



Case Presentation

Fractured Diaphyseal Tibiofibular Synostosis in an Adolescent Soccer Player

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Abstract

Diaphyseal tibiofibular synostosis is a rare cause of symptomatic shin pain with exertion. In this case, a 14-year-old male soccer player presented with atraumatic right shin pain made worse with running. Computed tomography revealed heterotopic ossification, or synostosis, of the tibial–fibular syndesmosis. The patient’s symptoms improved with rest, without the need for operative intervention.

Introduction

Tibial stress fractures, medial tibial stress syndrome, and chronic exertional compartment syndrome are common etiologies of exertional shin pain. Although far less common, both proximal and distal heterotopic ossification of the interosseus membrane between the tibia and fibula (tibiofibular synostosis) have been well documented as a source of anterior shin or ankle pain with activity [1-4]. Proximal synostoses are associated with leg length discrepancy and hereditary exostoses, whereas distal synostoses are associated with high ankle sprains and damage to the syndesmotic ligaments [2]. However, diaphyseal (mid-shaft) tibiofibular synostoses are a far less common entity, with very few cases reported in the medical literature [5]. We present the case of a conservatively managed, acutely fractured diaphyseal tibiofibular synostosis in a 14-year-old male soccer player.

Case Presentation

A 14-year-old male soccer player presented with a 2-week history of atraumatic right anterior leg pain that was worsened with running and relieved with rest. He denied prior medical evaluation or pain involving his other extremities. His family history and past medical history were negative. He characterized the pain as aching. Upon his initial presentation, plain film radiographs were obtained, which revealed a radiopaque density between the mid-shaft of the tibia and

fibula (Figure 1). The physical examination was notable for mild swelling and tenderness to palpation between the mid-shaft of the tibia and fibula. The pain was not reproduced by provocative maneuvers around the knee, ankle, or foot. The patient was able to demonstrate full active range of motion in all planes around the knee and ankle, and normal strength in all muscle groups of both lower extremities. Neurovascular examination findings were normal, there were no dermatological lesions, and there was no leg length discrepancy or lymphadenopathy. Magnetic resonance imaging (MRI) demonstrated an acutely fractured area of mineralization along the proximal interosseous membrane. This fracture involved the abnormal mineralization that formed between the tibia and fibula, but not the tibia or fibula themselves (Figure 2). The patient and his father declined a referral for biopsy of the mineralization. After 1 month of rest from sports, the patient was able to return to full athletic activities. However, after 5 months had elapsed, the patient presented with an atraumatic return of the same anterior shin pain that, as before, was exacerbated with running and soccer. As the patient’s symptoms failed to improve with his initial course of conservative treatment, further imaging was planned. After consultation with orthopedics and radiology, computed tomography (CT) without intravenous contrast was advised. The CT findings were notable for heterotopic ossification (or synostosis) of the mid tibial–fibular syndesmosis, with no evidence of osteosarcoma. There was a vertically oriented fracture or



Figure 1. Anteroposterior and lateral radiographs depicting diaphyseal tibiofibular synostosis.

lucency through the ossification, which otherwise demonstrated an area of complete bridging across its inferior margin (Figure 3). Because of the mature appearance and well-demarcated margins of the heterotopic bone, the radiologist did not believe that these findings represented a malignant tumor, and advised against further imaging or biopsy. After discussing treatment options including a surgical resection, the patient and his father elected another trial of conservative treatment. The patient was held from

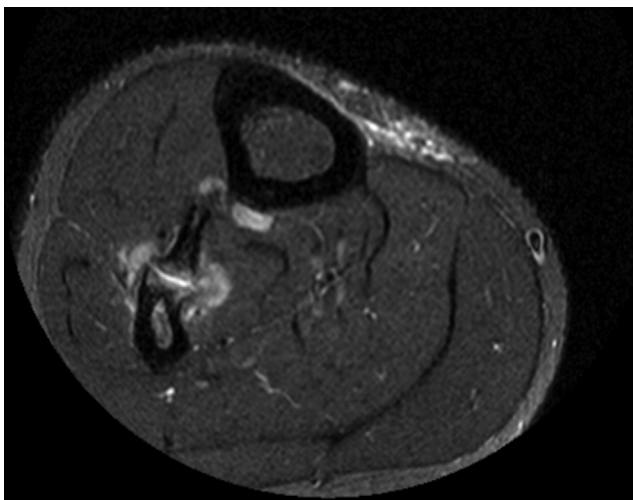


Figure 2. Magnetic resonance image depicting diaphyseal tibiofibular synostosis.



Figure 3. Computed tomographic image depicting diaphyseal tibiofibular synostosis.

running and soccer for 8 weeks. No weight-bearing restrictions were recommended. He was allowed to continue weight lifting and skill drills. Swimming was encouraged to prevent deconditioning. At a 2-month follow-up, the patient was instructed to gradually increase his activity level as tolerated under the guidance of his athletic trainer, progressing from the stationary bicycle to monitored jogging, running, and sprinting. This protocol was identical to that used to treat uncomplicated tibial stress fractures in the orthopedic sports medicine clinic in which the patient was seen. However, the goal of treatment was not radiographic healing of a fracture but, rather, clinical resolution of pain, which was believed to be secondary to either the fracture within the synostosis or to the abnormal restriction in motion of the fibula caused by the synostosis. After a gradual return to activity, the patient remained minimally symptomatic and fully functional with running, soccer, and sports for more than 6 months.

