Current Practice

CHILD CARE IN GENERAL PRACTICE

Failure to Thrive

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By failure to thrive one means the inability of an infant to reach the standards of weight and height normal for a child of that particular age. In practice the paediatrician becomes concerned when one or both of these measurements remain well below the three-percentile range (Fig. 1). This means that more than 97% of the child population for that age either weigh or measure more than the child in question. Essentially this is a problem confined to the first two years of life and I propose to limit the discussion to problems arising in this period of time.

FIG. 1.—A marasmic child.

A number of conditions producing this clinical situation include the various causes of vomiting, gastro-intestinal infections, and steatorrhoea and will be discussed by other contributors to the series and therefore will not be mentioned in any detail.

Putting the problem simply the infant does not thrive because: (1) The food is either incorrect or badly prepared. It is the right food but there is not enough of it. (2) The food cannot be taken properly. (3) It is the right food but it is not absorbed satisfactorily. (4) It is absorbed properly but cannot

be metabolized. (5) It can be metabolized but the conditions for optimum utilization are not present.

If we adopt this rule of thumb we can draw up a list of the causes referable to each section as follows:

- (1) *Insufficiency of Diet*
 - Incorrect preparation and presentation
 - Unsuitable feeding habits
 - Disturbed mother-child relationship
 - Nephrogenic diabetes insipidus
- (2) *Inability to take food properly*
 - Local lesions of mouth and jaw
 - Cleft palate and hare lip
 - Micrognathia
 - Choanal atresia
 - Upper gastro-intestinal tract
 - Hiatus hernia
 - Oesophageal stricture
 - Pyloric stenosis
 - Neurological
 - Muscle weakness due to anterior spinal muscular atrophy
 - Congenital hypotonia
 - Facial palsy
 - Brain damage due to birth injury or kernicterus
 - Congenital developmental abnormality
 - Hydrocephalus
 - Hydrancephaly
 - Severe congenital heart disease
 - Persistent respiratory infection
- (3) *Impaired Absorption*
 - Low-grade bowel infection, including giardiasis
 - Milk allergy
 - Lactose intolerance
 - Coeliac disease
 - Fibrocystic disease
 - Congenital dilatation of colon (Hirschsprung)
- (4) *Absorbed, but cannot be Metabolized Satisfactorily*
 - Localized infection
 - Hepatitis
 - Urinary infection
 - Generalized diseases
 - Tuberculosis
 - Still's disease
 - Chronic infection
 - Metabolic disorders
 - Diabetes
 - Hypothyroidism
 - Galactosaemia
 - Cystine storage disease
 - Glycogen storage disease
- (5) *Metabolized, but Conditions for Optimum Utilization not Present*
 - Children of low birth weight born at term (intrauterine dwarf)
 - Chromosomal abnormalities
 - Brain tumour (mid-brain)
 - Mental retardation
 - Chronic renal disease

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In considering the long but not exhaustive list of possibilities detailed above it should be remembered that the commonest reasons for failure to thrive are mismanagement and low-grade intestinal and respiratory infections.

Clinical Approach

A full, carefully obtained history will enable the practitioner to get details of the feeding routine and the general handling of the child. If he knows the family well he may be aware of the domestic situation, but on occasions he may need additional information which might easily be given by the health visitor for the district.

He should be acquainted with the story of the pregnancy and delivery in respect of maternal illness or abnormal labour and should determine whether a similar illness has been seen in any other child in the family or among near relatives.

While doing this he has had the chance to observe the child. Does the child look odd? Is he a mongol or obviously retarded mentally (Fig. 2)? Are there any easily discernible congenital abnormalities suggesting a possible chromosomal abnormality? Do we see a mouth-breathing baby with a nasal discharge that suggests nasal or post-nasal obstruction? Is this an infant with a very small lower jaw whose tongue is too big for the mouth

FIG. 2.—A cretin.

and tends to fall back into the posterior pharynx? Is the child cyanosed and is there any bulging or asymmetry of the thorax such as one might see in congenital heart disease? Does the baby lie flaccid with very little movement and with a weak cry which produces some recession of the lower ribs indicative of anterior spinal muscular atrophy? What is the daily fluid intake? If the baby drinks excessive amounts of fluid and is constantly wet one should think of diabetes insipidus. In this condition the child drinks so much fluid (four to five pints (2.3 to 2.8 l.) a day) that he has no desire for food.

