Spondyloenchondrodysplasia

A rare cause of short-trunk syndrome

Dror Robinson[1], Martin Tieder[2], Leonel Copeliovitch[1] and Nahum Halperin[1]

Departments of [1]Orthopedics A and [2]Pediatric Nephrology, Assaf Harofeh Medical Center, affiliated with the Sackler Medical School, Tel-Aviv University, Israel. Correspondence: Dr. M. Tieder, Pediatric Nephrology Unit, Assaf Harofeh Medical Center, Zerifin 70300, Israel. Tel +972-8-44 91 57. Fax +972-8-44 95 02
Submitted 90-10-30. Accepted 91-04-18

Multiple enchondromatosis was first described by Ollier (1900) as an asymmetric affliction of the appendicular skeleton, which most often spares the spine. During the last two decades, several cases have been described in which symmetric enchondromatous-like lesions involving both the axial and the appendicular skeleton predominate. This entity has been named Schorr's type spondyloenchondrodysplasia (Mainzer et al. 1971, Schorr et al. 1976, Spranger et al. 1978, Sauvegrain et al. 1980, Chagnon et al. 1985, Azouz 1987). We had the opportunity to study a pedigree in which 2 persons were afflicted with the disorder.

Case report

The index case was an 11-year-old boy, firstborn of nonconsanguineous parents. The pregnancy and delivery were normal. His weight and recumbent length at birth were both above the 10th percentile, with weight relatively higher than length. His development up to the age of 11 years was unremarkable. He was initially examined because of exercise-aggravated anterior knee pains and short stature. The knee arthralgia was bilateral and prevented his participation in sports. Previously, he was active in athletics and football.

The boy was markedly small in stature, measuring 133 cm (< 3rd percentile). His upper-to-lower segment ratio (U/L ratio) was 0.87 (normal 0.99; Hensinger 1986). Thus, his upper segment, measuring 62 cm, was below the third percentile of normal, and even 1 standard deviation below the average for achondroplastic dwarfs (Hensinger 1986). His lower segment measuring 71 cm was average for his age. On the other hand, his thoracic diameter was 74 cm (1 SD above average; Wilkins et al. 1965), thus giving the appearance of a short and thick trunk superimposed on lower limbs of relatively normal length.

The spleen and liver were palpable 2 cm below the costal rim, although their span was normal. His head diameter was normal (53 cm), as was his span (146 cm). His face was dysmorphic, with frontal bossing, a depressed nasal bridge, a circumflex-shaped upper lip, increased space between the teeth with malocclusion, and a prominent chin. Increased dorsal kyphosis was present, as well as a potbelly. The rest of the physical examination and screening blood tests for rheumatic, metabolic, and endocrinologic disorders were normal. There was no evidence of a mucopolysaccharidosis in urine tests. Radiographs of the knee taken 6 months previously (when the knee pains began) revealed irregular physeal plates and areas of calcification in a columnar arrangement, with radiolucent areas between them (Figure 1).

The skull was normal. The total number of vertebrae was normal, and no segmental defects were present. There was generalized platyspondylia (Figure 2). The vertical/sagittal ratio of the lumbar vertebrae was 0.47 (normal range 0.67–0.97; Hensinger 1986). The disc-to-vertebra ratio was 0.75 (normal range 0.2–0.4; Hensinger 1986). A long thoracic scoliotic curve was convex to the right, measuring 15° between T-2 and T-12. Dorsal kyphosis measured 55° from T-2 to T-8. The vertebral bodies contained scattered radiolucent areas and irregular endplates.

The pelvis exhibited several radiolucent areas, and similar lesions were also present in the proximal femora. The distal femora and proximal tibiae revealed radiolucent areas in a columnar arrangement located predominantly in the metaphyses and extending into the diaphyses. The metaphyses were flared. Qualitatively similar lesions, though much milder, were present in the wrists and ankles. The hands and feet were normal. Skeletal maturation was normal as determined according to ossification centers in hand radiographs (Greulich and Pyle 1959). The arthralgia resolved eventually. At no stage during the follow-up period were there any signs of arthritis or involvement of other joints.

