Investigating the child with malnutrition

Each month we present authoritative advice on the investigation of a common clinical problem, specially written for family doctors by the Board of Continuing Medical Education of the Royal Australasian College of Physicians.

DAVID BREWSTER
BA(Hons), MD, MPH, FRACP, PhD

Professor Brewster is Clinical Dean, Northern Territory Clinical School, Flinders University, SA, and Head of Paediatrics at the Royal Darwin Hospital, Darwin, NT.

Series Editor
CHRISTOPHER S. POKORNY
MB BS, FRACP

Dr Pokorny is Honorary Secretary, Board of Continuing Education, Royal Australasian College of Physicians, and a gastroenterologist in private practice, Sydney, NSW.

Terminology

A confusing array of terms and classifications is used to describe malnutrition. I will focus on undernutrition, excluding both obesity and specific nutrient deficiencies.

In the developed world, malnutrition is usually described as 'failure to thrive,' which means growth retardation or low weight-for-age. Failure to thrive usually refers to a child below the 3rd percentile for weight-for-age. However, this cut-off tends, on one hand, to identify genetically small children with transient growth deceleration due to an infection and, on the other hand, to miss significant weight loss in a bigger child. Consequently, failure to thrive should be seen as growth deceleration or crossing weight percentiles, particularly falling through two percentile ranges (e.g. from 50th to the 10th percentile or the 75th to the 25th percentile) on the weight chart (Figure 1).

Children who are underweight may also be classified as 'wasted' or 'stunted'. Stunting or short stature is defined as a height-for-age below two standard deviations of the mean (Z scores), but it needs to be appreciated that about 3% of normal children will grow on or below this cut-off. If a stunted child has had two height measurements at least a year apart, then the height velocity can also be charted. For example, the 3rd percentile for height velocity in boys of 7 to 12 years of age is about 4 cm/year.

Where stunting is caused by undernutrition, it represents chronic malnutrition. Wasting, on the other hand, represents more acute malnutrition and is measured as a low weight-for-height. Wasting means a child is thin, and severe wasting is called marasmus (Figure 2). The other form of severe malnutrition is kwashiorkor, which is rarely seen in Australia, and is characterised by oedema, hypoalbuminaemia, dermatitis and fatty infiltration of the liver. Although some underweight children will be both wasted and stunted, many do not satisfy criteria for either wasting or stunting and are merely underweight for age.

IN SUMMARY

- **Growth failure is the principal manifestation of malnutrition in children.**
- **Normal growth variations and errors in charting must be recognised and not labelled as malnutrition.**
- **Anthropometric assessment can differentiate wasting and stunting.**
- **In the primary care setting, major organic disease is uncommon (<5%) and can usually be suspected on clinical assessment.**
- **Routine hospital admission with an expensive laboratory work-up to exclude rare causes is considered inappropriate medical practice in the absence of other manifestations of illness.**
- **A detailed dietary history and assessment for psychosocial deprivation are important.**
- **Dietary improvement with home visits has been shown to increase growth in a fifth of children in a community study.**

Anthropometric indices

Growth measurements and charting are essential in investigating a child with possible malnutrition. Key measurements are weight (kg), length or height (cm) and head circumference (cm). For growth charting, length is measured in children younger than 24 months and height thereafter, because there is a mean difference of about 1.5 cm between height and length, and growth charts change from length to height at 24 months. Accuracy of measurements is essential, particularly for length or height. Errors in measurement are very common and should always be considered as the explanation for anthropometric indices that do not fit the clinical appearance of the child. Note that in some instances, anthropometric assessment alone is not a good indicator of nutritional status, such as in children with oedema and hypoalbuminaemia (kwashiorkor).

