

# Dyggve-Melchior-Clausen syndrome without mental retardation (Smith-McCort dysplasia)

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## ABSTRACT

Radiographic features of a 15-year-old boy with Smith-McCort dysplasia are presented. Dyggve-Melchior-Clausen syndrome without mental retardation has clinical and radiographic findings similar to those of Smith-McCort dysplasia. Both of these syndromes are rare autosomal recessive disorders affecting skeletal development. The radiographic appearance of generalized platyspondyly with double-humped end-plates, and the lace-like appearance of iliac crests are pathognomonic and distinctive of these syndromes. Diagnostic features of these diseases are compared with others like Morquio's disease and spondylometaphyseal dysplasia, which may have similar vertebral changes, and are discussed in the light of the literature.

*Key words:* • bone disease, developmental • mental retardation

**D**ygve-Melchior-Clausen syndrome (DMC) and Smith-McCort dysplasia (SMC) are rare autosomal recessive osteochondrodysplasias. DMC was first described by Dyggve et al. in 1962 and SMC was originally described by Smith and McCort in 1958 as skeletal dysplasias. Because both of the genes responsible for these disorders are localized on the same chromosome, they are thought of as allelic disorders (1). DMC with mental retardation and SMC without mental retardation have similar clinical and radiographic findings (2). DMC was described in only 58 patients in the literature as of 2002 (3). SMC is rarer than DMC dysplasia. A case of SMC, which was diagnosed by using radiographic and clinical findings, is discussed in this report in the light of the literature.

## Case report

A 15-year-old boy was admitted to our hospital with developmental and pubertal delay. The patient had undergone detailed examinations after a radiographic examination, which was performed for examining skeletal age, revealed skeletal dysplasia. He is the fifth child of a healthy family in which the parents are consanguineous. He was born termly with a birth weight of 3000 g through normal vaginal delivery. He had no history of severe health disease from the age of 3.5 years to the present, except slow growth and developmental delay. There was no history of abnormalities like difficulty in walking, kyphoscoliosis, and short stature in his mother, father, sister, or other relatives. At the time we examined him, he had a length of 118 cm (< 3rd percentile), weight of 22.5 kg (> 3rd percentile), pubic bone-heel distance (length of the lower segment) of 64 cm, an upper segment length of 54 cm and an upper to lower segment ratio of 0.85 (normal, 1). Neurological examination was normal and he was still training in primary education. His skeletal age was compatible with 13 years. An increased anteroposterior chest diameter and kyphoscoliosis was present, and proximal portions of the upper and lower limbs were short. On histopathological examination, there was no abnormality, except increased levels of phosphorus (5.08 mg/dl; normal range, 2.3-4.7 mg/dl) and alkaline phosphatase (751 U/l; normal range, 95-280 U/l). Urine amino acids were normal and there was no excretion of mucopolysaccharides.

In radiological examinations, lateral vertebrae X-ray demonstrated irregularities of the vertebral end-plates and the characteristic double-humped appearance was seen on vertebral bodies (Figure). Odontoid hypoplasia was present on cervical radiographs. Increased anteroposterior chest diameter and thoracolumbar kyphoscoliosis was seen on thoracic radiographs. Hypoplastic iliac bones and irregular lace-like appearance of the iliac crests were seen on anteroposterior pelvic radiographs.

Increased sacroiliac joint distance, decreased sacrosciatic notches, and ossification defect on the pubic bones was seen. Irregular ossification was



**Figure. a-d.** a. Platyspondyly, irregularities of end-plates, and characteristic double-humped appearance due to wedge-shaped ossification defect are seen on the lateral spinal radiograph. b. Small hypoplastic iliac crests and lace-like appearance due to irregularities are seen on the anteroposterior pelvic radiograph. Widened sacroiliac joints, decreased sacrosciatic notches, and ossification defect on the pelvis are visible as well. Irregular ossification of the acetabuli and flat acetabular roofs are present. Short femoral necks and irregularities of epiphyses and metaphyses are seen. These changes of the acetabuli and femoral necks caused lateral displacement of the femoral heads. c. The scapula is normal in size, but concavity on the inferior edge of the scapula due to irregular ossification is seen on the lateral radiograph of the scapula. d. Skeletal age was compatible with 13 years in the posteroanterior hand radiograph.

present on the acetabuli and the acetabular roofs were flat. Femoral necks were short and both epiphyses and metaphyses were irregular. These changes in the acetabuli and femoral heads were causing lateral displacement of the femoral heads. Mild irregularities were seen on metaphyses of the tibias bilaterally. The scapula was normal in size but there was a concavity on its lower edge due to irregular ossification. There was no abnormality on any other bones of the shoulder.

