CASE REPORT

Proximal fibular stress fractures in children and adolescents, what should we rely on? Lessons learned from a case

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SUMMARY

Fibula fractures are the third most common stress fractures in children and adolescents. The triad of localised periosteal reaction, endosteal thickening and radiolucent cortical lines, localised in the distal third of the fibula along with a typical clinical history is in most cases sufficient to establish the diagnosis. Proximal fibula stress lesions are a very rare finding, with few reports in the literature. Stress fractures in this location demand careful investigation before a definitive diagnosis can be made. In the presence of non-specific MRI findings, stress fracture should be a diagnosis of exclusion. The authors report a case referred to their department by a sports medicine physician with a suspicion of stress fracture of the proximal fibula without characteristic imaging findings, which was ultimately confirmed as a stress lesion only by biopsy.

BACKGROUND

Stress fractures are becoming increasingly prevalent in children and adolescents as the level of participation in competitive and recreational sports increases. The fibula is the third most common site of stress fractures in children and adolescents,¹ and these injuries are associated with running and jumping activities. Stress fractures are very rarely located in the proximal fibula in the paediatric population and only one case has been reported.² Patients typically present with a history of athletic participation and a characteristic distal leg pain, and with the radiographic triad of localised periosteal reaction, endosteal thickening and radiolucent cortical lines. In doubtful cases, MRI findings of periosteal and marrow oedema with or without fracture lines usually allow for a confident diagnosis in children. All other possible diagnoses should be ruled out whenever only low grade alterations are found on MRI.

CASE PRESENTATION

A 13-year-old male basketball player was referred to our hospital by his sports medicine physician with pain and local tenderness in the proximal lateral aspect of his right leg. His symptoms had started 3 months earlier, with insidious onset but rapid progression, aggravated by running and jumping. He reported a 2-month absence from competition prior to the beginning of his symptoms due to Osgood-Schlatter disease in his contralateral knee. He denied previous trauma, history of fever or recent infectious disease, weight loss or night pain. No visible lesions were apparent on plain

Figure 1 Anterior X-ray showing proximal lateral cortical reaction.

radiographs of the affected leg and ultrasound imaging showed periosteal inflammation. He was medicated with non-steroidal anti-inflammatory drugs and instructed to withdraw from sports activities. At follow-up 1 month later, the patient still complained of pain and at this time leg radiographs showed lateral and posterior periosteal reaction in the proximal fibula (figures 1 and 2). Family history were unremarkable. He had been playing basketball, as the pivot of the team, since the age of eight, with an average of 8 h of practice each week. Physical examination revealed pain on palpation of the lateral and proximal aspect of the leg. No soft tissue masses or local inflammatory signs were present. He had no fever and no other constitutional signs. A history of limb pain, associated with athletic participation and radiographical changes after a

Figure 2 Lateral X-ray showing proximal posterior cortical reaction.

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Figure 3 Bone scintigram before and after 10 min of Tc perfusion showing low uptake in right fibula.

previous normal radiograph, is the common presentation of a stress fracture. The findings of leg pain after return to play and of a periosteal reaction on the radiograph of the leg 1 month after initial symptoms were compatible with a stress fracture. However, the atypical location of the lesion, duration and persistence of symptoms, associated with age, raised the concern of other diagnoses. To exclude other possible diagnoses, it was decided to study the patient with a full laboratory panel, including Erythrocyte Sedimentation Rate (ESR), C reactive protein (CRP), alkaline phosphatase (AP) lactate dehydrogenase (LDH), Scintigram and MRI.

INVESTIGATIONS

Laboratory studies, including CRP, ESR, alkaline phosphatase/AP and LDH were unremarkable. Leg radiographs showed a posterolateral periosteal reaction and cortical thickening in the proximal meta-diaphyseal transition of the fibula (figures 1 and 2); the underlying bone was normal. Given the location, patient age and radiographical findings, an MRI and bone scan were obtained. The bone scan revealed low intake in the proximal

fibula (figures 3 and 4) and MRI showed posterolateral periosteal oedema (figures 5–7) surrounding the area of periosteal reaction, but no medullary or cortical alterations were found. These changes were non-specific for stress fractures and further evaluation by biopsy (figure 8) was necessary to discard neoplasm or osteomyelitis.

