Failure to Thrive (FTT) — Pathophysiology and Treatment

Inflicting harm upon children and toddlers, Failure to thrive (FTT) has psychosocial and organic origins and long-lasting repercussions on the general wellbeing of the society. This article aims to relate FTT from a medical perspective with a prime focus on the clinicopathological aspects.

Definition

Failure to Thrive (FTT) is understood to be sub-optimal weight gain and growth in infants and toddlers when compared to peers on standardized growth charts. It is multi-factorial in nature and has medical and psychosocial implications.

The most optimum definition of FTT is one based on standardized growth charts such as the national center for health statistics growth charts (NCHS).

There are specific objective measures formulated to impeccably identify FTT. They are of great significance and can be sequentially mentioned as follows:

- Weight below 2nd percentile for age/gender on more than 1 occasion (High-yield)
- Weight < 80% ideal weight for age
- Dropping 2 major percentile lines overtime beyond 6 months of age
- On the growth chart weight more than 2 standard deviations behind the mean for comparable colleagues of the same age and sex
- Weight for age (weight for height) Z score less than -2
- Decreasing trend in growth that has fallen two major growth percentile in a relatively small amount of time

While these criteria cannot yield 100% sensitivity in detecting every possible patient of FTT, they are not absolutely specific either. There are certain unique circumstances wherein the children meet these requirements but are still very much normal. Knowledge of the key features of these normal aberrations of growth is a must to evade the false-positive diagnosis of FTT. The same can be summarized as below:

<table>
<thead>
<tr>
<th>History of Prematurity</th>
<th>Genetic predisposition to short stature</th>
<th>‘Catch-down’ growth</th>
<th>Constitutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental percentile</td>
<td>• Normal</td>
<td>• Normal</td>
<td>• Normal</td>
</tr>
<tr>
<td>Development across the growth chart</td>
<td>• Uncorrected values are low, but the curve reveals catch up growth to normal eventually.</td>
<td>• It is an all-time low chart but does not keep falling across the percentiles.</td>
<td>• One encounters initial decrement of growth around 6 months to 1 year of age.</td>
</tr>
<tr>
<td>Birth weight</td>
<td>• Corrected age for gestation is to be considered in premature babies.</td>
<td>• Low to normal</td>
<td>• Above expected</td>
</tr>
</tbody>
</table>

### Epidemiology of Failure to Thrive

FTT incidence is about 5–10% of the pediatric population. About 4% of children admitted in tertiary and secondary care hospitals are diagnosed to have FTT and related complications. The most common etiology leading to FTT is lack of adequate supply of resources and nutrients. Almost 90% of FTT patients have sub-optimal levels of consumption of food secondary to parental issues such as poverty and neglect.

### Classification of Failure to Thrive

FTT can be segregated into severity grades based on weight and height parameters as follows:

<table>
<thead>
<tr>
<th>Growth parameter</th>
<th>Mild FTT</th>
<th>Moderate FTT</th>
<th>Severe FTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>75–90 %</td>
<td>60–74 %</td>
<td>Less than 60 %</td>
</tr>
<tr>
<td>Height</td>
<td>90–95 %</td>
<td>85–89 %</td>
<td>Less than 85 %</td>
</tr>
<tr>
<td>Weight/Height ratio</td>
<td>81–90 %</td>
<td>70–80 %</td>
<td>Less than 70 %</td>
</tr>
</tbody>
</table>

### Etiology of Failure to Thrive

Based on the etiopathogenesis and causative factors, FTT can be mainly segregated into the following categories:

- Inadequate intake
Inefficient or defective use of calories  
Inadequate absorption  
Excessive metabolic demands (High yield)

These are more generalized broad categories. The most common etiology leading to FTT is an inadequate intake of calories. Insufficient intake of calories essential for a toddler’s nutritional requirements manifests as retardation of physical and mental development. The possible factors leading to inadequate intake or absorption can be summarized as follows:

| Non-organic/Environmental | • Lack of available food  
|                          | • Psychosocial deprivation  
|                          | • Neglect/child abuse |
| Organic                  | • Impaired suck/swallow  
|                          | • Chronic illness |

Social issues such as poverty, economic stressors, marital issues, and family problems all lead to a dismal infant nutrition care which finally reflects as FTT.

Organic failure to thrive denotes medical conditions that are associated with chronic deterioration in the well being of the child and thus decreased percentiles for weight and height as compared to peers. Gastrointestinal disorders cause trouble with retention.

