturbed eating and elimination patterns. Children who had nonorganic FTT frequently resisted social interaction, became agitated upon physical contact, avoided facial contact except with strangers, and showed apathy toward their parents. With such behavior, it was no wonder that a mother might withdraw from her child. In an attempt to distinguish specific behavior patterns of infants who had organic and nonorganic FTT, Powell and associates tabulated the frequency and intensity of behaviors of 67 hospitalized infants, ages 3 to 24 months. These children included 17 who had organic FTT,

17 who had nonorganic FTT, and 33 who did not have FTT. Among the distressing behavior patterns were lack of vocal response to stimulus, lack of spontaneous vocalization, expressionless face, lack of motor response to stimulus, lack of smile in response to stimulus, general inactivity, and gaze abnormality. Even though these behaviors occurred more frequently and intensely in infants who had nonorganic FTT, they occurred to a significant degree in all three groups. Infant behavior alone could not identify the child who had nonorganic FTT.

The mother-child interaction during feeding was suggested as the answer to undernutrition and subsequent failure to thrive. A 1969 study reported that 11 of 13 "maternally deprived infants" gained weight at an accelerated rate when fed adequately in a hospital without stimulation from a caregiver. In addition, seven of seven "maternally deprived" infants gained weight rapidly in their own homes when fed an adequate diet by the mother. The authors concluded that "maternally deprived" infants were underweight because of underfeeding secondary to not being offered or not accepting adequate food.

In 1984, Chatoor tried to explain feeding interactions and FTT from a developmental point of view. She believed that eating behaviors followed a sequential pattern of homeostasis, attachment, and separation-individuation. During homeostasis, between birth and 2 months of age, the infant learns to suck, swallow, and regulate feedings by exhibiting signs of hunger and satiety. If the mother does not interpret these cues correctly, the infant may not be fed effectively, leading to undernutrition and possible delay in motor and language skills, a situation frequently seen in infants receiving gastrostomy feedings during the first few months of life. During attachment, between 2 and 6 months of age, an infant establishes interactional patterns with caretakers. If this does not occur, the infant may develop apathy, anorexia, and dysfunctional feeding patterns such as vomiting and rumination, leading to undernutrition. During separation and individuation, between 6 months and

3 years, the child learns to differentiate hunger from the emotional needs of affection, dependency, anger, and frustration. If this does not occur, the infant may not eat to express anger or autonomy. The caretaker then must learn to give comfort when the child is stressed and give food when the child is hungry. Failure to understand the child's mixed messages may lead to further frustration, anger, and food refusal by the child.

By 1985, theories explaining nonorganic FTT could be summarized as follows:

- 1) Inadequate maternal-child interaction, with possible emotional deprivation.
- 2) Infant behavior abnormalities.
- 3) Chronic undernutrition.

NONORGANIC FTT . . . REAPPRAISAL

In 1985, Skuse stated that the different etiologies given for nonorganic FTT were the result of theories based on an arbitrary description of a pattern of growth that varied among authors and that studies based on these descriptions involved too small a number of cases to be representative. The claims of maternal characteristics of anger, depression, and helplessness were primarily anecdotal, and no true "universal attribute" of caretakers had been found. To fault only the mother or caretaker overlooked the reciprocity of caretaker-child relationships and the unique characteristics of the child that may lessen a caregiver's ability to nurture. The resulting undernutrition was due more likely to both inadequate provision of food and intake. In evaluating the child who exhibited growth retardation for which no physical cause was readily apparent, Skuse suggested that the clinician obtain a history of the nutrition provided, the behavior at mealtime, and the amount of food consumed. Critical observation of feeding should include caretaker and child interactions. Management should be guided by, in order of importance, nutritional intake, quality of caretaking, and environmental effects on the caretaker's ability to function.

In essence, FTT should be approached as a syndrome of mal-

nutrition brought on by a combination of organic, behavioral, and environmental factors.

NONORGANIC FTT . . . NOW

By the early 1990s, evidence began to mount to explain why an infant may fail to ingest adequate calories. In 1976, Pollitt reported that 10 of 19 infants who had FTT had feeding problems such as poor appetite, poor suck, crying during feedings, vomiting after feedings, and difficulty weaning to solid foods. In 1987, Dahl and Kristianson followed 42 patients who had feeding problems, refused food, and vomited with no diagnosed cause. No relationship between severe psychosocial pathology and feeding problems could be demonstrated when these infants were matched with a control group, yet these infants had significant growth failure by 2 years of age. Heptinstall studied a group of inner-city children who had chronic growth retardation at 4 years of age and were diagnosed as having FTT in the first year of life. Nearly 50% of these children had some form of oral motor dysfunction.

