Failure to Thrive in Infants and Young Children

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Failure to thrive is a syndrome of infancy and early childhood, characterized by growth failure for no apparent cause. A careful history, thorough physical examination, and relatively simple laboratory and radiographic studies will identify the cause of the problem in most instances. Prenatal, genetic, familial, constitutional, and environmental factors are most important. Hospitalization for diagnostic evaluation is often effective from a therapeutic standpoint as well. The family physician is in a favorable position to manage most pediatric patients who fail to thrive.

Satisfactory growth in accordance with genetic potential provides important evidence of a child's basic good health. The term "failure to thrive" is commonly used to describe the condition of an infant or young child who is not growing adequately, or may actually *lose* weight, without obvious reason. If growth in length as well as weight is adversely affected, the cause is likely to be more severe and/or of longer duration. Though inadequate physical growth is the striking clinical finding, other symptoms such as developmental retardation, apathy, and disorders of food intake may be present.[1]

Definition

The finding of height and/or weight below the third percentile for age is commonly used to define a state of abnormal growth, but it should be remembered that three percent of the normal population would be included in such a group. Use of a definition based on measurements more than three standard deviations below the mean, results in identifying children with a much higher percentage of abnormalities.[2] More important, however, is a determination of the *rate* of growth, since some normal children may grow consistently though always remaining at below-average levels.[3] On the other hand, an infant or child whose weight is in the 50th percentile for age may be considered to be "failing to thrive" if a normal pattern of growth in the 90th percentile had been established; such patients are described as having a reduced *velocity* of growth. Several authors have categorized the various patterns of growth to assist in determining the likely etiology and the extent to which evaluation should be carried.[3,4] An adaptation of these classifications is presented in Table 1.

Causes of Failure to Thrive

In every textbook of pediatrics there is a listing or classification of causes for growth failure in infants and children, and review articles have appeared in the literature.[5] For the purposes of this discussion, only those causes that are not always clinically obvious will be included. Some categorization is warranted to assist in planning a logical diagnostic work-up, but it should be remembered that malnutrition is a common denominator in many of the categories. Thus, inadequate intake of calories may underlie failure to thrive in such diverse conditions as congenital heart disease[6] and environmental deprivation.[7] Similarly, it may be difficult to differentiate the unfavorable effect on growth of a chronic systemic disease such as asthma, ulcerative colitis, or rheumatoid arthritis from that caused by long-term treatment with corticosteroids.[8,9]

Some examples of the often subtle causes of growth retardation in infants and young children are listed in Table 2. Though most are self-explanatory, special attention is called to those listed as having a prenatal onset. Most chromosomal abnormalities are clinically apparent, but gonadal dysgenesis may be missed if examination is not carefully performed. Normal genetic factors undoubtedly account for many instances of "growth failure," and can often be diagnosed on the basis of a careful family history. Finally, it must always be remembered that growth begins at conception, not at birth; the importance of intrauterine growth can be judged from the fact that weight increases several billion times before birth, but only about 20 times after birth. Animal studies and available human data indicate that factors operative during crucial periods of rapid growth may adversely affect eventual size.[10] Studies of infants with low birth weight show that many continue to be small if they are small for gestational age (intrauterine failure to thrive), whereas they tend to "catch up" with normal infants if premature but of appropriate size for gestational age.[11] Thus, events during pregnancy

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Table 1. Analysis of Growth Patterns in Children with Failure to Thrive

Height and weight	Growth velocity	Bone age	Most likely diagnosis	Other possible diagnoses
At or just below third percentile	Normal	Equal to chronologic age	Genetic short stature	Gonadal dysgenesis; Primordial dwarfism
Slightly below but parallel to third percentile	Low normal	Approximates median age for height	Constitutional delay	Mild malnutrition
Far below but parallel to third percentile	Borderline	Significantly retarded	Constitutional delay; malnutrition	Systemic disease
Progressive deviation from previous channel	Slow	Markedly retarded	Chronic systemic disease	Endocrinologic abnormality

may have profound effects on postnatal growth patterns.

Special attention should also be directed to the final cause of failure to thrive listed in Table 2 – emotional deprivation.[1,2] It is often difficult for parents or physicians to accept the idea that failure to grow physicially can be the result of emotional neglect, lack of stimulation, or other psychosocial factors. As previously indicated, the mechanism in the individual child and family is not always a simple one; malnutrition, rumination, and other associated problems may contribute to the growth failure.[7] A retarded, chronically ill infant may fail to respond appropriately to his/her mother's care and attention. Because of this, the mother may become discouraged and gradually reduce the time and effort she invests in the child, and the result may be accentuation of a predisposition to failure to thrive. Therefore, despite the great importance of emotional deprivation as a cause of growth failure, it behooves physicians to look beyond obvious maternal neglect in seeking the reasons for failure to thrive. The corollary is true in regard to the infant who has an obvious organic etiology.

Diagnostic Evaluation

With the above etiologic possibilities in mind, it becomes possible to devise a logical approach to the evaluation of the infant or child who is apparently failing to thrive. The accumulation of data should proceed along traditional lines.

