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Case Series

Diagnostic Dilemma In Stress Fractures: A Report On 3 Different Cases

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ABSTRACT

Stress fractures are characterized by atraumatic partial or incomplete fractures, encompassing both fatigue and insufficiency fractures. The majority of stress fractures fall within the fatigue type, particularly prevalent in individuals participating in repetitive and intense physical activities for which they are not accustomed. This phenomenon is notably observed in military recruits. The diagnostic identification of stress fractures can pose challenges, often leading to misinterpretations that mimic tumorous or infectious conditions. In this study, we present three illustrative cases to underscore this diagnostic complexity. Two cases initially diagnosed as tumorous and cortical abscesses were later identified as stress fractures. Additionally, a case initially categorized as a stress fracture eventually revealed an underlying manifestation of osteomyelitis. These cases highlight the importance of a comprehensive diagnostic approach in distinguishing stress fractures from conditions with similar clinical presentations.

Keywords: Cortical Abscess; Diagnostic Dilemma; Military Recruits; Osteomyelitis; Stress Fracture

INTRODUCTION

Stress fractures, encompassing partial or complete fractures, are induced by repetitive submaximal loading of bones, constituting one extreme in the spectrum of disorders ranging from periostitis to complete stress fractures.[1] This categorization primarily distinguishes between fatigue fractures, resulting from prolonged cyclical mechanical stresses on normally structured bones, and insufficiency fractures, arising from physiological stress on bones debilitated by metabolic disorders or radiation therapy.[2]

In the context of military recruits, stress fractures predominantly manifest as fatigue fractures. The ramifications of stress fractures extend beyond heightened morbidity and prolonged training absences; they also impose significant economic burdens on both individuals and organizations.[3] Particularly vulnerable are individuals engaged in endurance and high load-bearing activities such as running, military service, and various sports, thus predisposing them to stress fractures. The diagnostic and therapeutic aspects of stress fractures in these populations present notable challenges.[2]

This study seeks to contribute to the understanding of stress fractures, focusing on their etiology, classification, and implications, with a specific emphasis on the challenges encountered in diagnosis and treatment within populations engaged in demanding physical activities.

CASE REPORT

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Case 1

A 20-year-old male paramilitary recruit in basic training sought evaluation at the orthopaedic outpatient department at Nepal Armed Police Force Hospital with a one-month history of debilitating pain, limping, and noticeable swelling in the left thigh. The severity of the pain compelled the patient to rely on a crutch for ambulation. No history of trauma, febrile illness, or weight loss was reported. Upon physical examination, mild swelling and local tenderness were observed in the distal aspect of the left thigh.

Preliminary investigations, including blood count, erythrocyte sedimentation rate, C-reactive protein, serum calcium, phosphorus, and alkaline phosphatase levels, were within normal ranges. The patient had previously undergone a magnetic resonance imaging (MRI) at another institution, revealing a potential infiltration of bone marrow fat with a soft tissue component. A bone marrow biopsy was recommended, with a differential diagnosis encompassing Ewing's sarcoma and chronic osteomyelitis. However, the patient declined the biopsy and sought further evaluation at our institute.

Upon admission, a decision was made to defer the bone marrow biopsy, opting instead for serial monitoring of radiographs. The initial radiograph of the right femur revealed a prominent lamellar periosteal reaction over the medial aspect of the distal femur (Fig. 1). Subsequent computed tomography (CT) scans demonstrated a radiodense line in the distal shaft of the left femur, accompanied by the periosteal reaction. 99mTC radionuclide scintigraphy exhibited elevated pool activity and increased tracer uptake in the distal shaft of the left femur. A follow-up CT scan, conducted three weeks later, identified at least two fracture lines in the midshaft of the left femur, accompanied by periosteal reaction indicative of a stress fracture.

Throughout a six-week observation period, serial radiographs exhibited a progressive thickening of the periosteal reaction (Fig. 2). Notably, the patient's symptoms gradually resolved during this period, obviating the need for a biopsy. This case underscores the diagnostic challenges posed by stress fractures and highlights the potential for spontaneous resolution with conservative management.