DIFFERENTIAL DIAGNOSIS

Only 2.5% of primary bone tumours are found in the fibula and malignant proximal fibular tumours represent two-thirds of these.^{3 4} Osteosarcomas and Ewing sarcomas are the main diagnoses of proximal malignant fibula tumours, found in 44% and 19% of patients, respectively.³ Ewing's sarcoma typically presents with a clinical picture similar to our patient, in the same age group, and the fibula is a typical location. Pain is the main presenting symptom and palpable masses are found in only 51% of patients at the time of diagnosis.³ Subacute osteomyelitis may present with the same clinical picture, without systemic illness. Radiographical and MRI findings resembled those in some forms of osteosarcomas, Ewing's sarcomas and subacute osteomyelitis, although the low uptake on bone scan was suggestive of subacute osteomyelitis and not osteosarcoma or Ewing's sarcoma. Osteoid osteomas represent 2% of proximal benign tumours,⁴ but clinical and imaging findings were not consistent with this diagnosis.

Figure 4 Full skeleton scintigram 2 h after Tc perfusion.

Figure 5 Axial T1-weighted sequences showing posterolateral hyperintensity.

TREATMENT

Treatment consisted of protected weight bearing, analgaesics for pain control and abstinence from sports participation for

Figure 6 Axial T2-weighted sequences showing posterolateral hypersignal.

Figure 7 Coronal T2-weighted sequences showing posterolateral hypersignal.

Figure 8 Biopsy images.

7 weeks until clinical and radiographical evidence of consolidation ([figure 9](#)).

OUTCOME AND FOLLOW-UP

The patient resumed basketball practice gradually after clinical and radiological evidence of consolidation. Three months after biopsy he was competing without limitation and was discharged 1 year later after clinical and radiological control ([figure 10](#)).

DISCUSSION

Stress injuries are overload injuries uncommonly seen in the paediatric population.^{1 5} The aetiology of stress fractures of the proximal fibula proposed by Devas⁶ included acute sudden muscular pull on the osseous structures. Later, Symeonides⁷ described stress fractures associated with jumping activities in military recruits and proposed a different set of mechanisms related to strenuous pull by foot flexors. Clinical presentation is age and activity specific. The tibia, metatarsals and fibula are the most common sites in this age group,³ and are related to running and jumping sports.^{2 8} In the fibula, stress lesions are usually located in the mid-shaft and distal shaft, and the radiographical patterns in children and adolescents include a periosteal reaction and/or endosteal thickening.^{1 2 5 8} Proximal fibula as a site of stress fracture in adolescents was described in the literature in a case report.⁹ In this report, MRI findings were unequivocal for stress fracture. Based on the presence of periosteal, medullary and cortical alterations on MRI, Fredericson¹⁰ classified stress injuries as low-grade or high-grade injuries.¹¹ Woods *et al*,¹² in a case series describing MRI findings in patients with fibular stress injuries, reported five patients with proximal fibular stress injuries, all with grade 2 or higher alterations. They also correlated X-ray alterations with high-grade MRI injuries. On MRI, our patient showed a grade 1 injury according to Fredericson's classification, associated with radiographical alterations, in contrast to Woods's findings, which related stress fractures with radiographical alterations to high-grade stress lesions. These imaging features and clinical picture were very similar to those seen in osteomyelitis and neoplastic lesions,^{2 3} making these differential diagnoses extremely critical, as they have a completely different treatment approach and prognosis. In our case, an overload mechanism could have been responsible for the development of the lesion, as the consequence of a long absence from training, as the patient was just readmitted to participation in sports. Diagnostic algorithms for stress lesions in children and adolescents have already been

Figure 9 Seven weeks postbiopsy X-ray.

proposed,⁵ and rely on clinical and imaging findings. In our case, diagnosis was difficult because although the history was suggestive of a stress fracture, imaging findings were not specific. A low-grade stress injury on MRI resembled those of neoplastic and infectious disease, and a histological diagnosis by biopsy was necessary to rule out those diagnoses. The histological examination from biopsy ruled out the presence of neoplastic cells or infectious process and demonstrated the presence of a rich remodelling bone process. Based on these histological findings, a final diagnosis of stress lesion was made. It is our opinion that, in similar cases, further evaluation is warranted until those two diagnoses can be confidently ruled out.

Learning points

- Stress fractures of the proximal fibula in the paediatric population are very rare events and atypical. Even in the presence of a typical clinical history, the presence of low-grade stress injuries on MRI should warrant further investigation.
- In similar cases, stress lesion/fracture should be a diagnosis of exclusion.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Figure 10 Final X-ray control 1 year after biopsy.

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