#### Discussion

DMC and SMC are autosomal recessive allelic osteochondrodysplasias caused by mutations on the same genes. DMC and SMC are both disorders of bone and cartilage that are characterized by a short trunk and extremities and a barrel shaped chest (4), in addition to mental retardation and microcephaly

(2). The radiographic appearances of both disorders are similar.

Platyspondyly with double-humped end-plates, anterior beaking, and scoliosis are seen in all vertebrae. Prolonged vertebral laminae, hypoplastic odontoid process, and C1-C2 dislocation may be present. A barrel-shaped chest, significant anterior convexity of the sternum, and widened costochondral junctions may also be present in radiological examinations. Small iliac bones, irregular lace-like appearance of iliac crests, widened sacroiliac joints, decreased sacrosciatic notches, widened pubic rami and ischiopubic synchondrosis, a flat acetabular roof with irregular ossification, lateral displacement of the femoral heads, and a widened symphysis pubis may be present. A small scapula, concave inferior scapular angle with irregular ossification, flat glenoid fossa, and a

wide and spreading acromion may also be seen. Shortness in varying degrees in long bones, irregular metaphyses, multicentric ossification and deformities on humeral and femoral epiphyses, and flat epiphyses may be present as well. Small carpal, metacarpal, and metatarsal bones in the hands and feet, cone-shaped epiphyses, and accessory epiphyses are also encountered (1, 3-5). Double-humped vertebrae and an irregular lace-like appearance of iliac crests are pathognomonic for DMC and SMC (4).

In our case, the presence of round shaped hypoplastic iliac crests, decreased sacrosciatic notches, and a flat and irregular acetabular roof in pelvic radiographs may have been indicative of achondroplasia. However, the lace-like appearance due to irregular ossification of iliac crests, absence of internal decrease in the interpedicular

distances in the lower spine, absence of radiological findings on the other long bones, and clinical features that were incompatible with achondroplasia were distinguishing features in our case. In achondroplasia, vertebrae are short and flat, pedicles are short, and the spinal canal is narrow. Anterior wedge-shaping may be present in one or more vertebrae. In our case, the double-humped end-plates due to wedge-shaped ossification defect was not compatible with the vertebral changes seen in achondroplasia.

In the differential diagnosis of the vertebral changes described in our case, brachyolmia (spondylodysplasia) must also be considered. Platyspondyly or end-plate indentations and irregularities similar to our case may be seen in spondylodysplasia, although the pelvic bone changes observed in our patient are not seen in this disorder.

Metatrophic dysplasia (MD) may mimic the signs of DMC and SMD. Kyphosis or scoliosis, small and spherical sacrosciatic notches, a flat and irregular acetabular roof, and odontoid hypoplasia are the signs of MD. But MD causes general shortness in all long and short tubular bones. Furthermore, a lace-like appearance of iliac crests is a significant sign for making a differential diagnosis between MD and SMD or DMC.

Indentations on end-plates of vertebrae due to osteoporosis in sponastrim dysplasia may mimic the signs of SMD or DMC's vertebral changes. Because the metaphyseal lines and osteoporosis seen in sponastrim dysplasia were not present in our patient and pelvic changes not seen in sponastrim dysplasia were, we decided that DMC or SMD were more plausible diagnoses for our patient.

Spondyloepimetaphyseal dysplasia (SE MD) and spondylometaphyseal dysplasia (SMDI) may also mimic the radiological findings present in our patient. Both of these disorders primarily affect the vertebrae. Irregularities on end-plates of vertebrae and platyspondyly may be present in both disorders. SEMD may mimic DMC or SMD, especially with features such as platyspondyly type tarda, hill-shaped irregularities in the central and posterior aspects of the su-

