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Case Report

Lipomembranous Polycystic Osteodysplasia

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Summary. A case of lipomembranous polycystic osteodysplasia is presented. The clinical features were characterized by multiple cystic changes of the bones and progressive psychomotor retardation. Although the diagnosis of polyostotic fibrous dysplasia of bone was made first because of expanded tumorlike lesions in bones, pathology of bone and bone marrow confirmed the diagnosis of lipomembranous polycystic osteodysplasia.

Light microscopy showed a great number of peculiar undulating membranous structures in the adipose tissue. With the electron microscope the membrane seemed to be composed of an accumulation of endoplasmic reticulum-like tubular profiles. They appear first, in close connection with fat droplets, within the mesenchymal cell.

Key words: Lipomembranous polycystic osteodysplasia – Membranous structure – Endoplasmic reticulum.

Introduction

Lipomembranous polycystic osteodysplasia (LMPO) has been increasingly recognized as a hereditary disease complex of bone and central nervous system. The disease was first described by Jarvi et al. in 1964. Thereafter an extensive clinical study of nine cases was reported by Hakola in 1972. More recently Nasu et al. (1973) described a postmorten case and proposed the name membranous lipodystrophy since abnormal systemic lipid metabolism seemed to underlie such a lesion. LMPO has not been well established clinically and nosologically because of its rarity. The case reported here offers another example of this rare and interesting entity, with speculation on the possible pathogenesis of the characteristic changes.

Case Report

The patient was a 36-year-old male without abnormal family history. Since the age of 16, the patient often suffered fractures in connection with minor accidents and was diagnosed to have fibrous dysplasia of bone. He was admitted to Kanagawa Rehabilitation Center for multiple fractures

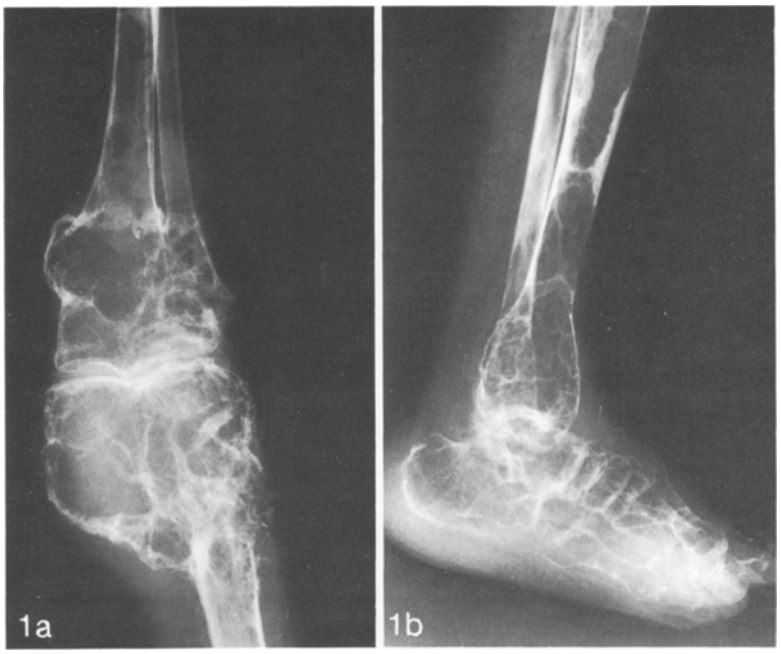

Fig. 1. a X-ray of knee. Cystic transformation in metaphysis of femur, tibia, and fibula. Enlarged epiphyses resemble drumsticks. **b** X-ray of foot. Marked atrophy and cystic degeneration of all bones

in both legs. On roentogenologic examination, multiple cystic changes of the bone were found (Fig. 1). The ribs, cranium, pelvic bones, and spinal column was rarely affected. The patient was mentally retarded and neurology suggested a degenerative process of the brain. On surgical exploration, the cysts of the bone were found to be filled with a yellow paste-like or a gray jelly-like mass. The subcutaneous fat tissue was reduced in amount and also showed a jelly-like appearance.

Histological Findings

The proper fat cells and other cellular components in bone marrow were decreased, being replaced with a great number of undulating membranes (PMS) which formed tiny cysts with an arabesque profile (Fig. 2). The histochemical findings of the membrane are listed in Table 1. PMS was sudanophilic in paraffin section. PAS stain gave a positive result after diastase digestion. The bone trabeculae had disappeared and cortical bone was also very atrophic, measuring only 0.5 cm. in thickness (Fig. 2b). PMS was also found in the adipose tissue of the skin and was less significant.

