

Discussion

The incidence of giardiasis in housed infants with diarrhoea (3%) was low; the higher incidence in itinerant infants (12%) was probably due to overcrowding and low standards of sanitation. Infants may become infected soon after birth and may suffer severe diarrhoea. The apparent better response to metronidazole in younger infants may indicate a greater likelihood of the diarrhoea in them being caused by the parasite than in the older infants; even so in no infant could one be sure of the relationship of the parasite to the diarrhoea, particularly in the absence of viral studies. Since a smaller proportion of infants with giardiasis required intravenous rehydration compared with those in whom the parasite was not found, diarrhoea

associated with this parasite tended to be less severe.

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Muscular changes in Engelmann's disease

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SUMMARY In a case of Engelmann's disease in an 11-year-old Japanese boy the muscular changes were studied in detail. Muscle weakness was maximal about the pelvic girdle. Muscle biopsy showed the selective atrophy of type II fibres, and no degenerative change could be seen histologically, histochemically, or electron-microscopically. Although the distribution of muscular weakness in Engelmann's disease is similar to that of a progressive muscular dystrophy, the disease does not seem to be a myopathy.

Engelmann's disease (progressive diaphyseal dysplasia) is a bizarre disorder, characterised by symmetrical cortical thickening and sclerosis of the diaphyses of long bones; its aetiology is still unknown. The principal clinical manifestations are malnutrition, muscular weakness, a waddling gait, and leg pains. No specific laboratory finding has been identified.

Most studies have been directed towards the bony changes, and little is known of the systemic ones. Muscular changes have received little attention, although they are often present,¹ and the disease has sometimes been confused with muscular dys-

trophy.²⁻³ We describe an additional case, and report the muscular changes in detail.

Case report

This Japanese boy was 11 years when he first visited our clinic. Family history was not remarkable. He had been the product of a term, uncomplicated pregnancy and had weighed 2.9 kg at birth. Labour and delivery had been normal. He had attained all the early motor milestones at the appropriate ages and walked at 15 months. At 3 years it was noticed that his gait was waddling and wide-based; he could not run or jump as other children. He was admitted to a hospital with suspected muscular dystrophy. At 4 years bilateral inguinal hernias were repaired. At 10 years he began to complain of pains in the legs. At 11 he was admitted to hospital because of muscular weakness and wasting, and because he tired easily; he had difficulty in climbing stairs and could not lift heavy objects above his head.

He was then a slender boy with an excessive lumbar lordosis; height was 133.3 cm (-1 SD) and weight 20.1 kg (-2.5 SD). Blood pressure was 100/46 mmHg, pulse rate 102/minute. Neurological examination was normal. His skeletal muscles were

wasted and weak. Joint movements were full. His intelligence was normal.

A bone survey showed symmetrical cortical thickening and sclerosis confined to the diaphyses of all long bones, among which the femur was the most severely affected (Fig. 1). Osteosclerosis of the base of skull was also present. Haemoglobin was 7.4 g/dl, white blood cell count $8.8 \times 10^9/l$, erythrocyte sedimentation rate 44 mm/1st hour, serum calcium 4.8 mEq/l (2.4 mmol/l), inorganic phosphorus 4.4 mg/100 ml (1.4 mmol/l), glutamic oxalacetic transaminase 22 KU, glutamic pyruvic transaminase 9 KU, alkaline phosphatase 11.7 KAU, lactic dehydrogenase 75 IU, creatinine phosphokinase 20 IU, aldolase 1.1 mU/ml, triglycerides 126 mg/100 ml (1.56 mmol/l), normal value for adult men 60-80 mg/100 ml (0.74-0.99 mmol/l).



Fig. 1 The femur, showing fusiform enlargement and sclerosis of diaphyses.

Bone biopsy, taken from the middle portion of the femur, showed a periosteum with a moderate degree of fibrous proliferation extending into the surrounding skeletal muscle, and blood vessels with thickened walls: trabeculae showed thickening with normal haversian system. Bone marrow culture taken at the time of the biopsy was sterile.

Muscle investigations. Muscular power examined semiquantitatively showed that most muscles were weak (Fig. 2), weakness being particularly severe around the pelvic girdle. Electromyography of deltoid, triceps, vastus medialis, and tibialis anterior was normal.