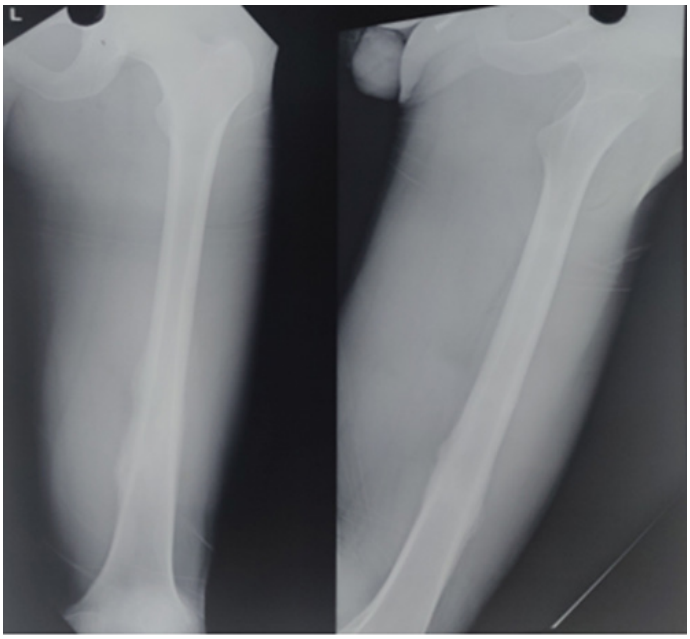

Fig. 1: Periosteal reaction seen over the medial aspect of the distal femur

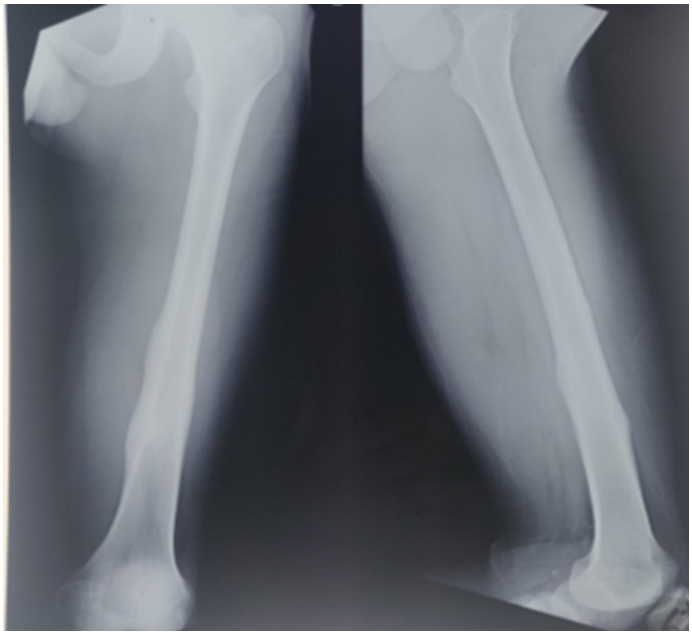

Fig. 2: Six weeks follow-up radiograph showing thickening of periosteal reaction

Case 2

A 20-year-old male paramilitary recruit in basic training presented at the orthopedic outpatient department of Nepal Armed Police Force Hospital with a prolonged four-month history of pain and swelling localized to the left proximal tibia. No incidents of trauma, fever, or weight loss were reported. Upon physical examination, mild swelling was noted over the proximal and medial aspects of the tibia. Initial investigations, including blood count, erythrocyte sedimentation rate, and C-reactive protein, revealed normal values. A prior MRI conducted at another institution depicted focal eccentric cortical thickening with periosteal reaction in the medial aspect of the proximal tibial shaft. Additionally, the imaging identified a focal thin intracortical lesion displaying hypersignal intensity within the thickened cortex, along with diffuse perilesional marrow edema in the proximal and mid-tibia. Despite these findings, the patient declined the recommended biopsy and sought further evaluation at our institute.

