Letter to the Editor

Proximal Tibial Stress Fractures: A Diagnostic Challenge

Dear Editor,

Stress fractures are caused by repeated micro trauma to the bone over a period of time. It can happen in normal bone exposed to abnormal repetitive stress or in abnormal bone receiving normal stress. In healthy individuals, tibia stress fractures occur most frequently amongst athletes who participate in activities that involve prolonged walking, running or jumping.[1] The tibia shaft is most commonly affected, whereas the proximal tibia is less common.[2] Risk factors include excessive training, alteration in normal gait biomechanics such as tightness of calf muscles, unequal leg length, osteoporotic bone and vitamin D deficiency.[3,4] This type of fracture can be easily misdiagnosed due to its clinical presentation and location near the knee,[5,6] which can mimic medial-sided osteoarthritis, meniscal injuries and pes anserinus bursitis. We describe an atypical presentation of atraumatic proximal tibia stress fracture in a young healthy male with no known risk factors.

Case Report

The patient, a 40-year-old customer service officer, had presented to the Sports Medicine and Surgery Clinic with acute onset of left knee pain after running at work to assist a customer. He had, otherwise, been well with no known past medical history and had a body mass index of 23. There had been no trauma, fall or injury and no history of a sudden increase in physical activity. He also did not have a history of vitamin D deficiency and did not drink alcohol.

The pain, which was mostly at the medial joint line, became worse with activity. On clinical examination, the patient was able to ambulate independently and had left knee range of movement of 0–125. There was no knee effusion. He complained of medial-sided joint line tenderness on palpation. There was no ligamentous laxity.

Initial radiographs (Fig. 1) revealed no obvious fractures or radiolucent lines. The initial impression was an exacerbation of mild left knee osteoarthritis. He was prescribed a course of analgesia and physiotherapy.

He was seen 1 week later and continued to complain of left knee pain that affected ambulation. It was noted then that he had an antalgic gait with persistent medial joint line tenderness. In view of the persistent pain, magnetic resonance imaging (MRI) of the left knee was ordered to look for possible intra-articular pathology. MRI revealed a stress fracture of the medial proximal tibia (Fig. 2). There was no other concomitant intra-articular injury. The patient was subsequently kept non-weight-bearing (with crutches) and was referred to an orthopaedic surgeon. He was treated non-surgically with gradual escalation to weight-bearing status with follow-up radiographs. Repeat radiographs 3 months postinjury did not show further varus collapse (Fig. 3A). He did not experience any subsequent pain and returned to work successfully.

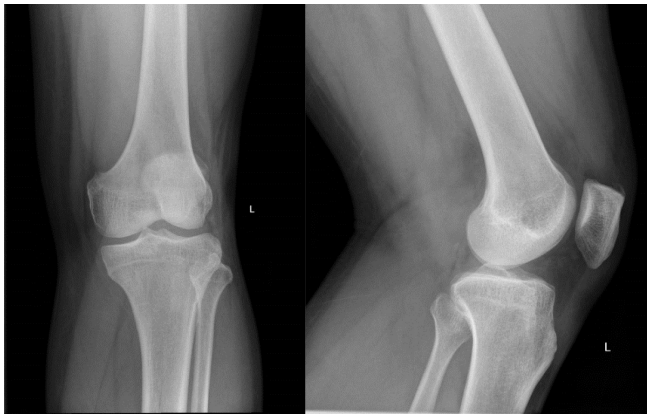

Fig. 1. Plain radiographs of the patient's left knee on initial presentation do not show any remarkable findings.

Discussion

Stress fractures of the tibia are one of the most common lower extremity stress fractures. The mid-tibial region is the most frequently involved area.[2] Proximal tibia stress fractures are less common and are usually associated with patients with significant coronal deformities.[7,8] However, this was an unlikely contributory factor in our patient as he had minimal arthritis and coronal malalignment as seen on the long leg film (Fig. 3B).

The clinical presentation of proximal tibial stress fractures can mimic other conditions in physical examination. There are few studies addressing this in the current literature, and there is a lack of proven clinical tests for the diagnosis of tibial stress fractures. While tests such as the tuning fork test (eliciting pain while placing an oscillating tuning fork over the fracture site), fulcrum test (eliciting pain while