perior and inferior end-plates of vertebrae, a hypoplastic cone-shaped odontoid process, mild or severe epiphyseal dysplasia, a small pelvic bone, and a short femoral neck. Irregular lace-like appearance, concave appearance of the inferior edge of the scapula due to ossification defect, and a double-humped appearance of the end-plates of vertebrae due to wedge-shaped defect, as seen in vertebrae radiographs, are important signs for distinguishing DMC or SMD from SEMD-type tarda or other SEMDs. Severe platyspondyly on vertebrae, end-plate irregularities, kyphosis, kyphoscoliosis, irregularities on the metaphyses of tubular bones, irregularities on the physis lines of femoral ossification centers, acetabular roof irregularities, and coxa vara may be present in Kozlowski-type SMDI, and they may be similar to our patient's radiographic findings. The lace-like appearance and irregularity of iliac crests that were seen in our patient's pelvic radiographs are characteristic and significant signs for making a differential diagnosis between SMD or DMC and Kozlowski-type SMDI or other SMDIs. Moreover, in our case, changes of the end-plates of vertebrae is seen as characteristic double-humped shape rather than irregularities.

Mucopolysaccharidosis Type IVA is one of the most important diseases that must be distinguished from DMC and SMD with radiographic findings (6). Severe platyspondyly, vertebral irregularities, hypoplastic odontoid process, atlantoaxial subluxation, pectus carinatus of the thorax, increased anteroposterior diameter of the chest, narrowed iliac crests, an oblique acetabular roof, coxa valga and femoral epiphyseal changes, as well as epiphyseal and metaphyseal irregularities of long bones, especially in the end-stage of the disease, are seen in mucopolysaccharidosis and are useful and important for making a differential diagnosis. A lace-like appearance of iliac crests, concavity of the edge of the scapula due to defective ossification, no excretion of mucopolysaccharides in urine screen, a horizontal acetabular roof, and double-humped end-plates of vertebrae are important signs supporting the diagnosis of DMC or SMD.

Dyggve-Melchior-Clausen syndrome without mental retardation and Smith-McCort dysplasia are very rare osteochondrodysplasias. Because of vertebral changes, differential diagnoses must include achondroplasia, brachyolmia (spondylodysplasia), spondylometaphyseal dysplasia, spondyloepimetaphyseal dysplasia, sponastrim dysplasia, and metatrophic dysplasia, which all cause irregularities on the end-plates of vertebrae and platyspondyly. However, due to the fact that the characteristic signs of Smith-McCort dysplasia, including lace-like appearance of iliac crests, double-humped end-plates of vertebrae, and concavity on the edge of the scapula due to defective ossification were present in our patient, we diagnosed our patient as Smith-McCort dysplasia. In conclusion, we would like to stress to the importance of remembering the differential diagnoses for disorders causing vertebral changes.

## References

1. Cohn DH, Ehtesham N, Krakow D, et al. Mental retardation and abnormal skeletal development (Dyggve-Melchior-Clausen dysplasia) due to mutations in a novel evolutionarily conserved gene. *Am J Hum Genet* 2003; 72:419-428.
2. Nakamura K, Kurokawa T, Nagano A, Nakamura S, Taniguchi K, Hamazaki M. Dyggve-Melchior-Clausen syndrome without mental retardation (Smith-McCort dysplasia): morphological findings in the growth plate of the iliac crest. *Am J Med Genet* 1997; 72:11-17.
3. Kandziora F, Neumann L, Schnake KJ, et al. Atlantoaxial instability in Dyggve-Melchior-Clausen syndrome. Case report and review of the literature. *J Neurosurg* 2002; 96:112-117.
4. Ehtesham N, Cantor RM, King LM, Reinker K, Powell BR, Shanske A, Unger S, Rimoin DL, Cohn DH. Evidence that Smith-McCort dysplasia and Dyggve-Melchior-Clausen dysplasia are allelic disorders that result from mutations in a gene on chromosome 18q12. *Am J Hum Genet* 2002; 71:947-951.
5. Lachman RS. Skeletal dysplasias. In: Taybi H, Lachman RS. *Radiology of syndromes metabolic disorders and skeletal dysplasias*. 4th ed. St Louis: Mosby, 1996; 745-951.
6. Coeslier A, Boute-Benejean O, Moerman A, Fron D, Manouvrier-Hanu S. Dyggve-Melchior-Clausen syndrome: differential diagnosis of mucopolysaccharidosis type IV or Morquio disease. *Arch Pediatr* 2001; 8:838-842.