In 1989, Mathisen and Skuse studied nine infants, whose weight for age was more than two standard deviations below the population mean for 3 months or more without a medical explanation, and matched them with nine comparable infants who did not have FTT and who were similar for age, race, gender, ordinal position, birthweight, gestation, maternal age and level of education, and type of housing. All case infants were fed in the living room rather than the kitchen or dining room. Case infants were placed standing at a low table, in a walker, or on the mother's lap during feeding. They were fed over less time than comparison infants. Case infants cried for their food, whereas comparison babies used gestures, vocalizations, and body and facial postures. Finally, case infants were more likely to have hypotonic lips and an aversive reaction to touch, particularly to the face. All of these findings suggested that these infants had minimally abnormal neurologic features that made feeding difficult for caretakers. As a result, feeding

became more of a functional action than a social action, with caretakers unwittingly feeding in distracting environments in a shorter time span.

The neurologic basis for nonorganic FTT in some infants received further investigational support. Ramsay and associates compared 38 infants who had nonorganic FTT (defined by weight below the 5th percentile or decline in weight by two or more percentiles) with 22 infants who had FTT due to organic disorders. There was no difference in socioeconomic class, maternal age and marital status, or birth order. The groups differed in gestational age, birthweight, and birth complications. Both groups showed developmental delay, with those who had organic FTT exhibiting greater delay. A very high percentage of infants from both groups had a history of abnormal duration of feeding time, poor appetite, delayed tolerance for texture, and difficult feeding behavior. Surprisingly, the groups did not differ in the incidence of maternal negative affect, infant negative affect, or negative maternal-infant interactions. There was no difference in deviant feeding behavior. The authors concluded that early feeding problems are common in infants who have organic and nonorganic FTT and are similar to those reported by mothers of children who have cerebral palsy. They theorized that these feeding disorders may have a common cause that may vary in severity. Even though the infants who had nonorganic FTT had no diagnosable neurologic disorder, nearly 50% had neurologic signs (eg, delayed texture tolerance, prolonged feeding duration) suggestive of an underlying dysfunction. Such findings raise the possibility of renaming nonorganic FTT as growth failure secondary to feeding skills disorder.

In 1995, Tolia described seven infants who had a persistent lack of appetite that developed shortly after birth, leading to decreased calorie intake and the inevitable weight decline below the 5th percentile. These term infants had birthweights greater than the 95th percentile and no perinatal complications. The decline in appetite was almost

immediate, despite efforts to encourage intake. No medical etiology, psychosocial pathology, or maternal psychiatric problems could explain the condition, and no developmental delay was noted. All patients gained weight, some markedly, upon starting enteral supplements, including nasogastric feedings in three patients and eventual gastrostomy tube placement in two. All patients lost weight when attempts were made to wean them from supplemental nutrition. The author concluded that there is a group of infants whose growth failure is due to primary abnormalities of appetite of unknown etiology. Such infants must be recognized early and fed aggressively. If necessary, nasogastric feedings should be administered to ensure caloric intake and to decrease or eliminate the emotional frustrations with feeding that could affect caretaker-child relationships adversely. This potential underlying neurologic disorder in nonorganic FTT is a disturbance in regulation of hunger and satiety.

Children who have feeding disorders have an additional risk for developing behavioral feeding problems. Those who depend on tube feedings appear to have a physiologic "critical period" for establishing oral feeding, after which it is very difficult for the child to acquire oral feeding skills. Infants who cannot be fed during the first month of life due to such conditions as gastrochisis or diaphragmatic hernia may experience delay in acquiring the skills of nutritive sucking. Interference with learning the skills of sucking, rooting, transferring food from the tongue to the pharynx, chewing, and tongue lateralization of a food bolus in the first year of life may lead to poor coordination of oral and pharyngeal phases of swallowing, thereby increasing the chances of aspiration. Such a child may associate feeding with discomfort or pain and refuse to eat or drink specific food types or textures or all foods. (Similarly, children who have gastroesophageal reflux may refuse to eat because of pain upon swallowing due to reflux esophagitis.) In an effort to get their child to eat, caretakers may offer inappropri-

ate foods or drinks that are “empty” in calories. If excess fruit juice is given, fructose and sorbitol malabsorption with nutrient loss may occur. The treatment for such a feeding disorder requires correction of an underlying anatomic disorder that interferes with feeding, occupational therapy to improve feeding skills, aggressive nutrition that includes tube feeding if necessary to ensure growth, and behavioral modification to increase appropriate feeding behavior and decrease maladaptive behavior.