Electron Microscopic Findings

PMS was also seen with ease by electron microscope. The inner surface of PMS was relatively well demarcated, containing neutral fat droplets in the

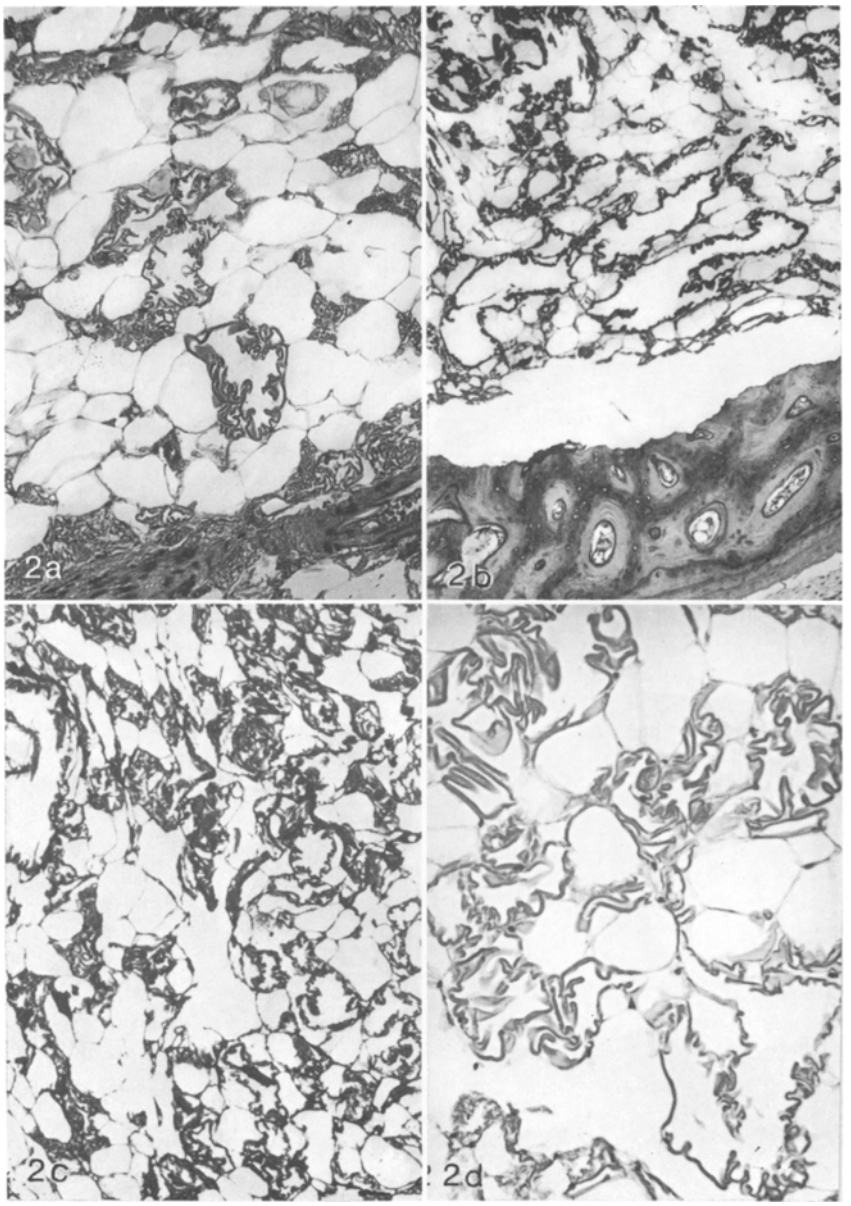

Fig. 2. a Undulating membranous structures in bone marrow. H & E. ×100. **b** Membranous structures are strongly stained with PAS. Marked resorption of bone is seen. PAS stain. ×100. **c** Membranes are brown in silver impregnation. Fat cells are reduced, being replaced by many membranes. **d** Membranous structure sometimes assumes cystic appearance. H & E. ×200

Table 1. Histochemical findings of membrane

	present case	Nasu's case
H.E.	eosinophilic	red
PAS	++	++
Sudan (paraffin)	orange	+
Reticulin	grayish brown	−
Azan-Mallory	polychromatic	polychromatic
Toluidine blue		
pH. 7.0	blue	−
pH. 4.1	−	−
pH. 2.1	−	−
LFB	+−	++
PAM	brown	−
PTAH	−	−
Sudan (frozen)	++	++
Nile blue	+	
Sudan black B	+	

inner cavity which was bordered by a single limiting membrane. The outer surface of PMS was poorly defined, shifting to a coarse amorphous substance (Fig. 3). The layer consisted of an accumulation of fine tubular structures, most of which had trilaminar profiles mostly simulating endoplasmic reticulum (Fig. 4). The size and thickness of PMS varied in different membranes. Some PMS were obscure in structure, suggestive of its chronological evolution. PMS was found, as a rare occurrence, within the cytoplasm of the mesenchymal cell (Fig. 4).

