

Imaging features and differential diagnosis of multiple diaphyseal sclerosis

A case report and review of literature

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Abstract

Rationale: Multiple diaphyseal sclerosis (MDS), known as Ribbing disease, is a rare congenital bone disease resulting from autosomal recessive inheritance. The case study involved a 22-year-old female patient who had been diagnosed with chronic sclerosing osteomyelitis due to lack of knowledge about MDS. Previous studies reported rarely on this condition.

Patient concerns: A 22-year-old female with MDS was analyzed.

Diagnoses: MDS is characterized radiographically by a fusiform widening of the diaphyseal portion of the long bones, which is caused by a thickening of the cortex with obstruction of the medullary cavity. The pathologies are observed utilizing diagnostic imagery and are often difficult to identify.

Intervention: The patient was following a suggested regimen of oral celecoxib capsules at 200mg/day for 6 days.

Outcomes: The patient's diagnosis was revised to the rare condition of Ribbing disease by reviewing the clinical history and distinctive radiography images and because the symptoms were alleviated by celecoxib capsule. We also present a review of the literature on the diagnosis and differential diagnosis of MDS based on clinical and imaging features.

Lessons: MDS is rare and may often be initially misdiagnosed as another type of sclerosing bone dysplasia, thus, it is important to be aware of the existence of MDS. Once MDS is suspected, differential diagnosis should be performed to exclude other sclerosing bone dysplasias, taking into account clinical history, distinctive radiographic appearance, distribution, and laboratory and histopathologic findings. Laboratory evaluation and pathologic findings are nonspecific but assist in excluding other diagnoses. More evidence is needed to illustrate the effectiveness of medical or surgical treatments for patients with MDS.

Abbreviations: CRP = C-reactive protein, CT = computed tomography, ESR = erythrocyte sedimentation rate, MDS = multiple diaphyseal sclerosis, MRI = magnetic resonance imaging, NSAIDs = non-steroidal anti-inflammatory drugs, STIR = short time inversion recovery.

Keywords: clinical case, differential diagnosis, multiple diaphyseal sclerosis, Ribbing disease

1. Introduction

Multiple diaphyseal sclerosis (MDS) is a rare condition of diaphyseal sclerosis first described by Ribbing,^[1] thus it has also been called Ribbing disease. MDS is characterized radiographi-

cally by a fusiform widening of the diaphyseal portion of the long bones, which is caused by a thickening of the cortex with obstruction of the medullary cavity. According to the literature, MDS is often initially misdiagnosed as chronic sclerosing osteomyelitis due to lack of knowledge about this infrequently

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Patient Consent The patient has provided written informed consent for the publication of the present case report and for use of the images.

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Figure 1. (A) Anteroposterior radiographs of both tibiae and fibulae demonstrated increased density and diaphyseal sclerosis of both right tibia and fibula; the left was normal. (B and C) Anteroposterior and lateral radiographs of the right tibia and fibula revealed increased diaphyseal periosteal and endosteal density with obstruction of the medullary cavity. (D–F) Anteroposterior and lateral radiographs of both femurs characterized by a fusiform widening of the diaphyseal portion of the long bones caused by thickening of the cortex.

occurring disease,^[2,3] as occurred with the patient in the clinical case presented here.

The etiology of MDS remains obscure. A few authors suggest that MDS may be caused by autosomal recessive inheritance.^[4,5] MDS presents at or after puberty. The lesions may exist without symptoms or may cause local pain that is deep and boring in nature.^[6] Laboratory evaluation, including erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP), often showed normal results with no distinctive findings.^[6] The rare condition of MDS was inadvertently discovered during an X-ray that was being conducted for other reasons. Due to lack of sufficient knowledge surrounding this uncommon disease, MDS may often be confused with other diseases with similar sclerosing bone dysplasia. These other diagnoses include chronic sclerosing osteomyelitis, Camurati–Engelmann dysplasia, generalized cortical hyperostosis (Van Buchem disease) and intramedullary osteosclerosis. The purpose of this study was both to report the case of a 22-year-old female with MDS and to review the literature to determine clinical and radiological presentations and aid in differential diagnosis, of patients with MDS.

2. Case report

This case report was approved by the Ethics Committee of The First Affiliated Hospital of Guangzhou University of Chinese Medicine, and informed consent was obtained from the patient.

A 22-year-old female had been suffering from severe pain in her right tibia for 6 months without injury or family history. The patient had been diagnosed with chronic sclerosing osteomyelitis by several specialists from different highly qualified hospitals in Guangzhou and prescribed NSAIDs. However, the pain did not go away. On December 9, 2016, the patient presented to our outpatient clinic.

Physical examination revealed skin temperature over the right tibia was normal. There was no localized erythema or swelling, deformity, contracture, or muscle weakness. There was tenderness over the middle of the right tibia. The neurologic examination of the patient was normal. Laboratory studies revealed no obvious abnormality, with normal ESR and CRP.