Pursuit of the caretaker’s role in FTT continues. In 1993, one study suggested that parental eating habits and attitudes concerning body shape and weight may lead to restriction of “sweet” foods or elimination of perceived fattening or unhealthy foods from the infant’s diet. Another study stated that the less nurturing and more neglecting the parents, the more the cognitive loss in an infant who has nonorganic FTT. Fleisher commented that although most children who have gastroesophageal reflux gain weight despite their disease, some do not. He described four infants who had gastroesophageal reflux and weight loss and came from emotionally stressed households. When hospitalized, these children gained weight without treatment except for feeding and comfort. His conclusion was that these infants may have “nervous vomiting,” which could be an extension of innocent vomiting that emotionally stressed parents misinterpret for rejection. The parents’ subsequent withdrawal stresses the infant, whose vomiting then worsens, leading to nutrient loss and FTT. These studies suggest that the psychosocial milieu, whether the cause or the result of an infant’s weight loss, is a contributing factor to FTT.

Today, the distinction between organic and nonorganic FTT is not clear. In the 1996 American Academy of Pediatrics publication *The Classification of Child and Adolescent Mental Diagnoses in Primary Care*, FTT is classified as inadequate nutrition variation, inadequate nutrition intake problem, or feeding disorder of infancy or early child-

hood. No category of organic or nonorganic FTT is listed.

Cognitive Outcome of FTT/Feeding Disorder/Inadequate Nutrition

In 1988, Drotar and Sturm studied the intellectual development of 59 infants who had been hospitalized at the average age of 4.9 months for nonorganic FTT. All infants were assigned randomly to one of three different outreach intervention programs and were followed over the next 2 to 3 years. The rate of cognitive development in these infants declined, and early intervention did not prevent the decline. All of the outreach programs were discontinued after 18 months of treatment, suggesting that such programs may need to last longer to be effective. The cognitive level was lower with lower family income, lower maternal education level, and earlier age of onset of FTT. Most of the infants attained normal weight for height. The authors concluded that children who have FTT are at risk for poor intellectual development without close monitoring and comprehensive treatment.

In 1994, Skuse showed in a prospective study of 1,558 inner city infants, 47 of whom had poor weight gain, that impaired growth in the first 6 months of life is associated with poorer mental and psychomotor development measured in the second year. A child whose standardized weight began to fall immediately below two standard deviations after birth could suffer a loss of 10 points in predicted mental/psychomotor abilities in the second postnatal year. A child who experienced the same ultimate weight loss but who started faltering 4 or more months after birth suffered a loss of only three points in predicted mental/psychomotor abilities. There were no significant differences in the maternal mean intelligence quotient (IQ) between the case and comparison infant groups and no evidence of neglectful maternal behavior to explain the case infants’ cognitive outcomes.

Even though Skuse did not prove that undernutrition was responsible

for growth faltering and mental outcome, it would appear that an infant who exhibits weight loss or poor weight gain should be fed aggressively to prevent cognitive loss while the clinician is searching for the underlying etiology of poor weight gain.

Malnutrition And FTT

The underlying question in the presence of suspected FTT is the source of the malnutrition. Diagnostic efforts should be directed toward determining whether the patient is experiencing one or a combination of the following factors:

- Inadequate calorie intake
- Inadequate calorie absorption
- Excessive calorie expenditure

The first two factors have features of organic and psychosocial disorders; the third is due primarily to organic disease.

INADEQUATE CALORIE INTAKE

The intake of calories may be thought of as a continuous series of events leading from appetite to food preparation to eating. However, food may not be available, ingesting food may be difficult, and the desire to ingest food may be nonexistent. Table 1 lists some examples of poor calorie intake. Anatomic defects, disease states, and psychosocial factors appear in all four categories.

INADEQUATE CALORIE ABSORPTION

Once ingested, calorie-containing foods may be digested inadequately; malabsorbed, causing diarrhea and nutrient loss; or eliminated too rapidly before digestion takes place. Table 2 lists examples of possible psychosocial and organic causes. A thorough history and physical examination should indicate the diagnostic path to follow.