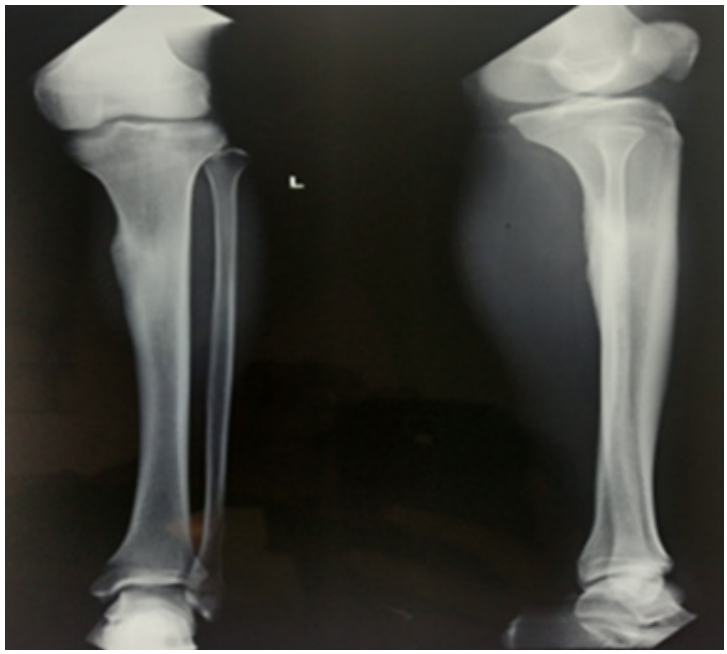

Fig. 3: Periosteal reaction over the medial aspect of the tibia

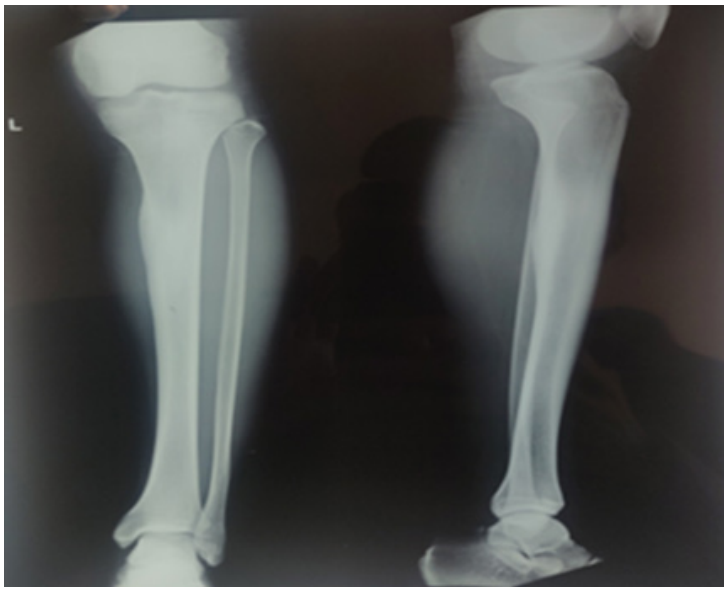

Fig. 4: 6 weeks follow up with maturation of the periosteal reaction

A radiographic examination of the left tibia at the time of the

initial assessment disclosed a substantial lamellar periosteal reaction over the medial aspect of the proximal left tibia (Fig. 3), indicative of a stress fracture. Given the patient's reluctance to undergo a biopsy, the bone marrow biopsy was postponed. Short-term follow-up was initiated, with repeat blood parameters measured at the 2nd and 6th weeks, all of which remained within normal limits. Serial radiographs in the 6th week consistently revealed features consistent with a stress fracture (Fig. 4), and consequently, a bone biopsy was not performed.

This case underscores the diagnostic challenges associated with stress fractures, emphasizing the clinical and radiological continuity observed during follow-up. The patient's refusal of biopsy, while limiting a definitive histopathological diagnosis, provides valuable insights into the management of stress fractures within a clinical context.

Case 3

A 20-year-old male paramilitary recruit in basic training sought emergency medical attention due to a two-week history of escalating pain in the left thigh accompanied by a mild limp. Initially, the pain surfaced only after strenuous exercise, evolving into a persistent discomfort that hindered his daily activities, intensifying both day and night. No history of trauma, febrile illness, or weight loss was reported. Upon physical examination, localized tenderness was identified over the lateral aspect of the thigh.

Laboratory investigations revealed elevated blood count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP), while serum calcium, phosphorus concentrations, and alkaline phosphatase activity remained within normal limits.