Muscle biopsy from the rectus femoris showed that some muscle fibres were atrophic. No group atrophy or perifascicular atrophy was seen. The atrophic muscle fibres were seen to be mixed with

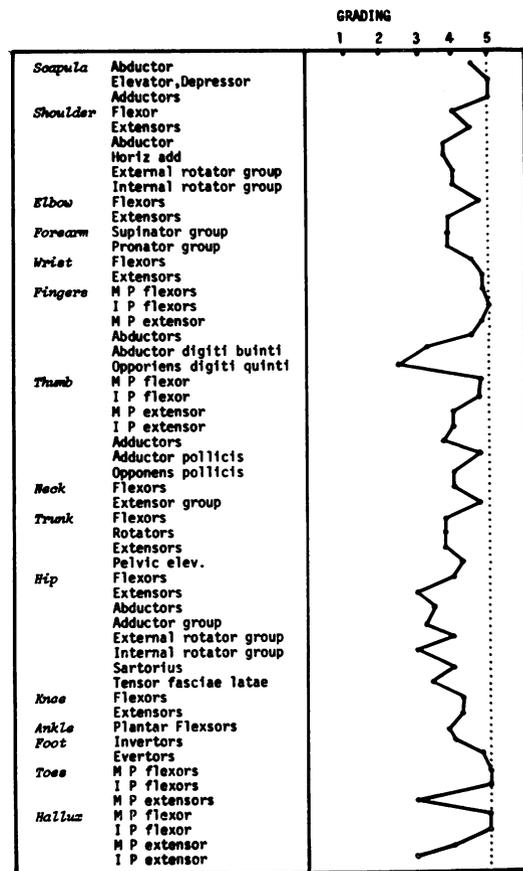


Fig. 2 Muscle testing.

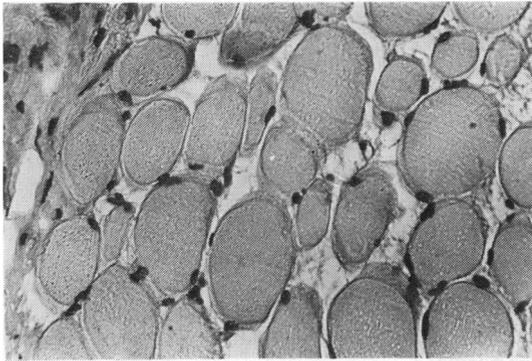


Fig. 3 Muscle biopsy. Atrophic muscle fibres are seen to be mixed with larger fibres. H and E \times 260.

larger fibres (Fig. 3). The sarcolemmic nuclei were situated in their normal position. The so-called tigroid nuclei or vesicular nuclei were not seen. There was no 'liquefied' fibre or granular fibre to suggest necrosis or degeneration. Cellular infiltrations were not seen. Perimysial fibrosis was moderate, but there was no endomysial fibrosis. Blood vessels in the perimysial connective tissue showed thickened walls and luminal narrowing. Histochemically, the intermyofibrillar network pattern was normal. Electron microscopical examination showed normal binding

Muscle fibre type	1	2
Mean diameter (μ m)	40	26
SD	8	6
Percentage of fibres	28	72

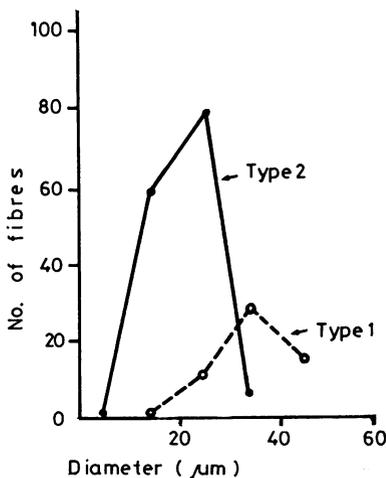


Fig. 4 Histogram of muscle fibre size.

patterns in all filaments, and no sign of degenerative change. Z-bands were straight and not smeared or widened. Normal mitochondria and a little accumulation of lipid could be seen in the intermyofibrillar spaces.