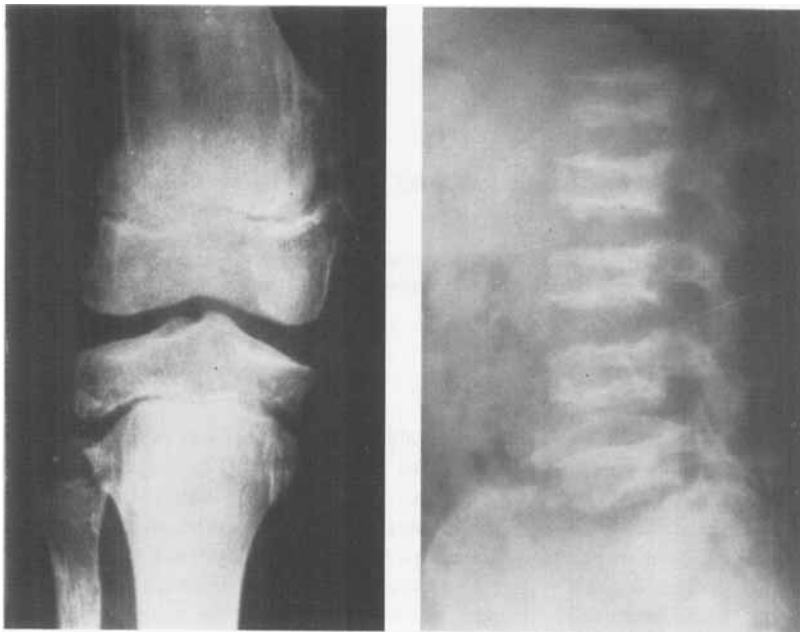

Figure 1. A 10-year-old boy with spondyloenchondrodysplasia.

Chondromatous-like lesions and cartilage streaks in the knee.

Lucent lesions occupy most of the vertebral bodies; marked platyspondylia.

In a postpubertal follow-up period, while 19 years of age, he reached a height of 158 cm (< 3 percentile; Hensinger 1986). His superior to inferior segment ratio was 0.75 (normal 0.99; Wilkins et al. 1965). The lower segment length was at the upper border of normal, while the upper segment length was below the third percentile of normal and 2 standard deviations below the average for patients with achondroplasia (Hensinger 1986). His thoracic diameter was 86 cm (normal average 82 cm; Wilkins et al. 1965). Thus, all the pubertal growth took place in the lower extremities, with the spine remaining short. However, the viscera were no longer palpable under the rib cage. The frontal bossing was less prominent, and the scoliotic and kyphotic curves did not progress. The skeletal survey was similar to the one described above, although the enchondromatous-like lesions in the long bones appeared smaller than in the prepubertal survey. The spinal lesions were unchanged.

The parents appeared normal. Neither parent had any orthopedic complaints. The mother was 159 cm tall and the father 167 cm. The paternal grandfather, who was 86 years old at the time of presentation of the index case, was 139 cm tall, and did not have any orthopedic complaints. His face was slightly dysmorphic, similar to that of his grandson. The body proportions were also similar, with a short torso and relatively normal lower limbs. Skeletal vertebral lesions were similar to those of the index case. The maternal grandmother, who was 75 years old at the time of presentation of the index case, was also of short stature (less than 145 cm). Unfortunately, she was not examined radiographically, and thus other details are lacking.