Radiographic evaluation of the left femur during the initial assessment showed no apparent fracture line or periosteal reaction (Fig. 5). However, a computed tomography (CT) scan revealed a fracture line in the posterior medial cortex of the femoral shaft with minimal periosteal reaction, indicative of a stress fracture. Serial monitoring of blood count, ESR, and CRP indicated an increasing trend. A week after admission, the patient experienced multiple episodes of high-grade fever with chills and rigor. Consultation with a medical specialist led to a comprehensive assessment ruling out malaria, brucella, scrub typhus, leptospirosis, and dengue.

Radiographs in the third week displayed cortical erosion with irregularities in the posterior cortex of the left femur, accompanied by periosteal reaction and soft tissue swelling in the adjacent region (Fig. 6). Ultrasonography of the left thigh revealed a heteroechoic area in the mid-thigh. Subsequent MRI confirmed multiple pockets of abscess within the bone and muscle plane, indicative of osteomyelitis (Fig. 7).

Intravenous antibiotics were administered continuously for six weeks, resulting in the normalization of blood counts by the fourth week of admission. However, ESR and CRP remained elevated. A second MRI scan in the sixth week indicated a persistent abscess cavity, albeit reduced in size compared to the previous scan. A week later, decompression

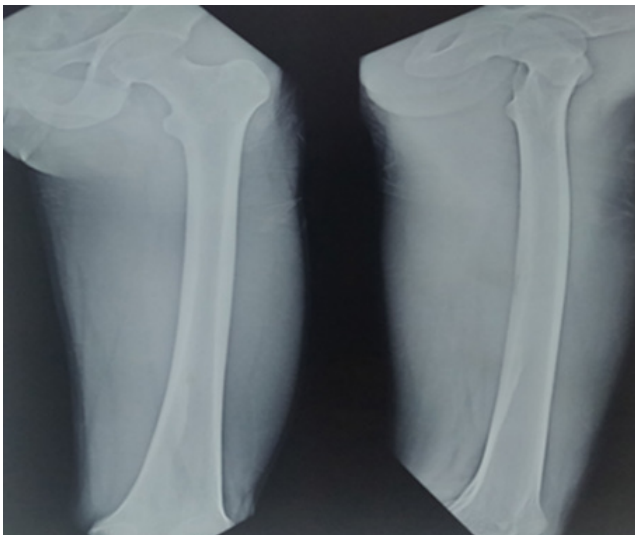

Fig. 5: No apparent periosteal reaction

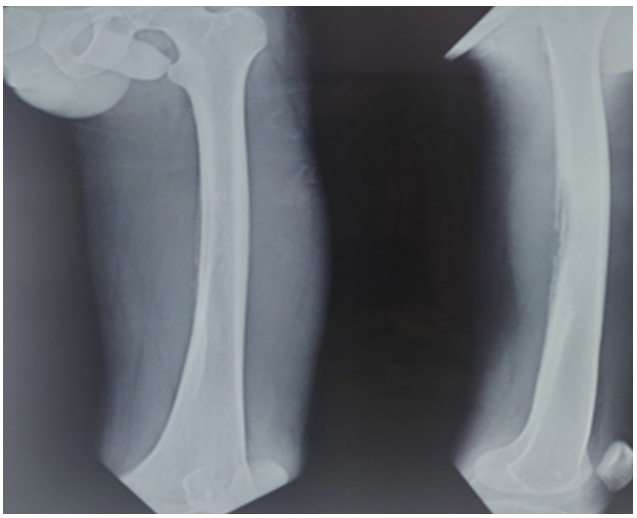

Fig. 6: 3rd week follow-up with irregularities in posterior cortex

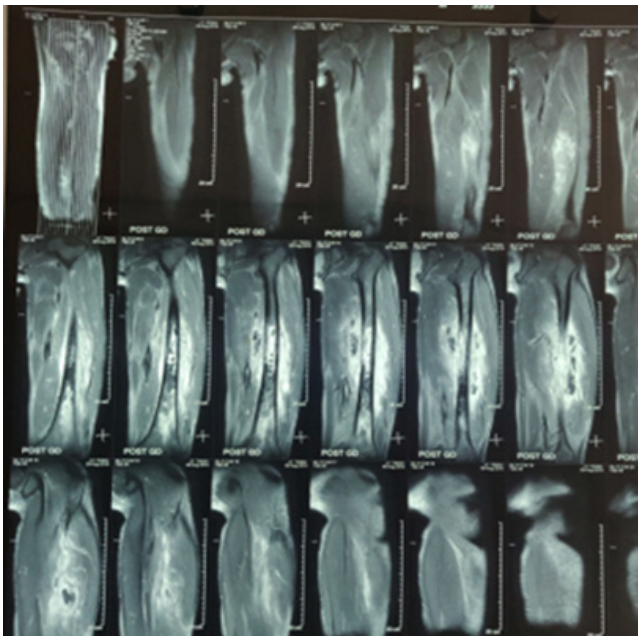

Fig. 7: MRI showing multiple pockets of abscess in the bone and muscle plane

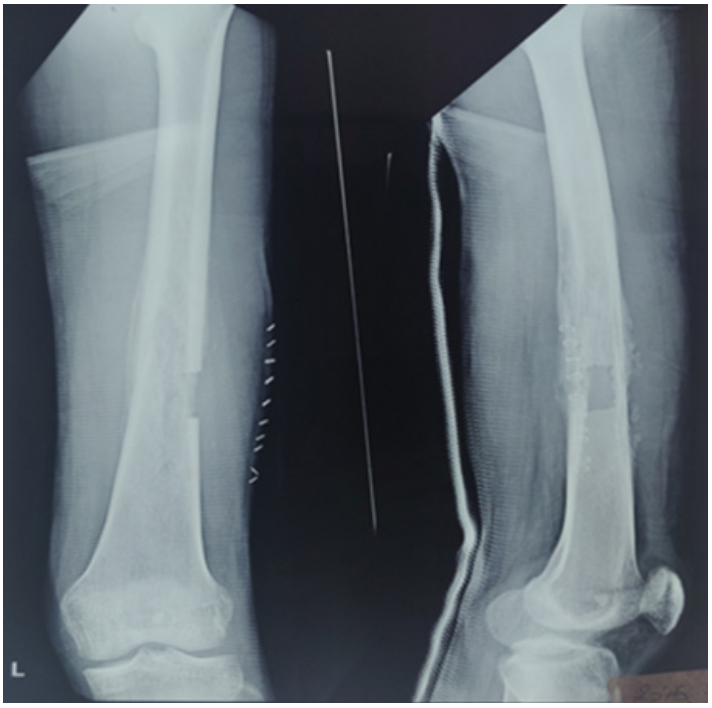

Fig. 8: Immediate postop radiograph after corticotomy and decompression