The X-ray of bones showed that there was a fusiform thickening of a portion of the right tibia and fibula. The involved area was extremely dense, and the cancellous bone structure was largely or completely obliterated. However, the left tibia and fibula were normal (Fig. 1A–C). The X-ray of the femurs confirmed a bilateral diaphyseal cortical thickening with near obliteration of the intramedullary cavity (Fig. 1D–F). Radiographs of the skull, both of the upper limbs, the ribs, and spinal bones showed no obvious abnormality.

The essential MRI findings for both tibiae and fibulas confirmed uneven sclerosis and bone marrow oedema in the right tibia and bone marrow oedema in the diaphysis of the right fibula (Fig. 2A–C)



Figure 2. (A and B) 4-mm-thick coronal position T1-weighted image through the mid-tibia confirming low signal and massive endosteal sclerosis that caused obliteration of the canal of the right tibia, revealing bone marrow oedema in the diaphysis. (C) 4-mm-thick axial T2 STIR image revealing endosteal sclerosis with associated hyperintense oedema in the endosteal canal of the right tibia and fibula. STIR=short time inversion recovery.

Her diagnosis was then revised to the rare condition of Ribbing disease after reviewing the clinical history, laboratory examination, distinctive radiographic images and MRI images.

It was suggested that the patient begin a regimen of oral celecoxib capsules at 200 mg/day for 6 days. One week later, she felt the pain was relieved and refused to take any more medication. A month later, she reported occasional discomfort in the right tibia.

3. Discussion

3.1. Overview

MDS is a rarely encountered constitutional disease of bone and presents a diagnostic challenge. This disease is confined to the diaphyses of long bones, especially the tibia and the femur.^[1,7] Patients with MDS present at or after puberty, either asymptotically or with pain or swelling.^[6] Laboratory evaluation often yields normal results without distinctive findings.^[2] In this clinical case, the patient was initially diagnosed with chronic sclerosing osteomyelitis. MDS is often initially misdiagnosed. We present the characteristics and the radiographic differential diagnosis of MDS.

3.2. Radiological features and diagnosis

In this case report, a 22-year-old female patient was diagnosed with MDS according to following characteristics. A 22-year-old female with pain in the right tibia for 6 months without history of injury. Physical examination suggested skin temperature over the right tibia was normal. There was no localized erythema or swelling, no deformity, contracture, or muscle weakness, except for tenderness on the middle of the right tibia. The neurologic examination was normal. Laboratory studies had no obvious abnormality, with normal ESR and CRP. The X-ray showed that there was a fusiform thickening at a portion of the right tibia and fibula. The involved area was extremely dense, and the cancellous structure was largely or completely obliterated. The X-ray of the femurs confirmed a bilateral diaphyseal cortical thickening with near obliteration of the intramedullary cavity. MRI showed that both tibias and fibulas confirmed the uneven of sclerosis and bone marrow edema in the right tibia and bone marrow edema in the diaphysis of the right fibula.

Open literature sources indicate that MDS is either unilateral, asymmetrical, or asynchronously bilateral, characterized by benign endosteal and periosteal bone growth confined to the diaphysis.^[7-10] It has been reported only in long bones, with sparing of the metaphyseal and epiphyseal portions of the bone. However, depending upon the disease progression and degree of deterioration, there is a tendency towards symmetrical changes and multiplicity of bones involved, with the tibia and femur most frequently affected.^[1] Conventional radiology demonstrates the cortical thickening of the diaphyseal portion of long bones.^[8] Obliteration of the medullary canal is also a manifestation of the disease progression.^[2] The X-ray of the 22-year-old female also revealed a fusiform thickening at a portion of the right tibia and fibula. The femurs showed a bilateral diaphyseal cortical thickening with near obliteration of the intramedullary cavity. MRI images confirmed diaphyseal sclerosis, both periosteal and endosteal thickening associated with bone marrow signal abnormality are consistent with marrow oedema.^[3] The disease may progress slowly over years and eventually stabilize. In our patient, MRI of both tibias and fibulas confirmed uneven sclerosis and bone marrow oedema in the right tibia as well as bone marrow oedema in the diaphysis of the right fibula, which is consistent with the previous study.^[3]

The diagnosis of MDS was determined by reviewing the clinical history, distinctive radiographic images, and laboratory and histopathologic findings.^[2] Laboratory and histopathologic findings are nonspecific but assist in excluding other diagnoses. X-ray may be the most useful in diagnosing MDS, and clinical information is essential in establishing the diagnosis. The diagnosis seems to be simple, but it is not easy. To make an accurate diagnosis of this disease, a couple of aspects are important to note. A comprehensive knowledge of the disease (both its X-ray manifestations and clinical features) should be mastered, otherwise, it is very easy to misdiagnose or to have a missed diagnosis. The patients were of normal physical and mental development and were considered healthy except for local symptoms.^[1] Most of the patients received only local radiographs because of local symptoms. If the MDS diagnosis is strongly suspected, we should take X-rays of the skull, spine, pelvis, and both upper limb and lower limbs. Only in this way can we complete a comprehensive evaluation and distinguish it from other similar diseases. MDS may be caused by autosomal recessive inheritance. Clinical information, including medical and family history, is essential in establishing the diagnosis. Other family members of the patients should receive a routine X-ray examination if necessary.