Discussion

Enchondromatosis is a disorder of unknown etiology that involves defective endochondral ossification. Spinal involvement is so rare that it has been suggested that it does not occur in the syndrome (Lovell and Winter 1986). Enchondromatosis is usually sporadic, though its occurrence in siblings has been reported (McKusick 1971). In the last few years, several cases were reported in which enchondromatous-like lesions involved both the long bones and the spine, and an autosomal recessive mode of inheritance has been suggested (Mainzer et al. 1971, Schorr et al. 1976, Spranger et al. 1978, Sauvegrain et al. 1980, Chagnon et al. 1985, Azouz 1987, Menger et al. 1989, Ziv et al. 1989, Frydman et al. 1990). Although the prevalence of spondyloenchondrodysplasia is unknown, it is striking that approximately 40 percent of all the cases reported occurred in Israel (Schorr et al. 1976, Menger et al. 1989, Ziv et al. 1989, Frydman et al. 1990), whose population is about 0.1 percent of the

Table 1. Characteristics of various causes of the short-trunk syndrome and other disorders to be differentiated from Schorr's type dysplasia

	Schorr	SED	Ollier	Kozlowski	Kniest	Dyggve-Melchior
Height	↓	↓N	N	↓	↓	↓
U/L ratio	↓	↓	↑N	↓	↓	↓
Facies	bossing	N	N	N	hypertelorism	grotesque
Associated diseases	none, brain calcification	N	N	N	myopia, MPS, deafness	mental retardation
Age at diagnosis (yr)						
	5–15	10–20	8–15	1–2	birth	birth
Limbs	usually N	coxarthrosis	short, not symmetric	tibia vara or N	fusiform joints	short arms, polydactyly
Spine	short trunk	short trunk	N	short trunk	kyphosis	lumbar lordosis, short trunk
Radiography						
Limbs	enchondroma-like lesions	deformed femoral heads, N physes	enchon-dromas	femoral metaphyseal lytic lesions	fragmented epiphyses	honeycombed ilia, wide metaphyses
Spine	flat vertebrae, enchondroma-like lesions	ovoid vertebrae, deformed posterior elements	N	flat vertebrae, tongue-like anterior body	wedged vertebrae, delayed ossification	flat vertebrae

MPS Mucopolysaccharidosis in urine and organs
N Normal
SED Spondyloepiphyseal dysplasias
U/L Upper segment-to-lower segment ratio

total world population. The prevalence in Israel according to the reported cases is about 1 per 250,000–500,000.

These cases were divided into two types, which differ in the degree of involvement of the long bones (the hands and feet in particular) relative to that of the spine (Azouz 1987). In the currently described pedigree, the spinal involvement is very severe, whereas the extremities are only minimally affected. The type of the lesions seemed to change along with the growth of our patient. In the prepubertal skeletal survey, the involvement of the long bones was very prominent, concomitant with involvement of the spine. However, a few years later, the long bones lesions had decreased in size, while the vertebral lesions were unchanged.

Making the right diagnosis depends on the recognition of the very short spine as compared with the extremities. This is easily recognized if the upper segment-to-lower segment ratio (U/L ratio) is calculated. This finding narrows the range of possible diagnoses to some of the causes of the short-trunk syndrome (Table 1). On the other hand, in most of the common causes of short stature, such as malnutrition, hormonal disorders, metabolic disorders, rickets, as well as the more frequent skeletal dysplasias (achondroplasia), the growth centers of the lower extremities are principally affected. Thus, most often the U/L ratio is either normal or increased. This allows a tentative diagnosis to be made quite easily by physical examination alone.

The causes of short-trunk syndrome can also be quite easily differentiated from spondyloenchondrodysplasia by physical examination and skeletal radiographs.

The type IV-A mucopolysaccharidosis (Morquio-Brailsford) present similar radiographic features to spondyloenchondrodysplasia, such as platyspondylia and flared metaphyses. However, the range of joint motion is often decreased, and corneal clouding is common. The diagnosis is clinched by the presence of mucopolysaccharides in the urine.

Another difficult differential diagnosis is spondylometaphyseal dysplasia of the Kozlowski type (Kozlowski et al. 1967). This type of bone dysplasia is differentiated by the location of the enchondromatous lesions, which are confined to the metaphysis, usually

in the upper end of the femur, and do not extend as a rule into the diaphysis (Schorr et al. 1976). Moreover, the vertebrae have a well-defined tongue protruding from the anterior border of the vertebrae, as well as a widening of the vertebral bodies in the transverse plane. By contrast, in spondyloenchondrodysplasia as described by Schorr et al. (1976), discrete islands of cartilage are present in the vertebral bodies, as well as in the long bones.