What is the domestic situation? Is it a happy well-run home with sensible secure parents or is it an untidy badly run establishment with many children and possibly an inadequate weekly income? Does this wasted but active child wolf down the first correctly made up feed offered him and then look around for more? Is there evidence of a mild gastro-enteritis or an infection of the ears; are the stools greasy and do they smell singularly unpleasant as in fibrocystic disease? Is the child pot-bellied and constipated, or pot-bellied with greasy, bulky stools suggesting, respectively, Hirschsprung's disease or the coeliac syndrome? Are there any abnormal physical signs—for example, jaundice and enlargement of the liver—suggesting a possible hepatitis or galactosaemia? Is there hydrocephaly or microcephaly or any neurological signs suggesting a cerebral palsy? Can we detect clinical signs of rickets? Is there any bowing of the long bones? Are the epiphyses thickened? Is there any bossing of the forehead with delayed closure of the anterior fontanelle? Are the joints of the hands and the larger joints deformed with pain and swelling as found in rheumatoid arthritis? Has the child coarse skin, a harsh cry, a protruding tongue, and a small umbilical hernia suggesting cretinism?

Investigations

Certain simple but important observations can be made at home or in the surgery. Firstly, the response to a correctly prepared feed of adequate volume should bring to light the case of feeding mismanagement: here the supervision should be shared with the local health visitor or district nurse. Next the examination of the urine for protein, reducing substances and acetone, and pus cells would pinpoint urinary infection, diabetes, or galactosaemia respectively and in certain circumstances indicate the need for a more detailed study of renal function. It is preferable to use either Benedict's solution or the Clinitest material in the first instance. If this is positive, Clinistix, which is specific for glucose, will distinguish between this hexose and the other reducing substances. These tests might lead one to investigate further in hospital for glycogen-storage disease or the Fanconi syndrome.

A full blood count might demonstrate an anaemia or a leucocytosis and a stool examination reveal either fatty droplets suggesting a steatorrhoea or a *Giardia lamblia* infection; culture might produce a growth of enteropathic organisms. A positive Mantoux test in a young unvaccinated child would suggest the possibility of an active primary tuberculous lesion. Finally a skin test to exclude cystic fibrosis of the pancreas would be done with the child as an out-patient. In this test one collects a small amount of body sweat and determines the level of sodium and chloride. This is markedly raised in this disorder, the figure being in the region of 80 and 100 mEq/l. respectively.

In hospital further studies would be planned in relation to the clinical diagnosis and the preliminary tests carried out by the practitioner. They can be grouped by systems or by special techniques.

Gastro-intestinal Investigations

Radiological.—These examinations will include barium meal and follow-through studies plus barium enema in certain cases, and will assist in the diagnosis of oesophageal and pyloric obstructions, hiatus hernia, gut reduplication, Hirschsprung's disease, and in coeliac disease, where jejunal clumping and segmentation can be seen.

Tests for Malabsorption.—These should include fat-balance studies (glucose tolerance and xylose excretion tests) and intestinal biopsy. Here a small piece of jejunal mucosa is removed using a small intestinal capsule which contains a retractable cutting blade. In coeliac disease the mucosal villi are appreciably flattened—a significant diagnostic feature.

Respiratory Investigations

Radiological.—These examinations will include bronchography in such disorders as bronchiectasis, tuberculosis, and cystic fibrosis of the pancreas.

Neurological Investigations

Radiological.—These investigations will include air encephalography and angiography.

Electroencephalographic.—These investigations would identify hydrancephaly, cerebral tumour, and so on.

Biochemical and Histochemical.—Blood and bone-marrow would be examined; also material from the brain and from biopsy of the rectal mucosa in the lipidoses and the demyelinating conditions.

Other Investigations

Cardiological.—In cases of congenital heart disease electrocardiography, cardiac catheterization, and angiography should help to establish a diagnosis.

Chromosomal.—Examination of cells from buccal smears for the presence of a peripheral chromatin mass and the culture of white cells with special preparation and staining of the chromosomes might pinpoint an abnormality of the sex or autosomal chromosomes.

Special Biochemical.—These tests would include estimations of the activity of certain enzymes, the estimation of the urine chromatography, serum electrophoresis, the study of the serum electrolytes, and other individual determinations to identify individual metabolic upsets.