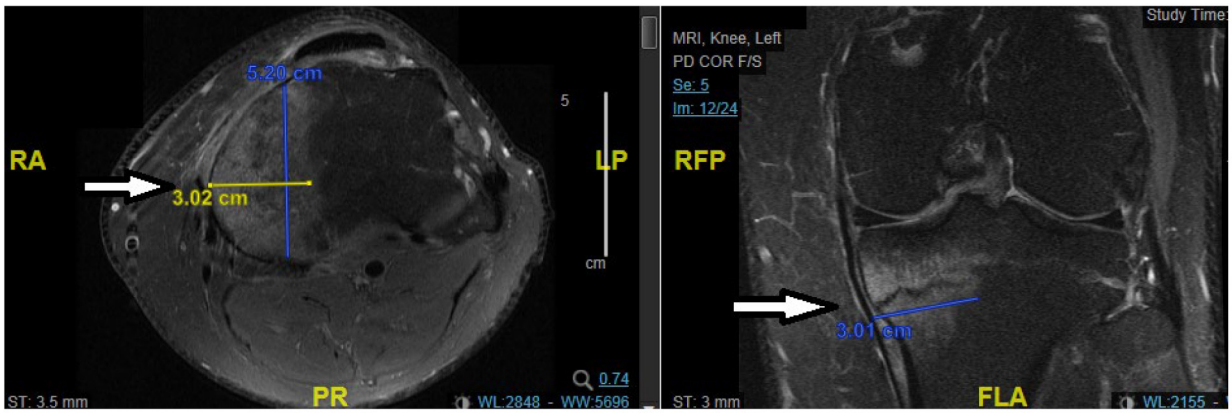

Fig. 2. T2-weighted sequence magnetic resonance images reveal stress fractures of the medial proximal tibia.

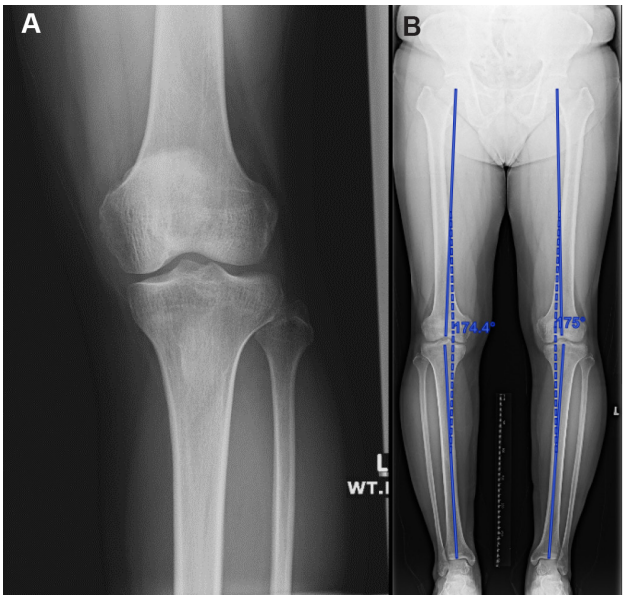

Fig. 3. Radiograph images. A: Anterior-posterior weight-bearing view of the left knee shows no further Varus collapse of the medial tibia plateau. B: Long leg film demonstrates alignment of the left lower limb.

applying a downward pressure over the fracture site using the examiner's arm as a fulcrum) and therapeutic ultrasound tests (eliciting pain while therapeutic ultrasound is applied over the fracture site) have been described, they lack adequate sensitivity or specificity to be relied upon for diagnosis.[9] It is generally recommended that clinicians have a high index of suspicion for the condition through a thorough history and examination, especially in patients that have persistent pain despite initial conservative treatment.

Early diagnosis of stress fractures is important for appropriate treatment and prevention of complications. Plain radiographs are often negative at the onset of symptoms and have a high rate of false-negatives. Compared to radiographs, MRI is a more sensitive and specific mode of evaluation of suspected stress fractures.[10] Bone scans are also highly sensitive for stress fractures. However, they are non-specific and can be mimicked by other conditions such as malignancy or infection.[11] Some studies have proposed guidelines to aid the clinician's assessment of suspected stress fractures.[10,12] However, these guidelines are dependent on the clinician having a clinical suspicion of stress fracture in the first place. This may not be helpful in the clinical setting as proximal tibial stress fractures may present in a similar manner as the more common conditions. Patients with an atypical presentation and who lack conventional risk factors for stress features can be potentially misdiagnosed. In our patient, MRI was ordered in view of persistent activity-related pain despite initial conservative treatment. Persistence or progression of activity-related pain is well documented in the literature as being suggestive of lower limb stress fracture.[13]

Classification systems for stress fractures such as Kaeding-Miller—which has high inter- and intra-observer reliability—can be used to guide treatment.[14] Treatment options for proximal tibia stress fractures can be surgical or non-surgical. Non-surgical management includes a period of offloading with gradual escalation to weight-bearing status. This may include the use of a cast or brace for immobilisation of the fracture site. Follow-up radiographs are recommended to look for complications including non-union, malunion or varus collapse of the tibial plateau that may require surgical intervention. While rare, late complications such as post-traumatic formation of osteoid osteoma have also been described in the literature.[15,16] Most patients treated conservatively can return to full activities at about 12 weeks.[17]