3.3. Differential diagnosis

Differential diagnosis for diseases that consist of narrowing the medullary canals and thickening of the diaphyses of long bones typically considers the following conditions: chronic sclerosing osteomyelitis, progressive diaphyseal dysplasia (Camurati-Engelmann disease), generalized cortical hyperostosis (Van Buchem disease) and intramedullary osteosclerosis. Although they may share similarity, viewed radiographically as endosteal and periosteal new bone formation along the diaphysis of bones, there are still many clinical differences that exist.

Chronic sclerosing osteomyelitis is a low-toxicity bone infection and often occurs in teenagers. Patients present with swelling, followed by local pain of a deep, boring nature, especially at night. Lesions in some osteomyelitis patients were discovered without a clear border of skin redness and with swelling and exudate of sinus abscesses. Radiographs consistently reveal hyperosteogeny and sclerosis. The surface of the cortical bone is not flat. This condition mainly manifests itself in a single bone; manifestations in multiple bones are rare. It does not manifest itself in the tibia and fibula at the same time, as in this case. Chronic sclerosing osteomyelitis can be excluded if there is bilateral involvement. Sequential symmetrical radiographs of the lower extremities that show sparing of metaphyseal and epiphyseal areas can help differentiate between MDS and chronic sclerosing osteomyelitis. Intramedullary osteosclerosis is a disorder that typically affects the mid-diaphyseal region of one or both tibiae, however, the fibula and femur can also be involved.^[5] It most often presents in adult females. There is neither genetic cause, nor is it associated with an infection, trauma or systemic illness. There is a tendency for this condition to present in the mid-tibia with activity-related lower leg pain in regions that also reveal stress fractures. Radiologically, increased sclerosis of the medullary canal can be seen, but in contrast to MDS, cortical thickening and periosteal reaction are absent.^[5] Therefore, it is essential that imaging features, clinical information, and laboratory analyses are all considered when trying to establish the correct diagnosis. Hyperostosis corticalis generalisata or endosteal hyperostosis, (Van Buchem disease) has an

autosomal recessive inheritance pattern. Radiographs consistently reveal that Van Buchem disease is associated with dense homogeneous cortical thickening of the skull, facial bones and mandible. The long bones, axial skeleton, pelvis, and ribs may also be affected. Endosteal cortical thickening and narrowing of the medullary canal is characteristic. Progressive diaphyseal dysplasia (Camurati–Engelmann disease) may also be confused with MDS due to a similar presentation of sclerosing bone dysplasia. Some definite differences were found to distinguish these two conditions, although some investigators have come to view MDS as part of a spectrum of progressive diaphyseal dysplasia.^[10] Progressive diaphyseal dysplasia has an autosomal dominant inheritance pattern. MDS may be caused by recessive inheritance. Many clinical differences also exist. Progressive diaphyseal dysplasia presents during childhood, whereas MDS presents in middle age. Progressive diaphyseal dysplasia is bilateral and symmetrical and involves both long bones and the skull, whereas MDS is either unilateral, asymmetrically or asynchronously bilateral, and affects only long bones. Neurological abnormalities associated with progressive diaphyseal dysplasia are absent in MDS. MDS manifests osteoblastic activity alone along with severe periosteal hyperplasia, whereas progressive diaphyseal dysplasia features trabecular thickening, and both osteoblastic and osteoclastic activity, implying bone formation and bone progressive resorption.

3.4. Treatment

There are no definitive medical or surgical intervention methods that completely treat MDS, however, many efforts may be employed to relieve the progressive pain.^[11] Medical treatment consists of nonsteroidal anti-inflammatory drugs (NSAIDs), bisphosphonates and prednisone.^[12] It is reported that NSAIDs are effective for most patients, especially at disease onset.^[2] Surgical intervention methods include intramedullary reaming and fenestration.^[2] A case reported by Beals described that intramedullary reaming dramatically relieved pain of both the femur and the tibia by removing the sclerotic endosteal new bone.^[12] In our patient, symptoms were relieved by oral celecoxib capsules at a dosage of 200 mg/day for 6 days. However, after one week she refused to take any medication. At the one-month follow-up, she reported occasional discomfort in the right tibia.

4. Conclusion

MDS is rare and may often be initially misdiagnosed as another type of sclerosing bone dysplasia. It is important to be aware of their existence. Once suspected, differential diagnosis should be performed to exclude other types of sclerosing bone dysplasia by considering clinical history, distinctive radiographic appearance, distribution, and laboratory and histopathologic findings.

Laboratory evaluation and pathologic findings are non-specific but assistant in excluding other diagnoses. More evidence is needed to illustrate the effectiveness of medical or surgical treatments for patients with MDS.

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