Critical and common systemic illnesses associated with FTT can be tabulated as follows:

<table>
<thead>
<tr>
<th>Illness</th>
<th>Example/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic systemic infection</td>
<td>HIV, Tuberculosis, and Parasitosis</td>
</tr>
<tr>
<td>Gastrointestinal disorder</td>
<td>Chronic diarrhea, GERD, Vomiting</td>
</tr>
<tr>
<td>Neurological disease</td>
<td>Cerebral palsy, Mental retardation</td>
</tr>
</tbody>
</table>
| Genitourinary system    | Urinary tract infection (UTI) is an important curable and common reason for FTT  
|                         | All patients of FTT need a mandatory urine examination to rule out UTI |

Malabsorption can be a consequence of several systemic disorders. The few prominent, relevant ones can be mentioned as follows:

- Celiac disease  
- Cystic fibrosis  
- Milk protein intolerance  
- Short gut syndrome

Many pathological situations can culminate in failure to utilize nutrients, which subsequently leads to failure to thrive. These are as follows:

- Syndromes-Chromosomal  
- IUGR or severe prematurity  
- Metabolic disorders-Congenital hyperthyroidism  
- Congenital infection  
- Amino acid and organic acid disorders  
- Storage disorders

Not infrequently, increased metabolic requirements ultimately precipitate a state simulating failure to thrive. The most relevant pathological causes of escalation in metabolic requirements of the child can be summarized as follows:

- Thyrotoxicosis
- Cystic fibrosis
- Malignancy
- Chronic infection such as HIV, Immune deficiency
- Congenital heart disease
- Amino acid and organic acid disorders

**Diagnosis of Failure to Thrive**

The diagnosis of FTT often relies on a good clinical observation strengthened by laboratory evidence. One should rather have a lower threshold to suspect FTT and then trace it accordingly. Important measures to follow once you suspect FTT can be summarized as follows:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| Take a good history | • Perinatal/prenatal  
• Growth/development  
• Dietary/feeding |
| Do a physical exam | • Underlying medical condition  
• Vitamin deficiencies due to malnutrition |
| Get labs          | • CBC for anemia  
• Serum electrolytes, etc  
• Hepatic and renal function  
• UA and urine culture  
• ESR and CRP  
• Tissue transglutaminase  
• Growth hormone/ thyroid |
| Use of growth charts | • Growth charts have been elaborately utilized to detect FTT and then to monitor the progress in patients successfully. |
| Feeding surveillance | • The technique of feeding might be the culprit and hence feeding under observation is useful. |

**History is the most critical and foremost component of evaluation** of a child suspected with FTT. A detailed meticulous history can indeed be instrumental in detecting these children and bringing them back to the normal growth curves before it is too late.

**History in a patient with FTT is multifaceted in nature.** It is mandatory to encompass all major medical and psychosocial aspects of the patient’s life to determine the dysregulated culprit. The prime essential features of the diverse history of FTT can be summarized as follows:

<table>
<thead>
<tr>
<th>Key history</th>
<th>Sub-components</th>
</tr>
</thead>
</table>
| Prenatal history    | • Prenatal maternal drug abuse, alcohol, and cigarette use  
• Obstetric history of the mother |
| Perinatal history   | • Birth weight  
• Neonatal asphyxia  
• Breastfeeding establishment and feeding-related issues in the perinatal period |
| Medical history     | • Immunizations  
• Past history of infections  
• Developmental milestones  
• Review of systems to detect any underlying organic cause of malnutrition and FTT  
• Specifically, one should rule out UTI, mental retardation, chronic gastrointestinal diseases |
| Social history      | • Life stressors in the family  
• Economic status  
• Social support system  
• Any clue to abuse and violence |
<table>
<thead>
<tr>
<th>Nutritional history</th>
</tr>
</thead>
<tbody>
<tr>
<td>• An extensive elaborate history of breastfeeding</td>
</tr>
<tr>
<td>• Use of supplements such as vitamins and minerals</td>
</tr>
<tr>
<td>• Food allergies</td>
</tr>
<tr>
<td>• Solid foods</td>
</tr>
</tbody>
</table>

The importance of examination cannot be undermined as it has the potential to reveal the tell-tale signs of some specific etiologies of FTT. The crucial aspects of physical examination which point to FTT can be tabulated as follows:

- **Neglect**: dirty fingernails, unkempt hair, diaper rash, and disheveled clothing
- **Developmental retardation**: hypotonia and persistent infantile clenched fists
- **Apathy**: absent facial expression and lack of eye contact, cuddling may be conspicuously absent.
- **Hunger and dissatisfaction**: there might be incessant thumb sucking.

A quintessential illustration of psychosocial FTT secondary to parental marital disharmony is mentioned below to make the concept loud and clear.