1. *History.* Emphasis should be placed on the events of pregnancy and delivery, birth weight in relation to gestational age, and the pattern of growth; also, data regarding measurements at specific ages are very helpful. A careful feeding history should include a typical day's diet. The family

Table 2. Etiology of Failure to Thrive

Prenatal onset

- Chromosomal abnormalities
  - Gonadal dysgenesis (Turner syndrome in girls)
- Genetic causes
  - Normal (familial, racial, constitutional delay)
  - Abnormal (cystic fibrosis, achondroplasia)
- Intrauterine disturbances
  - Placental dysfunction
  - Infection (rubella, cytomegalovirus, toxoplasmosis)
  - Injury due to drugs, radiation
  - Severe maternal malnutrition

Postnatal onset

- Undernutrition
  - Inadequate intake
  - Excessive losses (vomiting, rumination, chronic diarrhea)
  - Malabsorption
  - Associated with systemic disease
- Systemic disease
  - Renal (insufficiency, tubular disorders)[14]
  - Central nervous system (anomaly, tumor)[13]
  - Cardiac (cyanotic congenital heart disease, failure)[6]
  - Pulmonary (asthma, pulmonary insufficiency)[8]
  - Gastrointestinal (regional enteritis)[9]
  - Metabolic (inborn errors, idiopathic hypercalcemia)
  - Endocrine (hypothyroidism, hypopituitarism)[4]
- Chronic infection
  - Tuberculosis
  - Intestinal parasites
- Iatrogenic
  - Corticosteroids
  - Central nervous system stimulants[15]
- Social/emotional deprivation

history will provide important information regarding genetic potential, developmental patterns, familial disorders associated with poor growth, and any adverse psychosocial environmental factors. The systemic review should elicit information about the various organ systems potentially responsible for the problem – especially vomiting, abnormal stools, or evidence of a hypermetabolic state.

2. *Physical examination.* Specific attention should be paid to height, weight, body proportions, head circumference,[13] and evidence of abnormal sexual development. It is also necessary to evaluate the blood pressure and optic fundi. (These are commonly neglected in the examination of small children.) The presence of minor congenital anomalies may provide a clue to a more important hidden anomaly, or to a chromosomal abnormality. The physical stigmata of thyroid disease, adrenal abnormalities, and the like are examples of conditions in which characteristic clinical findings may lead to specific diagnostic studies.

3. *Laboratory evaluation.* It is obvious that any laboratory study may be appropriate if indicated on the basis of the history and physical examination. The challenge to the physician, however, is to refrain from ordering all the possible studies, but to select only those necessary to rule out the *reasonable* diagnoses. Thus, it would be foolhardy to pursue the diagnosis of possible heart disease in an infant with no murmur, normal heart size, normal blood pressure and pulses, and no signs of heart failure. Nor does it make sense to order serum carotene levels and quantitative stool fat studies for a child with normal stools. A reasonable list of initial screening studies is given in Table 3. Subsequent additional studies should be done only when indicated by the finding of abnormal values in the initial work-up, or if appropriate management does not result in an improved growth pattern.

4. *Radiographic studies.* A determination of skeletal age (bone age) is very helpful in the diagnosis of growth failure,[3,4] as indicated in Table 1. Radiographs of the skull may identify calcifications, evidence of increased intracranial pressure, or abnormalities of the sella turcica. A chest radiograph provides information about heart, lungs, and bony structure.

Management

Failure to thrive is one of the few clinical problems for which hospitalization is indicated to provide an improved emotional and physical milieu.[1,12] Hospitalization for study provides an excellent opportunity to quantify caloric intake, observe any unusual behavior, and evaluate interactions of the child with his or her mother and with hospital personnel. Not infrequently, hospitalization results in dramatic weight gain and improved social responsiveness, thus obviating the need for exhaustive and expensive medical evaluations. An alternative to hospitalization is temporary placement in a warm, stimulating foster home, or with a family member capable of providing suitable stimulation and nutrition. This latter course, however, is often less acceptable to the child's family, who may prefer a more medically-oriented regimen until the results of hospitalization provide a diagnosis. Counseling and support by physician and social worker or family service agency are then indicated for the family to ensure that the child will receive adequate care upon returning home; careful follow-up is obviously necessary in this type of situation. The importance of adequate follow-up care is emphasized by the poor prognosis for many victims of environmental deprivation,[17] due possibly to the severity of the emotional problems in some of their mothers.[18]

A discussion of the treatment of all possible causes of failure to thrive is outside the scope of this paper. Obviously, specific treatment should be instituted for any organic disease that is identified. When the final diagnosis is genetic or familial short-stature or constitutional delay in development, substantial support and reassurance may be required to relieve the family's anxiety; again, careful follow-up is mandatory.

Table 3. Initial Laboratory Evaluation for Failure to Thrive

Complete blood count
Urinalysis including specific gravity, pH and culture
Erythrocyte sedimentation rate
Serum electrolytes, calcium, phosphorus, thyroxine
Blood urea nitrogen
Sweat chlorides
Tuberculin test
Buccal smear (females)
Stool for ova and parasites (depending on geographic area)
Urinary screen for metabolic disorders[16]

Discussion

A recent survey of problems seen by family physicians in Virginia reported that failure to thrive, though relatively uncommon, was the most frequent diagnosis in the category, "Certain Diseases of Early Infancy."[19] Stewart suggested that this may actually represent under-reporting.[20] A recent analysis of the recording of patient problems in family practice confirms that secondary diagnoses may not be identified or recorded;[21] thus, many patients with primary diagnoses other than failure to thrive may not have been reported in the Virginia study as having growth failure.

It seems apparent that the problem is of sufficient significance to warrant that family physicians be able to identify the affected patient, develop a logical differential diagnosis, and initiate appropriate studies. In most cases, the diagnosis will be apparent after relatively simple evaluation has been carried out. No professional person is in a better position to evaluate and manage the most frequent causes of growth failure (genetic, constitutional, and environmental) than the family physician.

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