Treatment

Prevention

The problem of failure to thrive would be much reduced if we could ensure that all needful mothers were prepared to attend well-staffed clinics for instruction and supervision. This education is offered in infant welfare and certain general-practitioner baby clinics and can be augmented by the health visitor, who should be aware of the particular problem and also of the clinical appraisal of the doctor in the case and his instructions to the mother.

The health authorities would probably identify the problem family and institute domiciliary as well as clinic supervision. In special cases the mother could be offered residential accommodation for herself and two or three of her children where she could rest and relax while her instruction was proceeding. Such homes are run by voluntary organizations in different parts of the country, sometimes in conjunction with a local authority. They provide very useful services, but unfortunately they are too few in number.

Continued slum clearance with good rehousing should reduce the incidence of low-grade intestinal and respiratory infection.

In families where there is reason to suspect an inherited disorder it is important to examine thoroughly the newborn infant on several occasions to exclude any congenital structural abnormality or a metabolic error, and if such a disturbance is detected—for example, galactosaemia or phenylketonuria—treatment should be instituted immediately. The preliminary diagnosis of galactosaemia has been described above. It can be confirmed by estimations of the activity of the enzyme galactose uridyl transferase in the child's red cells. In affected cases this will be nil, hence the inability to convert galactose to glucose. In tests for phenylketonuria either ferric chloride solution is added to acidified urine, which turns green in affected cases, or a Phenistix paper (ferric ammonium sulphate) is dipped in the urine and changes from white to grey-green. It is important to confirm this by determining the serum phenylalanine level. Normal levels are 2–4 mg.%, but in affected cases the figure rises to 16 mg.% or more.

Correct dietary advice concerning milk and vitamin preparations and the sensible use of antibiotics for the respiratory and intestinal infections will reduce the volume of the problem greatly. In order to do this the practitioner or nurse must become familiar with the method of reconstituting certain milk preparations and with their detailed composition and calorie value. This will be discussed in other articles. The addition of an acidifying preparation containing the lactobacillus after a gastro-enteritis or during a course of antibiotic therapy is helpful and a preparation such as Enpac can be added to the feeds for this purpose.

The management of the large and heterogeneous group of disorders concerned in failure to thrive cannot be discussed in

detail and the treatment of four conditions only will be described: galactosaemia, phenylketonuria, diabetes, and hypothyroidism.

Galactosaemia

In galactosaemia (Holzel and Komrower, 1957) and phenylketonuria (M.R.C. Report, 1963) the aim is to establish the diagnosis as early as possible and to remove lactose (or galactose) and phenylalanine respectively from the diet. By doing this one hopes to prevent the development of any physical stigmata and to allow normal mental development. The real danger period is the first two years of life, when there is maximal brain development, but the diet should be maintained as long as the child will permit.

In galactosaemia it is essential to avoid all milk-containing foods, and lactose-free milks—for example, Galactomin, Low Lactose Cow and Gate, and Nutramigen—have been produced and can be used with safety. Margarine should be substituted for butter (either vegetable oil or the products that do not contain added butter), and cheese must be removed from the diet. Baby foods that do not contain added milk are safe and cereals that have no added lactose, such as rice flour and corn-flour, can be given.

It is possible to maintain this diet for many years and the author has patients who are physically and mentally well whose condition was diagnosed very shortly after birth and who are now more than 10 years of age (Fig. 3).

FIG. 3.—A child with galactosaemia diagnosed at birth. She has never drunk milk.

Phenylketonuria

The treatment of phenylketonuria is more difficult, as phenylalanine, which is an essential amino-acid, is found in appreciable amounts in meat, milk, eggs, fish, and bread. Once again special "milks" have been devised—for example, Minafen, Cymogran, Lofenalac, and Albumaid X.P., and a special phenylalanine-low bread is baked. The majority of green vegetables can be given without worry, but the amount of potatoes and root vegetables must be prescribed. It is essential to arrange a diet that contains between 25 to 50 mg. phenyl-

alanine/kg. body weight per day, as serum levels of phenylalanine below 1 mg.% can be dangerous. The babies will not thrive and may develop megaloblastic anaemia. This is prevented by appropriate amino-acid and adequate mixed vitamin intakes.

It is difficult to maintain these children on a phenylalanine-low diet when they grow older, as the variety of permitted foods is far more restricted than in galactosaemia. As a result paediatricians are allowing a more normal diet, in the hope that after 4 or 5 years of age this will not prejudice the further mental development of the child. Only time will tell whether this is true, but in the light of present knowledge it is a justifiable risk to take. It has been shown that a too-rigid supervision of the diet, whether it be in the above-mentioned conditions or in diabetes, is likely to give rise to psychological upsets in these children.