What growth standard should be used? Until recently, the conventional answer was the National Center for Health Statistics growth curves, which are the basis of growth charts used in Australia (Figure 1). However, these are based on North American children, most of whom were bottle fed, so they may not be appropriate for breastfed children. New international growth curves are being developed which should also be used in Australia and will probably be introduced soon. Revised American (www.cdc.gov/growthcharts) and European (www.eurogrowth.org) growth curves have recently been published and are more appropriate for breastfed children. If the

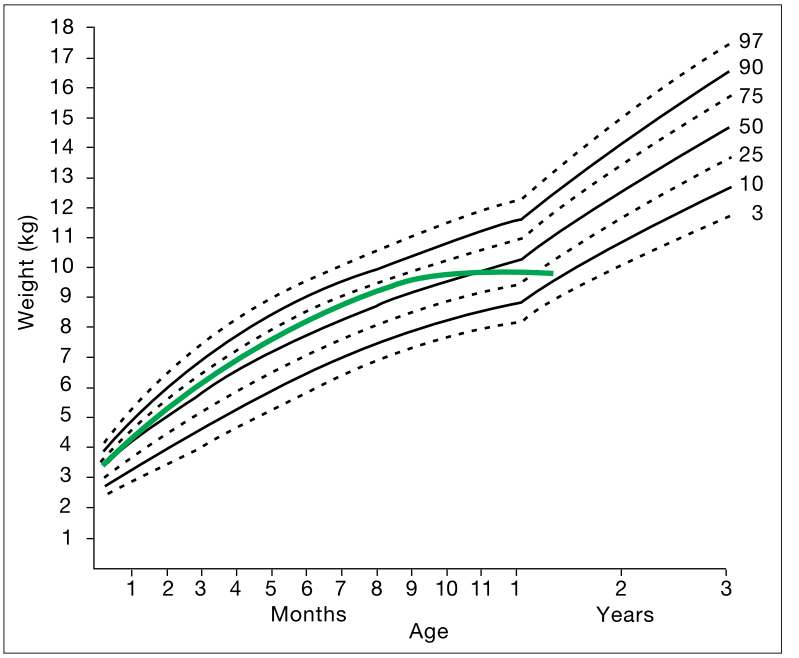

Figure 1. Growth curve of a 16-month-old boy with failure to thrive in the weaning period.

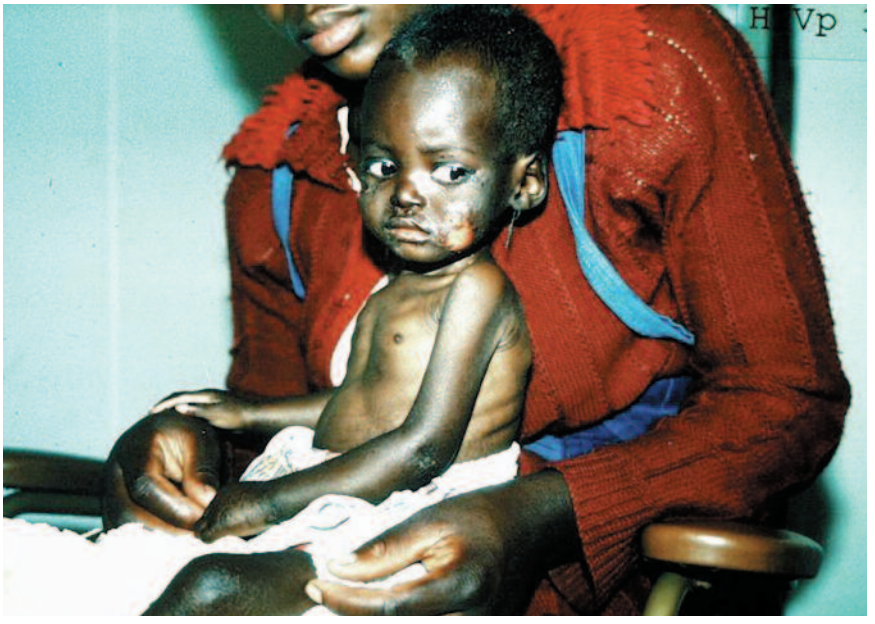

Figure 2. An African child with marasmus due to AIDS.

child was premature, correction of age must be made during the first 18 months for head circumference, 24 months for weight and 40 months for height.[1]

Routine growth monitoring is a key component of infant and child health services. It has come under scrutiny in recent years in both the developing and developed world, being criticised as a waste of valuable time and causing unnecessary parental anxiety. A systematic review found no reliable evidence of a benefit.[2] A UK consensus meeting recommended that infants need be weighed only at birth and when attending for immunisations and surveillance checks, with only those causing clinical concern weighed and measured thereafter.[3] In settings where only mild malnutrition is seen, weight-for-age alone may be the most appropriate anthropometric index.[4] These issues are best decided at a regional level on the basis of the existing evidence and local circumstances.