with corticotomy was performed, and a bone biopsy was sent for histopathological examination, which excluded malignancy but confirmed features consistent with chronic osteomyelitis. Intravenous antibiotics were continued for an additional six weeks, during which ESR and CRP gradually normalized.

This case underscores the complexity of stress fractures and the diagnostic challenges associated with secondary complications such as osteomyelitis. The multidisciplinary approach, including imaging, microbiological investigations, and timely intervention, proved instrumental in managing this intricate clinical scenario.

DISCUSSION

Stress fractures, arising from repetitive microtrauma that surpasses the bone's reparative capacity, necessitate a comprehensive understanding and management of associated risk factors.[1] The diagnostic and therapeutic aspects of stress fractures remain formidable challenges in clinical and radiological realms.[2,5] Various imaging modalities, including plain radiography, computed tomography (CT), scintigraphy, and magnetic resonance imaging (MRI), are frequently employed to diagnose stress fractures. However, even with the integration of multiple modalities, diagnostic complexities persist.[2,5]

In the context of the presented cases, the trainees exhibited distinct clinical presentations, underscoring the prevalence of stress fractures within this population. The commonality among trainees lies in the rapid escalation or modification of physical loading magnitude and intensity as integral components of training programs. Clinically, the hallmark feature of stress fractures is localized pain, typically emerging after or towards the end of physical activity and alleviated by rest.

Distinguishing stress fractures from other pathologies is crucial. The differential diagnosis encompasses conditions such as osteoid osteoma, osteomyelitis, osteomalacia, metastasis, osteosarcoma, and Ewing's sarcoma.[2] Notably, patients with osteoid osteoma often experience nocturnal exacerbation of pain, contrasting with stress fractures that worsen with activity and improve with rest.