INCREASED CALORIE REQUIREMENTS

An infant or child may not be gaining weight due to increased calorie needs because of an increased metabolic rate or inefficient use of calories ingested (Table 3). Psychosocial

TABLE 1. Inadequate Calorie Intake

Lack of Appetite

- Anemia (eg, iron deficiency)
- Psychosocial problems (eg, apathy)
- Central nervous system (CNS) pathology (eg, hydrocephalus, tumor)
- Chronic infection (eg, urinary tract infection, acquired immunodeficiency syndrome)
- Gastrointestinal disorder (eg, pain from reflux esophagitis)

Difficulty With Ingestion

- Psychosocial problems (eg, apathy, rumination)
- Cerebral palsy/CNS disorder (eg, hypertonia, hypotonia)
- Craniofacial anomalies (eg, choanal atresia, cleft lip and palate, micrognathia, glossoptosis)
- Dyspnea (congenital heart disease, pulmonary disease)
- Feeding disorder
- Generalized muscle weakness/pathology (eg, myopathies)
- Tracheoesophageal fistula
- Genetic syndrome (eg, Smith-Lemli-Opitz syndrome)
- Congenital syndrome (eg, fetal alcohol syndrome)

Unavailability of Food

- Inappropriate feeding technique
- Insufficient/inadequate volume of food
- Inappropriate food for age
- Withholding of food (abuse, neglect, psychosocial)

Vomiting

- CNS pathology (increased intracranial pressure)
- Intestinal tract obstruction (eg, pyloric stenosis, malrotation)
- Gastroesophageal reflux
- Drugs (eg, purposeful administration of syrup of ipecac)

problems are not listed as the primary disorder, but they may be an added detrimental factor, depending on the caretaker's and infant's response to the primary disorder.

FTT Evaluation (Figure)

When evaluating an infant or child who exhibits poor weight gain or weight loss without an apparent cause, the clinician should follow a logical investigative approach.

The basis of making the correct diagnosis rests firmly on a good history rather than on laboratory tests. During the history taking, the clinician must show concern and compassion and avoid placing blame on the caretaker who, in response, may hamper any further evaluation. Specific questions should include the following:

- Feeding history, including details of breast or formula feeding, timing and introduction of solids, medical or feeding advice already followed, who feeds the infant,

position and placement of the infant for feeding, and any stooling or vomiting patterns that may be associated with feeding.

- Developmental history, including gestational and perinatal history, developmental milestones, infant temperament, and the infant's daily routine.
- Psychosocial history, including family composition, employment status, financial status, stress, potential isolation, child-rearing beliefs, history of maternal depression, and the caretaker's own history of possible childhood abuse or neglect.
- Family history, including heights, weights, illnesses, and development that may indicate constitutional short stature, inherited diseases, or developmental delay.

Observation of the infant and caretaker while feeding and playing may provide clues about their interaction. The infant may avoid eye contact or withdraw from physical attention and may show a poor suck

TABLE 2. Inadequate Calorie Absorption

Malabsorption

- Biliary atresia/cirrhosis
- Celiac disease
- Cystic fibrosis
- Enzymatic deficiencies
- Food (protein) sensitivity/intolerance
- Immunologic deficiency
- Inflammatory bowel disease

Diarrhea

- Bacterial gastroenteritis
- Parasitic infection
- Starvation diarrhea

Hepatitis

Hirschsprung Disease

Psychosocial Problems

- Refeeding diarrhea

or swallow or aversion to oral stimulation. The caretaker may reveal an ineffective feeding technique or inappropriate response to the infant's physiologic or social cues.

The physical examination should begin with plotting the patient's height, weight, and head circumference on a standard growth curve specific for gender. If all three measurements are below the 3rd percentile, there is a good chance of an underlying organic disease. If all three measurements are consistently below the 3rd percentile but show the same rate of increase over a period of time, there is a good chance that the infant had intrauterine growth retardation. If the child's median age for weight (age at which weight is in the 50th percentile) is less than the median age for height (age at which length is in the 50th percentile), the child may be undernourished. The clinician also should look for dysmorphic features and signs of central nervous system, pulmonary, cardiac, or gastrointestinal disorders as well as signs of neglect or abuse, such as poor hygiene, unexplained bruises or scars, or inappropriate behavior.