Table. Changing energy requirements with age

Age	Energy requirements per kg		Energy requirements per day	
	kJ/kg/day	kcal/kg/day	MJ/day	kcal/day
0 to 3 months	460	110	2.1	500
3 to 6 months	420	100	2.7	650
6 to 9 months	400	95	3.1	750
9 to 12 months	420	100	3.8	900
1 to 2 years	440	105	4.8	1200
2 to 4 years	410	100	5.9	1400
4 to 6 years	380	92	7.1	1700
6 to 8 years	350	83	7.5	1800
8 to 10 years	290	69	7.9	1900

Clinical assessment

All children being investigated for malnutrition should have a complete history and physical examination. The history will establish whether the child was premature or of low birthweight because of intrauterine growth retardation. Clinical assessment also needs to establish whether there are signs or symptoms of organic disease.

A dietary history, developmental assessment, observation of parent–child interaction, and assessment of family stress, dysfunction or neglect are also important. It is always worth ensuring that:

- the infant formula is being prepared correctly and not diluted as a cost saving device
- excessive fruit juice is not replacing milk
- low energy 'diet' foods are not being given in the erroneous belief that they are beneficial to health
- food fads or restricted diets for alleged food allergies are not causing inadequate energy or micronutrient intake.

If there are problems in any of these areas, more detailed assessment with the assistance of a dietician or other allied health professionals should be considered.

Normal growth variants

In investigating a child with possible malnutrition, it is important not to cause undue parental anxiety by incorrectly labelling a child who has normal nutritional status. Errors in measurement or charting are one pitfall, as mentioned previously. Infants show considerable variability in the early weeks, with 5% shifting

up or down in percentiles as part of normal growth.[3] This is often referred to as 'catch-up' growth or 'catch-down' adjustments. In the latter case, breastfeeding problems need to be considered without causing unnecessary anxiety to a mother.

Familial short stature is a common normal variant, and unnecessary parental anxiety can be avoided by adjusting for parental height (taking the average of both parents' height), although it can be misleading unless allowance is made for regression to the mean.[5]

Constitutional growth delay occurs in a subgroup of mostly boys whose length or height falters between 3 and 36 months of age with delayed bone age – ultimately they attain normal adult height. Studies have found that the label 'constitutional growth delay' tends to be used for middle-class families whereas 'failure to thrive' is more likely to be used for poor families with the same degree of growth retardation.[3]

Children commonly have weight loss and anorexia accompanying infections, particularly gastrointestinal infections, but this is followed by catch-up growth provided the child receives a diet adequate in protein and energy.

Organic or nonorganic causes

Historically, failure to thrive was divided into organic and psychosocial causes. Major organic disease is found in less than 5% of community cases of failure to thrive, and can usually be diagnosed from signs and symptoms accompanying the growth failure. Furthermore, even with organic disease, failure to thrive may be due to poor nutrition in addition to the disease process.

Nonorganic causes imply poor emotional or physical nurturing, which is often classified as reactive attachment disorder, but infant temperament and difficulty feeding may also be factors in poor growth. Abuse, neglect or deprivation is likely to result in malnutrition, but these account for only 5 to 10% of failure to thrive cases in developed countries.

Many consider this organic/psycho - social dichotomy obsolete since most cases are of mixed aetiology.

Undernutrition

Undernutrition is a factor in up to two-thirds of cases of growth retardation in childhood, and the degree of wasting and poor dietary intake may often not be recognised. Caregivers may often not appreciate the high energy needs of infants and toddlers, which are considerably greater than for adults on a bodyweight basis (Table). They may also not appreciate the need for catch-up growth after illness. If the child's intake does not increase after illness, catch-up growth may not occur, and the child continues to grow along the percentile to which he or she has fallen during the illness.