Discussion

In this patient, pathologic fracture at the age of 16 was followed by a characteristic polycystic osteopathy and psychomotor retardation in a chronic course. Bone marrow pathology showed a characteristic membranous structure (Fig. 2) but it was not pathognomonic for this disease since it has been observed in Farber's disease (Farber, 1952; Abul-Haj et al., 1962) and in some cases of rheumatoid arthritis treated with large doses of corticosteroids (Yagishita et al., unpublished).

This disease has been reported only in Japan (Kashima et al., 1973; Nasu et al., 1973) and Scandinavia (Jarvi et al., 1964; Hakola, 1972; Sourander, 1970). Skeletal symptoms begin at the age of 20 years on an average. Fractures in conncetion with minor accidents are the initial sign in all cases. Roentgenography revealed large symmetric cystic cavities in the metaphyses of the long bones, in metatarsal bones, and in the phalanges of the toes. The ribs, cranium, spinal column and pelvic bones are rarely affected. In all three autopsy cases (Nasu et al., 1973; Kashima et al., 1973; Sourander, 1970) pathologic changes of the brain are leukodystrophy of the sudanophilic type.

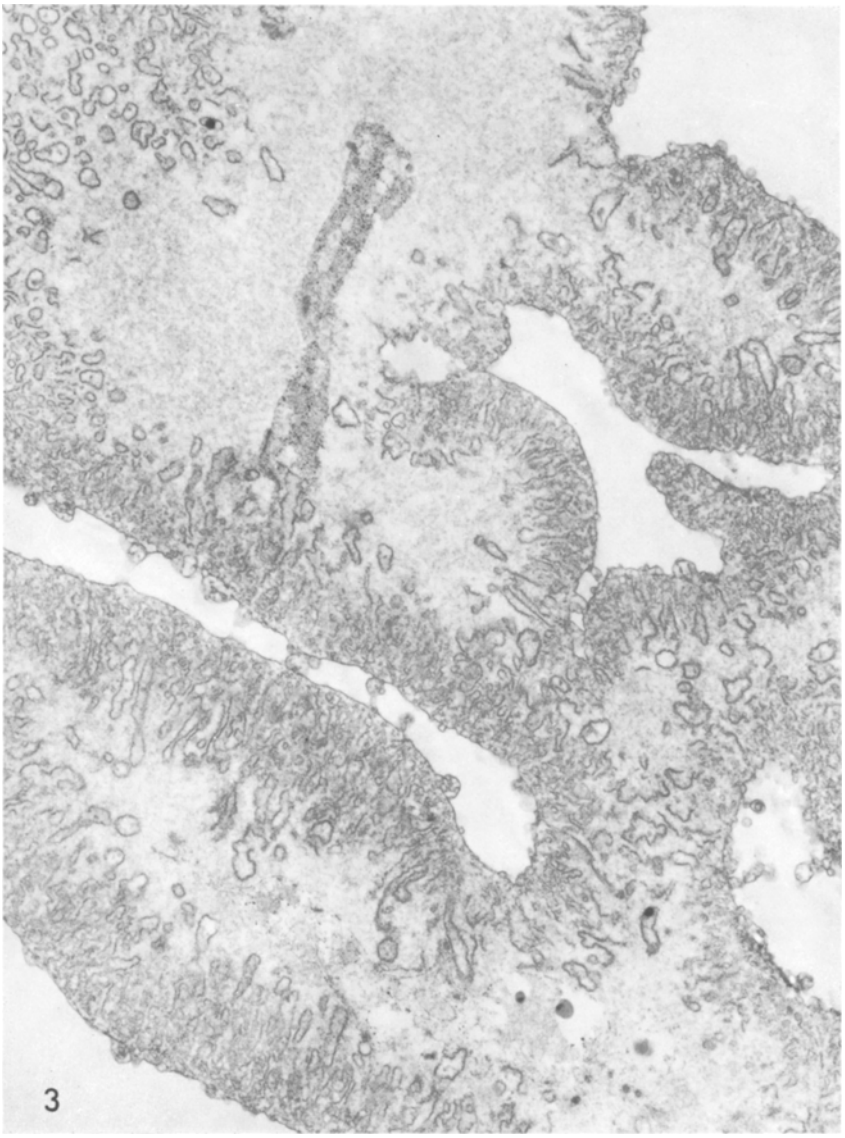

Fig. 3. Membranous structure of bone marrow is composed of an accumulation of numerous fine tubular profiles, which are well demarcated from the neutral fat but poorly defined from the surrounding amorphous substance. ×12,000

The fine structure of PMS has been rarely described to date. It consists of a minute tubular structure (Nasu et al., 1973). In the present case PMS appeared to be composed of an accumulation of endoplasmic reticulum-like tubular structures. They varied in structure in different membranes, which was considered to represent a chronological evolution of PMS.