In one of the freshly-frozen sections a histogram of muscle fibre size was constructed as described by Dubowitz and Brooke.⁴ The histographic analysis (Fig. 4), showed that 28% of the fibre were of type I and 72% of type II. No fibre type predominated. Mean diameters of the type I and II fibres were 40 and 26 μ m respectively, with SD $<$ 10 μ m. These changes are indicative of type II fibre atrophy.

Discussion

The disorder was first described by Engelmann in 1929⁵ and generally carries his name. The diagnosis can be made from x-rays:⁶ generally symmetrical skeletal distribution, fusiform enlargement of the diaphyses of the long bones, and thickening of the cortex by endosteal and periosteal accretion of mottled new bone without recognisable trabecular pattern (Fig. 1). Reports record more than 100 cases,⁷ and there are slightly more males than females.¹ Symptoms such as muscular weakness, waddling gait, leg pains, and a tendency to tire easily generally develop early in life, and our patient is characteristic.

Muscular atrophy and weakness have been noted in so many patients that most observers have regarded both as an essential part of the disease.¹⁻⁸ Our patient was initially diagnosed as having muscular dystrophy at 3 years of age. The muscle evaluation at 11 years showed weakness maximal about the pelvic girdle, as seen in muscular dystrophy. Stronge and McDowell⁹ also reported a similar distribution and this feature has sometimes led to the disease being confused with muscular dystrophy.²⁻³ Nevertheless, there have been few detailed descriptions of the muscular abnormality.⁸ Muscle biopsies have seldom been performed,⁷ no electron microscopical examination has been reported, and biopsy findings have been inconsistent. The biopsy of our case showed a type II fibre atrophy—a rather nonspecific change. Muscle biopsies from patients with muscular dystrophy or other myopathies usually show an abnormal variability in fibre size,¹⁰ but in our case there was a normal variability in size of each fibre type, and the electron microscopical examination revealed no degenerative change. These facts argue against regarding Engelmann's disease as a myopathy.

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Urinary excretion of *N*-acetyl- β -D-glucosaminidase in children

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SUMMARY The normal range for the urinary *N*-acetyl- β -D-glucosaminidase/creatinine ratio was determined in 82 children. The range was found to vary with age, and the distribution was found to be logarithmic. This test should help to detect renal tubular disease in children; it gave abnormal results in some of these children.

Recently there have been many reports on the value of urinary *N*-acetyl- β -D-glucosaminidase (NAG) for the detection of renal tubular disease in adults.¹⁻² There has been one report on its use in children.³ I report a normal range in childhood, and give the results in a few children who may have renal tubular disease.

Methods and subjects

Urine was obtained from children by midstream collection after informed consent had been obtained from at least one of their parents. The normal range was determined from children of friends, and from siblings of patients. In no case was there a history or family history that suggested renal disease. Urine was collected also from several children with a variety of diseases, and generally more than one urine sample was obtained from each. NAG was assayed fluorimetrically and the enzyme activity was divided by the creatinine concentration to take into account

varying rates of urine flow.² Creatinine was measured using a Technicon autoanalyser. One NAG unit equals 1 nmol of 4-methylumbelliferone released per hour at 37°C per μ mol creatinine. (One unit is equal to 11.3 nmol of 4-methylumbelliferone released per hour at 37°C per mg of creatinine). Since there is no sex difference in the excretion of NAG in adults,² the results from both sexes were combined.

Results

The normal excretion of NAG was determined in 82 children and was found to vary with age (Fig. 1). The distribution of excretion of the enzyme was found to be logarithmic (Fig. 2) and \log_{10} values were used to calculate the normal range. For this purpose, three arbitrarily chosen age groups (12-59, 60-119, and 120-200 months) were selected to determine the mean and standard deviation. However, the other age groupings result in mean plus 2 standard deviation values which would fall very close to a line joining the three mean plus 2 standard deviation values shown.

Six children who required reimplantation of ureters because of severe reflux and recurrent infections despite prophylaxis all had normal NAG excretion levels before surgery. None was known to have intrarenal reflux although 2 had at least one kidney smaller than normal. A 1-year-old child with urethral valves and severe reflux had NAG excretion