Laboratory tests

The tendency to order many tests to exclude an underlying organic disease needs to be avoided as it has a very low yield. In one report, abnormal test results aided the diagnosis in only 16% of inpatients with failure to thrive and only 0.8% (39 of 4880) of tests were helpful.[6] Vomiting was often associated with organic disease. Wright[3] suggests the following screening tests:

- full blood count
- thyroid function tests
- urea and electrolyte levels
- antiendomysial antibodies
- midstream urine
- chromosomes in girls to exclude Turner's syndrome
- chest x-ray, sweat test, HIV serology and Mantoux test if appropriate.

These screening tests are only done to exclude pathology, most of which is evident clinically. For example, coeliac disease, hypothyroidism, Turner's syndrome and renal diseases may not always be evident from the history and physical examination alone.

There are no reliable early laboratory tests of nutritional status, since serum albumin, cholesterol, triglycerides and β-carotene levels are unreliable or late signs of nutritional deficiency. Vitamin A or zinc levels may be unreliable because serum levels do not always change in parallel with body stores. The general experience with investigating children with malnutrition is that laboratory studies not suggested on the basis of the initial clinical examination are rarely helpful.

Trial of therapy

Children with growth retardation in the primary health care setting rarely need hospital admission or dietary supplements but can be managed in the primary care setting in the first instance. For example, a recent randomised controlled trial in the UK found a significant benefit for an intervention led by health visitors, with one-fifth of children showing improvement after dietary advice,[7] although two other randomised trials failed to document a growth benefit of home visits.[8,9] With more severe degrees of malnutrition, the most important investigation in the hospital context is a trial of feeding and close observation of parent–child interactions and feeding patterns. Hospital admission is much less effective in finding

an underlying cause of malnutrition than in providing an environment in which to assess dietary intake, feeding techniques and parent–child interactions.

Conclusion

In conclusion, investigating the child with malnutrition relies heavily on growth charts but must take into account normal variations in growth, as well as the all too common errors in measurement. All children investigated for malnutrition should have a full history and physical examination with particular emphasis on signs and symptoms of organic disease, a dietary history, developmental assessment and assessment of parent–child interaction (looking for family dysfunction, stress or neglect). The tendency to order an extensive battery of laboratory investigations to exclude the long list of differential diagnoses associated with malnutrition is not appropriate, but there may be a need for selective tests to exclude organic disease suggested in the clinical assessment. Finally, for milder cases, follow up after dietary advice with home visits if feasible can be done in the primary health care setting. Paediatric specialist referral is needed only in the minority of children who are more severely affected or whose condition is not improving. MT

References

1. Schwartz ID. Failure to thrive: an old nemesis in the new millennium. Pediatr Rev 2000; 21: 257-264.
2. Garner P, Panpanich R, Logan S. Is routine growth monitoring effective? A systematic review of trials. Arch Dis Child 2000; 82: 197-201.
3. Wright CM. Identification and management of failure to thrive: a community perspective. Arch Dis Child 2000; 82: 5-9.
4. Raynor P, Rudolf MC. Anthropometric indices of failure to thrive. Arch Dis Child 2000; 82: 364-365.
5. Wright CM, Cheetham TD. The strengths and limitations of parental heights as a predictor of attained height. Arch Dis Child 1999; 81: 257-260.
6. Berwick DM, Levy JC, Kleinerman R. Failure to thrive: diagnostic yield of hospitalisation. Arch Dis Child 1982; 57: 347-351.
7. Wright CM, Callum J, Birks E, Jarvis S. Effect of community based management in failure to thrive: randomised controlled trial. Br Med J 1998; 317: 571-574.
8. Raynor P, Rudolph MC, Cooper K, Marchant P, Cottrell D. A randomised controlled trial of specialist health visitor intervention for failure to thrive. Arch Dis Child 1999; 80: 500-506.
9. Black MM, Dubowitz H, Hutcheson J, Berenson HJ, Starr-RH J. A randomized clinical trial of home intervention for children with failure to thrive. Pediatrics 1995; 95: 807-814.