**Clinical vignette**: a 2-year old who is not growing.

A 2-year-old male child is being examined. His parents are going through a divorce and begin arguing in the office. They are asked to leave the room. A nurse takes the boy’s height and weight measurements and the pediatrician immediately becomes worried noticing no change in weight from the last visit which was already low.

The red signals in this child which must be registered by the pediatrician at once are:

- Stress
- No change in height and weight
- Low weight low (below the 2nd percentile)

**Management of Failure to Thrive**

FTT is mainly secondary to organic or psychosocial factors. Due multi-pronged attack on FTT, it is essential to revive the health of the pediatric patient. A dedicated team approach is the best solution in this regard.

Specific elements of management of non-organic FTT are as follows:

- Reinforcement for positive eating behavior
- Pediatric dietitian can be involved to assess the quantity and composition of food intake.
- It can also be instrumental to recommend strategies for increasing energy intake.
- Clinical psychologist or social services
- Child abuse specialist consult if abuse/ neglect is suspected.
- **Hospital admission only if the concerned patient is less than 6 months of age** or suffers from severe FTT in which case one needs active re-feeding.

**Outcome of Failure to Thrive**

If FTT is detected and treated in a timely and dedicated manner it has a good prognosis. However, not infrequently, albeit being treated, FTT can lead to the following situations:
Continued under-eating
- Underweight
- Short term impaired development

However, there is no doubt that untreated FTT is worse. The most crucial potential implications of untreated FTT can be mentioned as follows:

- Short stature
- Secondary immune deficiency
- Long term cognitive and behavioral effects

**Note:** Re-feeding syndrome is an important distinct entity associated with overzealous treatment of FTT that one should be aware of.

The key features of re-feeding syndrome are as mentioned below:

- Hypophosphatemia
- Hypomagnesemia
- Fluid retention
- Hypokalemia

In order to evade re-feeding syndrome, a slow introduction of calories with daily increments of about 10–20% should be made. The initial caloric supplementation should not be more than 20% over and above the child’s intake. It is perfectly safe to start the child otherwise on about half of the normal energy demand.

**Summary of Failure to Thrive**

FTT is defined as a sub-optimal weight gain and growth in infants and toddlers when compared to peers on standardized growth charts. It is multi-factorial in nature and has medical and psychosocial implications.

There are specific objective measures based on weight/age and height/age ratios formulated to impeccably identify FTT.

There are few situations such as constitutional short stature and children with a genetic predisposition to short stature which is why it falsely appears that the child has FTT. Hence, several other factors such as parental percentiles and development across the growth charts need to be considered.

FTT affects about 5–10% of the pediatric population.

**FTT is segregated into grades of mild, moderate and severe** based on growth parameters such as weight, height, and weight/height ratio.

Based on etiopathogenesis, FTT is classified as FTT due to inadequate intake of calories, inefficient use of calories, inadequate absorption, malabsorption and FTT secondary to excessive metabolic demand.

The diagnosis of FTT relies mainly on clinical suspicion fostered by laboratory workup. **Detailed history taking and meticulous physical examination to pick any signs of FTT are essential.**

Growth charts are extremely useful. Feeding surveillance is of prime importance as the majority of children suffer from FTT due to inadequate intake of calories.

Management depends upon identification of the causative factor, correction of the deterioration in growth and elimination of the causative factor for long term control. If left
untreated, FTT has serious harmful repercussions such as cognitive and functional decline, short stature and psychosocial issues.

Re-feeding syndrome is a complication of overzealous rather acute correction of FTT. It is characterized by electrolyte imbalance and fluid retention. Slow, quasi-physiological correction of the caloric depletion is the key.

Review Questions

The correct answers can be found below the references.

1. Which of the following indicates severe FTT?
   A. Height less than 80 %
   B. Weight less than 75 %
   C. Weight /Height ratio less than 70 %
   D. Weight/ Height ratio less than 85 %

2. Which of the following is a feature of Re-feeding syndrome?
   A. Hyponatremia
   B. Hyperkalemia
   C. Hypermagnesemia
   D. Hypophosphatemia

3. Which of the following statements is false?
   A. The initial caloric supplementation should be more than 40 % over and above the child’s intake to prevent the re-feeding syndrome.
   B. FTT can lead to cognitive dysfunction.
   C. The most common cause of FTT is inadequate intake.
   D. FTT affects about 5-10% of the pediatric population.

References


Failure to thrive: an ambulatory approach. Schwartz R, Abegglen JA.

Nurse Pract. 1996 May;21(5):19-20, 26-8, 31-2

Correct answers: 1C; 2D; 3A