Necessary laboratory testing should be guided by findings on the history and physical examination, keeping in mind that laboratory "fishing expeditions" are fraught with cost, misleading information

(such as the frequent finding of elevated liver enzymes in malnourished infants, which can be confused as other hepatic pathology), and failure to help find a diagnosis. If results of the history and physical examination do not suggest a cause, routine laboratory testing, such as a complete blood count, urinalysis, urine culture, blood urea nitrogen, creatinine, serum electrolyte levels, and a tuberculin test, may reassure all involved that there is no significant immediate life-threatening organic pathology. It is important to remember that the likelihood of finding a diagnosis by routine testing is extremely small. A radiologic determination of skeletal maturation, or bone age, may be helpful. If the bone age is normal, it is unlikely that the infant has a systemic chronic disease or hormonal abnormality as the cause of poor weight gain. In the face of severe malnutrition, laboratory examination should include measurement of albumin, alkaline phosphatase, calcium, and phosphorous concentrations to assess protein status and to look for biochemical rickets. Further tests, such as human immunodeficiency virus screening, sweat test, or radiologic examination, are indicated only if history and physical examination results indicate a diagnosis.

If findings on the history, physical examination, and laboratory evaluation do not help determine a diagnosis, consider a feeding evaluation to rule out any subtle feeding disorder. Feeding assessments usually are performed by occupational therapists, although they sometimes are performed by speech therapists. If indicated, pursue a psychological evaluation.

Treatment And Management

If the initial history and physical examination do not indicate an organic cause, it is important to feed the infant while continuing the diagnostic evaluation. Feeding the infant may require the assistance of a nutritionist. Frequently, malnourished infants are anorectic and will not acquire an appetite until partial nutritional recovery occurs. The malnourished infant who has a feeding disorder may not ingest

TABLE 3. Increased Calorie Requirements

<p>Increased Metabolism/Increased Use of Calories</p> <ul style="list-style-type: none"> • Chronic/recurrent infection (eg, urinary tract infection, tuberculosis) • Chronic respiratory insufficiency (eg, bronchopulmonary dysplasia) • Congenital heart disease/acquired heart disease • Malignancy • Chronic anemia • Toxins (lead) • Drugs (eg, excess levothyroxine) • Endocrine disorders (eg, hyperthyroidism, hyperaldosteronism)
<p>Defective Use of Calories</p> <ul style="list-style-type: none"> • Metabolic disorders (eg, aminoacidopathies, inborn errors of carbohydrate metabolism) • Renal tubular acidosis • Chronic hypoxemia (eg, cyanotic heart disease)

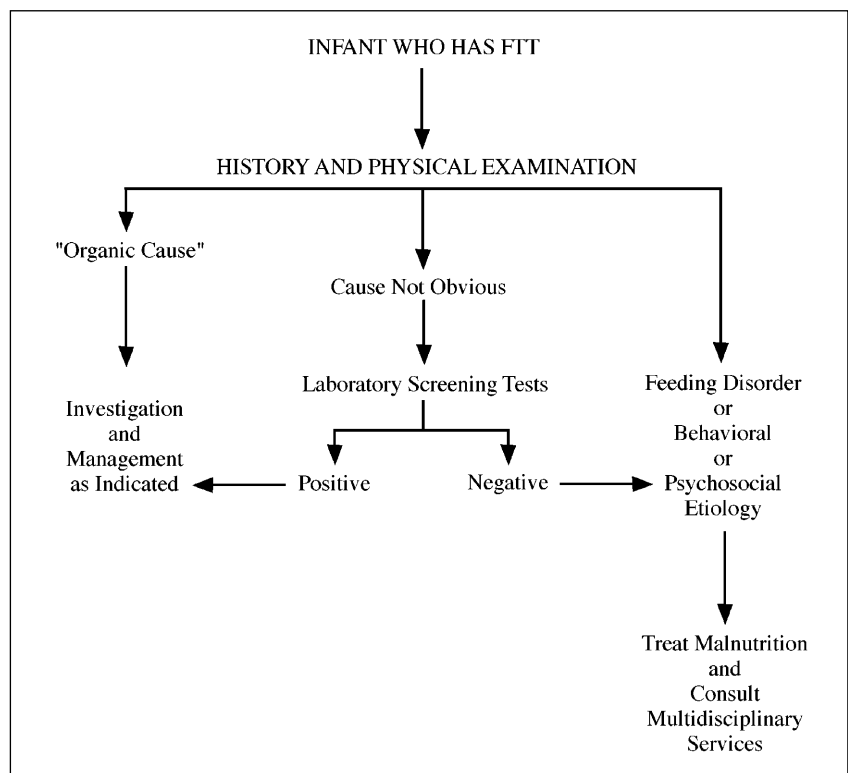


FIGURE. Evaluation algorithm for FTT.

food effectively. An occupational therapist may provide ways for the caretaker to feed the infant effectively. Refeeding of the infant may cause a transient malabsorption with subsequent diarrhea. Other symptoms of nutritional recovery include sweateness, hepatomegaly (from increased glycogen stores), and mild hyperactivity.