In sum, enchondromatosis involving the long bones, as well as the spine, might present several different phenotypes. Moreover, a single patient, examined repeatedly during a long-term follow-up may show involvement of different skeletal sites. Thus, overly differentiated divisions into subtypes, as suggested in the literature, do not seem to be warranted (Mainzer et al. 1971, Spranger et al. 1978, Azouz 1987). The disorder does not seem to affect life expectancy, neither in the cases described by us nor in those described in the literature. The association of the chondromatous lesions with an increased frequency of chondrosarcoma, which occurs in the typical cases of Ollier's disease, as well as in Maffuci's syndrome (Jaffe 1958), has not been described to date in spondyloenchondrodysplasia.

Acknowledgements

The authors wish to thank Professor P. Maroteaux of the Hospital des Enfants Malades, Paris, France, for graciously agreeing to help us to diagnose the case.

References

Azouz E M. Case report 418: Multiple enchondromatosis (Ollier disease) with severe vertebral changes. *Skeletal Radiol* 1987; 16 (3): 236–9.

Chagnon S, Lacert P, Blery M. Spondyloenchondrodysplasie. *J Radiol* 1985; 66 (1): 75–7.

Frydman M, Bar Ziv J, Preminger Shapiro R, Brezner A, Brand N, Ben Ami T, Lachman R S, Gruber H E, Rimoin D L. Possible heterogeneity in spondyloenchondrodysplasia: quadriparesis, basal ganglia calcifications, and chondrocyte inclusions. *Am J Med Genet* 1990; 36 (3): 279–84.

Greulich W W, Pyle S I. *Radiographic atlas of the skeletal development of the hand and wrist*, 2nd ed. Stanford University Press, Stanford 1959.

Hensinger R N. *Standards in pediatric orthopedics: Tables, charts, and graphs illustrating growth.* Raven Press, New York 1986.

Jaffe H L. *Tumors and tumorous conditions of the bones and joints.* Lea & Febiger, Philadelphia 1958.

Kozlowski K, Maroteaux P, Spranger J. La dysostose spondylo-metaphysaire. *Presse Med* 1967; 75: 2769–74.

Lovell W W, Winter R B. *Pediatric orthopaedics.* 2nd ed. J B Lippincott Co, Philadelphia 1986.

Mainzer F, Minagi H, Steinbach H L. The variable manifestations of multiple enchondromatosis. *Radiology* 1971; 99 (2): 377–88.

McKusick V A. *Osteochondromatosis in Mendelian inheritance in man.* 3rd ed. John Hopkins Press, Baltimore 1971.

Menger H, Kruse K, Spranger J. Spondyloenchondrodysplasia. *J Med Genet* 1989; 26 (2): 93–9.

Ollier L. De la dyschondroplasie. *Bull Soc Chir Lyon* 1900; 3: 22–7.

Sauvegrain J, Maroteaux P, Ribier J, Garel L, Tato L, Rochiccioli P, de Magalhaes J, Duhamel B. (Multiple chondroma affecting the spine: spondylo-enchondroplasia and other forms [author's translation]). *J Radiol* 1980; 61 (8–9): 495–501.

Schorr S, Legum C, Ochshorn M. Spondyloenchondrodysplasia. Enchondromatomosis with severe platyspondyly in two brothers. *Radiology* 1976; 118 (1): 133–9.

Spranger J, Kemperdieck H, Bakowski H, Opitz J M. Two peculiar types of enchondromatosis. *Pediatr Radiol* 1978; 7 (4): 215–9.

Wilkins L, Blizzard R M, Migeon C J. *The diagnosis and treatment of endocrine disorders in childhood and adolescence.* 3rd ed. Charles Thomas Publisher, Springfield 1965.

Ziv N, Grunebaum M, Kornreich L, Mimouni M. Case report 512: Spondyloenchondrodysplasia (SED) in two siblings. *Skeletal Radiol* 1989; 17 (8): 598–600.