Discussion

Umesan defined synostosis as “union between adjacent bones or parts of a single bone made up of osseous material, such as ossified connecting cartilage or fibrous tissue” [6]. A specimen presented by Umesan, obtained via surgical resection of a proximal tibiofibular synostosis, was found to contain cancellous bone comprising trabeculae with vascular foraminae. The pathophysiology was postulated to involve soft tissue damage with bleeding across the interosseous membrane, resulting in new bone formation. Surgical

excision of a symptomatic diaphyseal tibiofibular synostosis, performed by Kobayashi et al, was pathologically characterized as osseous or fibrous tissue without atypia or inflammatory reaction [5].

In this case, the patient's pain was in the anterior shin, not the ankle. Increased intramuscular pressure is a potential mechanism suggested by Kobayashi et al to explain exertional shin pain the setting of diaphyseal tibiofibular synostosis [5]. Hanypsiak et al report a case that suggests the hypothesis of increased intramuscular pressure as the explanation for exertional shin pain in a professional football player with a symptomatic, acutely fractured diaphyseal tibiofibular synostosis refractory to conservative care that progressed to acute anterior compartment syndrome, necessitating emergent 4-compartment fasciotomy [7]. In the case that we present, no such inciting trauma occurred, and there were no symptoms consistent with compartment syndrome; rather, it is likely that our patient's pain is more directly attributable to alteration of the normal downward and medial motion of the fibula during gait, in which the fibula is, on average, pulled distally 2.4 mm by the flexors of the foot with ensuing interosseous membrane tightening and medial fibular motion, as described by Frick et al [8]. Even a fractured synostosis may limit tibiofibular movement, especially one such as that seen in our patient, which had an area of complete bone bridging at its inferior margin.

The most common treatment of diaphyseal tibiofibular synostosis is surgical resection. Kobayashi et al cite current literature depicting 9 cases in which surgical resection was undertaken in 6 instances [5]. James et al presented one such case in 2007, in which a professional football player developed symptomatic diaphyseal tibiofibular synostosis refractory to conservative care that underwent dramatic improvement with surgical excision. James et al suggest that, based upon his case and review of prior literature, idiopathic diaphyseal tibiofibular synostosis is recalcitrant to conservative management and should invariably be treated with resection [9]. Conversely, Horst reports that stress fracture of a distal tibiofibular synostosis may be well managed conservatively [10]. Moreover, Henry et al advocate conservative management in a description of the cases of 2 professional basketball players [1]. Henry and Horst documented treatment with a bone stimulator [1,10]. However, if much of the pain related to synostosis may due to abnormal tibiofibular movement, as described by Frick et al [8], then promoting further ossification of the synostosis would not likely result in decreased pain. The successful outcome in our patient suggests that use of a bone stimulator may not be a necessary component of nonoperative management of a synostosis.

In one of Henry's 2 cases of synostosis, the patient (a professional basketball player) was treated with

immobilization and casting for 2 months [1]. The casted athlete was cut from his team for undocumented reasons and did not appear to have had an outcome superior to that of the athlete who was not casted. The successful outcome in our patient further suggests that casting and immobilization may not be necessary to treat a symptomatic synostosis.

Hanypsiak reported 19 cases of tibiofibular synostoses, including proximal, mid-shaft (diaphyseal), and distal locations, in which surgical excision was undertaken for 15 of the patients. The recurrence rate (of regrowth of the synostosis) among those 15 patients is documented at 27% [7]. In light of the high recurrence rate with excision, and documented improvement of symptoms in the literature with relative rest, we advocate an initial trial of conservative management of tibiofibular synostosis. Certainly, a thorough musculoskeletal and neurovascular examination is paramount to ensure that other potential etiologies of anterior exertional shin pain are ruled out, and to assess for potential emergent entities, such as compartment syndrome or osteosarcoma. Plain films are essential as an initial diagnostic tool. Magnetic resonance imaging with gadolinium is recommended for the evaluation of primary bone tumors, especially in the pediatric population, in which there is a higher incidence of osteosarcoma [11]. If a tibiofibular synostosis is suspected, CT may be the optimal study to evaluate the heterotopic ossification.

Conclusion

Diaphyseal tibial fibular synostosis is an uncommon cause of atraumatic shin pain in the active population. In this case, our patient had painful synostosis with pain that was likely secondary to the biomechanical effects exerted on the tibia and fibula, rather than the fracture seen in the synostosis. If diaphyseal synostosis is diagnosed, a trial of conservative treatment and rest is advised. However, in many cases, surgical resection may be indicated to provide symptom relief.

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Disclosure

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