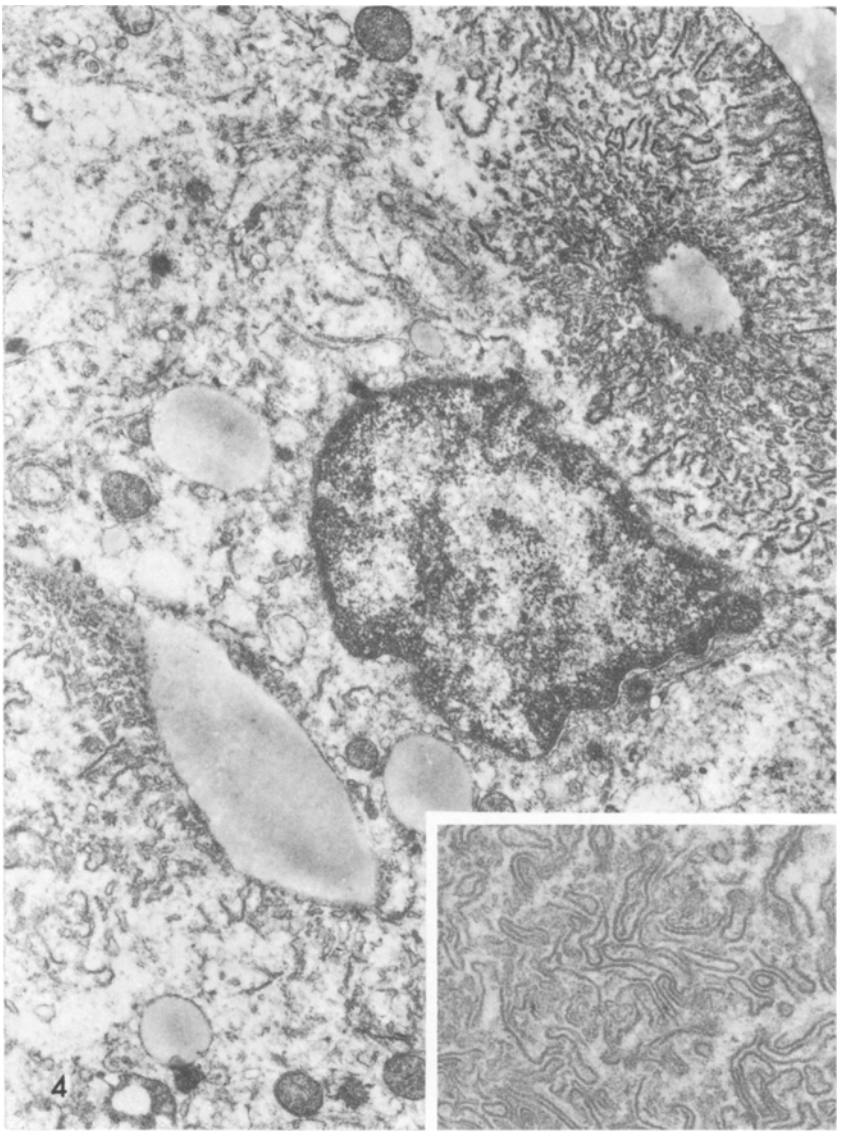

Fig. 4. Membranous structures in mesenchymal cell, suggestive of their origin. ×16,000. Trilaminar structures simulating endoplasmic reticulum (inset) ×23,000

As to the pathogenesis of this disease several hypotheses have been proposed: (1) a developmental anomaly of blood vessels of bone (Jarvi et al., 1964); (2) a metabolic disorder affecting structural components common to both bones and myelin sheaths (Sourander, 1970); and (3) abnormal systemic lipid metabolism (Nasu et al., 1973). In the present case the cause of this disease was

assumed to be a metabolic disorder of lipid in the mesenchymal cells, resulting in the formation of a peculiar membranous structure as a sequence of proliferation of endoplasmic reticulum closely related to fat droplets.

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