The normal, healthy infant requires an average of 100 kcal/kg of body weight per day. Any child whose weight has dropped below the 5th percentile or below two

standard deviations requires more than that amount to “catch up” to prior values. Generally, the nutritional requirements are 50% more than the average, suggesting that a diet of 150 kcal/kg per day is necessary. Some nutritionists believe that the protein content in the diet also should be increased. The number of calories per ounce of formula can be increased by adding less water (13 oz infant formula concentrate mixed with 10 oz water provides 24 kcal/oz high-calorie formula) or by adding more carbohydrate in the

form of glucose polymers or fat in the form of medium-chain triglycerides or corn oil. For the older child, foods can be fortified with such items as milk products, margarine, oil, and peanut butter. Fat is an excellent source of "dense" calories. Once nutritional recovery begins, the infant often demands and eats enough food to gain weight. At this point, ad libitum oral feedings are appropriate.

For the infant or toddler who does not gain weight despite offered oral feedings, the diet should be supplemented by nasogastric tube feeding. Feeding assessment and therapy to improve oral feeding may be warranted. If weight improves over 3 to 6 months, the infant can be weaned to oral feedings. If nasogastric feedings or weaning to oral feedings is not successful, gastrostomy tube placement should be considered.

If a disease was diagnosed, the appropriate treatment is begun.

The need for behavioral intervention should be addressed after feeding has been established. Meal time must be relaxed, social, free of battles over eating, and without food being forced or withheld as a punishment. Mealtime distractions should be minimal, and the caretaker should recognize the infant's cues for hunger, satiety, and food preferences. If such efforts are unsuccessful, the services of a mental health professional may be helpful.

Maternal psychopathology, stress, or economic strain may require referral to psychology/psychiatry or social services. Visiting home nursing care, respite care, and assistance programs may be of great help. In the face of child abuse or neglect, both child protective services and legal authorities must be notified.

Even though the initial coordination of mental health, nutritional, medical, and social services may be easier in the hospital, today's cost consciousness and growing managed care necessitate an outpatient course of treatment. Hospitalization is necessary when outpatient management fails, the degree of malnutrition is severe, or the psychosocial circumstances put the infant at risk for harm. The infant who is hospitalized and gains weight consistently should be discharged with frequent outpa-

tient follow-up. Keep in mind that frequent weight fluctuation occurs in the early stages of renutrition.

There are several key points in the management of FTT. First, the parents or caretakers should be involved in the process of diagnosis and treatment without the clinician placing blame for the infant's condition. Generally, these same parents ultimately are responsible for the child's care, and feelings of guilt, incompetence, or anger may interfere with their abilities to nurture the child. Second, FTT often is the result of many factors that may require the expertise of several disciplines, including nutrition, gastroenterology, speech, occupational and physical therapy, behavioral psychology, psychiatry, and social services. Third, the infant or child who has poor weight gain due to poor intake requires long-term follow-up. These children should be seen frequently to ensure adequate nutrition and to assess ongoing development because they are at risk for developmental and cognitive delay.

Conclusion

FTT is an ill-defined, but readily recognizable description of an infant or child who presents with unexplained poor weight gain. This pattern of growth is due to undernutrition that, if left untreated, has deleterious effects for the child and family. Categorizing the infant's condition as organic or nonorganic FTT is acceptable only if doing so

helps to guide treatment and does not distract from feeding the child. However, such categorizations are artificial; the distinction between organic and nonorganic FTT blurs with each new rigorous study.

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PIR QUIZ

- Based on surveys of primary care, approximately what percent of children show growth failure?
 - 1%.
 - 5%.
 - 10%.
 - 25%.
 - 33%.
- Which of the following is *most* likely to provide the basis for making the correct diagnosis in an infant or child who fails to thrive?
 - Blood chemistries.
 - Cultures.
 - History.
 - Physical examination.
 - Radiographic studies.
- One cause of failure to thrive as a result of excessive caloric expenditure is:
 - Bacterial gastroenteritis.
 - Cystic fibrosis.
 - Gastroesophageal reflux.
 - Inappropriate feeding technique.
 - Malignancy.
- Which of the following is *not* an effective means of increasing caloric value of the formula of a malnourished infant?
 - Adding corn oil.
 - Adding glucose polymers.
 - Adding less water to the formula concentrate.
 - Adding medium-chain triglycerides.
 - Adding multiple vitamins.

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