Laboratory parameters, including total and differential counts, erythrocyte sedimentation rate, and C-reactive protein, play a pivotal role in ruling out osteomyelitis. However, the potential involvement of a tumor introduces complexity, with clinical and diagnostic findings sometimes providing limited guidance. Even bone biopsies, though often considered a definitive diagnostic tool, may exhibit histological similarities between healing stress fractures and bone sarcomas or Ewing's tumors.

Radiographic films are indispensable for evaluating periosteal bone formation, cortical margins, and fracture lines. However, their sensitivity may be limited in detecting acute stress fractures, with evidence often emerging only after three weeks.[2,4,7] Consequently, other imaging techniques, such as CT scans, are recommended for a more precise diagnosis.[3]

Serial radiographs, particularly repeated after two weeks, are crucial when stress fractures are suspected but initial imaging studies show no abnormalities. The absence of healing within 1-2 weeks post-cessation of the causative activity reinforces the diagnosis. In cases of uncertainty, CT scans provide enhanced clarity. Caution is advised in considering biopsies until radiographs unequivocally demonstrate no signs of healing, suggesting the possible presence of lesions other than stress fractures.

This discussion highlights the intricacies involved in diagnosing and managing stress fractures, emphasizing the significance of a multidisciplinary approach and the judicious application of various diagnostic modalities to ensure accurate and timely intervention. Further research and advancements in imaging technologies are imperative for refining diagnostic precision and elucidating optimal treatment strategies for stress fractures.

CONCLUSION

Stress fractures, under their clinical presentation mirroring other pathologies such as infections and tumors, present a diagnostic challenge. The successful identification of stress fractures hinges on heightened clinical suspicion, reinforced by the judicious application of advanced imaging modalities for timely and accurate diagnosis. Evolving techniques, including radionuclide methods and contemporary MRI, have become integral in unraveling the nuanced spectrum of stress-related bone changes.

Ensuring that both under and overdiagnosis is avoided is paramount when dealing with individuals susceptible to stress fractures. The delicate balance in diagnostic precision mandates a thorough and systematic approach, involving serial monitoring of clinical, laboratory, and imaging parameters. This comprehensive strategy is indispensable

for effective management, enabling tailored interventions that address the unique characteristics and progression of stress fractures in each patient.

REFERENCES

1. Sayani J, Stott P. Stress fractures: aetiology and management principles. Orthop Trauma [Internet]. 2020;34(3):124–30. https://doi.org/10.1016/j.mporth.2020.03.004

2. Fayad LM, Kamel IR, Kawamoto S, Bluemke DA, Frassica FJ, Fishman EK. Distinguishing stress fractures from pathologic fractures: A multimodality approach. Skeletal Radiol. 2005;34(5):245–59. https://doi.org/10.1007/s00256-004-0872-9

3. Takkar P, Prabhakar R. Stress fractures in military recruits: A prospective study for evaluation of incidence, patterns of injury and Invalides out of service. Med J Armed Forces India. 2019 Jul 1;75(3):330–4. https://doi.org/10.1016/j.mjafi.2018.09.006

4. Kahanov L, Eberman LE, Games KE, Wasik M. Diagnosis, treatment, and rehabilitation of stress fractures in the lower extremity in runners. Open access journal of sports medicine. 2015 Mar 27:87-95. https://doi.org/10.2147/OAJSM.S39512

5. Crönlein M, Rauscher I, Beer AJ, Schwaiger M, Schäffeler C, Beirer M, Huber S, Sandmann GH, Biberthaler P, Eiber M, Kirchhoff C. Visualization of stress fractures of the foot using PET-MRI: a feasibility study. European Journal of Medical Research. 2015 Dec;20:1-7. https://doi.org/10.1186/s40001-015-0193-6

6. Ferry AT, Graves T, Theodore GH, Gill TJ. Stress fractures in athletes. Phys Sportsmed. 2010;38(2):109–16. https://doi.org/10.3810/psm.2010.06.1788

7. Kokkinakis M, Darmanis S, Anastasopoylos S, Zagkas I, Karliaftis K. Multiple Stress Fractures: A Case Report. Journal of Medical Cases. 2011 Jan 20;2(1):1-3. https://doi.org/10.4021/jmc46w

8. Agarwal A, Gulati D. Dilemma in stress fractures. Int Orthop. 2009;33(2):585. https://doi.org/10.1007/s00264-008-0635-7