Conclusion

Proximal tibial stress fractures are relatively rare. Its clinical presentation may mimic other conditions leading to a delay in diagnosis. In the absence of obvious risk factors in the clinical evaluation, a stress fracture should be suspected in patients who have persistent or progressive activity-related lower limb pain despite initial conservative treatment. This can be used to guide decisions for further

imaging studies. In the absence of complications on follow-up, gradual escalation to weight-bearing status and activity modification are usually successful.

REFERENCES

1. Feldman JJ, Bowman EN, Phillips BB, Weinlein JC. Tibial stress fractures in athletes. Orthop Clin North Am 2016;47:733–41.
2. Behrens SB, Deren ME, Matson A, Fadale PD, Monchik KO. Stress fractures of the pelvis and legs in athletes: a review. Sports Health 2013;5:165–74.
3. Becker J, Nakajima M, Wu WFW. Factors contributing to medial tibial stress syndrome in runners: a prospective study. Med Sci Sports Exerc 2018;50:2092–100.
4. Kahanov L, Eberman L, Games K, Wasik M. Diagnosis, treatment and rehabilitation of stress fractures in the lower extremity in runners. Open Access J Sports Med 2015;6:87–95.
5. Yukata K, Yamanaka I, Ueda Y, Nakai S, Ogasa H, Oishi Y, et al. Medial tibial plateau morphology and stress fracture location: a magnetic resonance imaging study. World J Orthop 2017;8:484–90.
6. Vossinakis IC, Tasker TP. Stress fracture of the medial tibial condyle. Knee 2000;7:187–90.
7. Soundarrajan D, Rajkumar N, Dhanasekararaja P, Rajasekaran S. Proximal tibia stress fracture with osteoarthritis of knee – radiological and functional analysis of one stage TKA with long stem. SICOT J 2018;4:13.
8. Kahanov L, Eberman LE, Games KE, Wasik M. Diagnosis, treatment and rehabilitation of stress fractures in the lower extremity in runners. Open Access J Sports Med 2015;6:87–95.
9. Schneiders AG, Sullivan SJ, Hendrick PA, Hones BD, McMaster AR, Sugden BA, et al. The ability of clinical tests to diagnose stress fractures: a systematic review and meta-analysis. J Orthop Sports Phys Ther 2012;42:760–71.
10. Wright AA, Hegedus EJ, Lenchik L, Kuhn KJ, Santiago L, Smoliga JM. Diagnostic accuracy of various imaging modalities for suspected lower extremity stress fractures: a systematic review with evidence-based recommendations for clinical practice. Am J Sports Med 2016;44:255–63.
11. Moran DS, Evans RK, Hadad E. Imaging of lower extremity stress fracture injuries. Sports Med 2008;38:345–56.
12. Nye NS, Covey CJ, Sheldon L, Webber B, Pawlak M, Boden B, et al. Improving diagnostic accuracy and efficiency of suspected bone stress injuries. Sports Health 2016;8:278–83.
13. Shindle MK, Endo Y, Warren RF, Lane JM, Helfet DL, Schwartz EN, et al. Stress fractures about the tibia, foot and ankle. J Am Acad Orthop Surg 2012;20:167–76.
14. Kaeding CC, Miller TL. The comprehensive description of stress fractures: a new classification system. J Bone Joint Surg Am 2013;95:1214–20.
15. Soon M, Low CK, Chew J. Osteoid osteoma after a stress fracture of the tibia: a case report. Ann Acad Med Singapore 1999;28:877–8.
16. Riley ND, Camilleri D, McNally MA. Osteoid osteoma following fracture of the distal tibia: a case report and literature review. Injury Extra 2014;45:69–72.
17. Robertson GA, Wood AM. Return to sports after stress fractures of the tibial diaphysis: a systematic review. Br Med Bull 2015;114:95–111.

Chenghan Wu, [1]*MBBS, MRCS*,
Sean WL Ho, [1]*MBBS, MMed (Ortho), FRCSEd (Ortho)*,
Lester TJ Tan, [1]*MBBS, MMed (Ortho), FRCSEd (Ortho)*

[1]Department of Orthopaedic Surgery, Tan Tock Seng Hospital, Singapore

Address for Correspondence: Dr Wu Chenghan, Department of Orthopaedic Surgery, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433.
Email: chenghan.wu@mohh.com.sg