Diabetes

In diabetes the ability to control the average case will depend on the willingness of the child and parent to accept the disability and on the doctor creating an atmosphere of confidence by giving regular and practical advice over the years. To obtain these requirements the patient must be allowed to lead as normal a life as is possible under the circumstances, and the physician must permit a certain elasticity of approach in the control of any particular case.

The child must have sufficient calories for normal growth and activity. The diet must be varied and with an adequate vitamin complement. The supervision should be regular in order to avoid acetonuria and the development of acidosis. The majority of physicians do not restrict protein and fat and allow a liberal but measured amount of carbohydrate (approximately

4 g./lb. (8.8 g./kg.) body weight). Insulin dosage is then adjusted to allow of some glycosuria throughout the 24 hours. It is usually possible to maintain young children on a single daily dose of long-acting insulin (lente insulin) or a combined dose of protamine zinc and soluble insulin, but towards puberty when control becomes more difficult a twice-daily injection of soluble insulin is advisable. A careful watch must be kept for hypoglycaemic reactions and the children and parents must be taught to recognize the symptoms and to give carbohydrate in an easily absorbable form.

Hypothyroidism

In hypothyroidism the principle of treatment is, in the first instance, to give thyroxine or thyroid extract in increasing doses to the limit of tolerance and then to increase the daily dose as the child grows. The level of serum-protein-bound iodine, which should range between 6 and 8 μ g./100 ml., and the maintenance of normal growth are good indices of adequate treatment. The usual initial dose in infancy is thyroxine 0.025 mg. (thyroid extract 20 mg.), working up steadily to thyroxine 0.1 mg. by the end of the first year and afterwards increasing steadily to 0.3 to 0.4 mg. daily. Overdosage gives rise to tachycardia, restlessness, and diarrhoea.

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TO-DAY'S DRUGS

Local Analgesics

Many local analgesic drugs have been used since Koller first demonstrated the local analgesic properties of cocaine on the cornea in 1884; only five, however, are in common use to-day in Great Britain—amethocaine, cinchocaine, cocaine, lignocaine, and procaine.

Procaine

Procaine (ethocaine, Novocain, Planocaine, Neocaine, Novutox) was synthesized by Einhorn in 1904 and was for many years the standard local analgesic drug in this country. It is still extensively used all over the world, partly on economic grounds and partly because it is rapidly detoxicated. Procaine is hydrolysed by the enzyme procaine esterase, which is present in the plasma and liver, at the rate of 1 g. per hour, and consequently large volumes of solutions of effective concentrations can be injected with relative safety for massive nerve blocks and infiltrations. It is not effective as a topical agent except in very high concentrations.

Lignocaine

Lignocaine (Xylocaine, Lidocaine, Duncaine) was introduced into anaesthetic practice by Gordh in 1948. This drug rapidly achieved popularity and has to some extent replaced procaine

because of its speed of onset, greater duration of analgesia, and topical action. Lignocaine, though not the ideal local analgesic drug, represents the nearest approach to this concept available to-day. Amongst the criteria of an ideal agent are rapid onset and adequate duration of analgesia, low systemic toxicity and absence of side-effects, reversible action, lack of irritation, effectiveness by all routes of administration, solubility in water, and stability during storage and after repeated sterilization.

There is a latent period with lignocaine between the time of injection or topical application and the onset of analgesia, so that five, or preferably ten, minutes should always be allowed before starting surgery. The duration of action without the addition of adrenaline is about one and a half hours. Provided the dose is related to the patient's weight, general condition, and rate of absorption into the circulation, the systemic toxicity and incidence of side-effects are low. The action is reversible and solutions are comparatively non-irritant to the tissues—the pH of a 2% solution being 6.9. Lignocaine is effective by all routes of administration and is available as the water-soluble hydrochloride salt in solutions for injection of 0.5, 1, 1.5, and 2%, with or without the addition of adrenaline; and for topical application in 2 and 5% concentrations in the forms of a jelly, syrup, and ointment. The solutions are stable for long periods and can be autoclaved many times without loss of potency.

This drug falls short of the ideal because the onset of analgesia is not immediate, the duration is limited, and serious, even fatal, side-effects can result from overdosage.