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# Bilateral medial malleolus stress fractures due to osteoarthritis of knee: A case report and review of literature



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## ABSTRACT

**INTRODUCTION:** Medial malleolar stress fracture is a relatively uncommon injury but it can occur in athletes participating in running and jumping activities. Stress fractures of pelvis, proximal tibia and metatarsals are well documented in the elderly population but medial malleolus involvement in this subgroup has never been reported.

**PRESENTATION OF CASE:** We report a case of bilateral medial malleolus stress fractures secondary to bilateral knee osteoarthritis.

**DISCUSSION:** Osteoporosis and mechanical malalignment have been postulated as the possible risk factors for stress fractures in the elderly population. The pathomechanics and management of the case are discussed here.

**CONCLUSION:** A high index of suspicion is required to identify such fractures. Identification and treatment of the predisposing factors are a very important part of treatment.

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## 1. Introduction

The incidence of stress fractures of the medial malleolus varies from 0.6 to 4.1% of all stress fractures.<sup>1</sup> These fractures have been almost entirely described in young skeletally mature athletes involved in running and jumping activities. Abnormal weight transmission and torsional forces are thought to be the cause for this pattern of injury.

Mechanical axis deviation due to osteoarthritis of the knee is an uncommon cause of stress fractures. These fractures are usually found at the proximal end of tibia but there has been an isolated report of distal tibial involvement.<sup>2</sup> However, the association of knee osteoarthritis and medial malleolar stress fracture has not been documented before.

We describe a case of bilateral medial malleoli stress fractures in a postmenopausal female secondary to bilateral osteoarthritis of the knees. The etiology, pathomechanics and management of the case are discussed. To our knowledge, this is the first report of this association. The patient was informed that data concerning the case would be submitted for publication and informed consent has been obtained.

## 2. Presentation of case

A 65-years-old female presented with insidious onset of bilateral ankle pain and difficulty mobilizing for 4 weeks. She was initially seen by her general practitioner and was prescribed anti-inflammatory medications. She eventually attended emergency department as the pain continued and she was unable to weight bear. She had no history of trauma or overuse of the extremity. The patient was a non-smoker and was on calcium supplements for decreased bone density.



Fig. 1. AP radiograph showing bilateral medial malleolus fractures.

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Lower limb examination revealed varus malalignment of both knees with minimal swelling over medial malleoli bilaterally. Palpation revealed tenderness of both medial malleoli and slight decrease in ankle dorsiflexion. Examination of both knees showed symmetrical varus deformity but surprisingly no knee tenderness was elicited.

Plain radiograph showed bilateral medial malleoli stress fractures with identical fracture pattern. The fracture line was running vertical from the junction of the tibial plafond and the medial malleolus to the distal tibial metaphysis (Fig. 1). Long leg alignment views showed symmetrical varus malalignment of both knees with weight bearing plumb line passing through medial border of medial tibiofemoral compartment (Fig. 2). Bilateral knee radiographs



Fig. 2. Standing long leg radiograph showing altered mechanical axis.

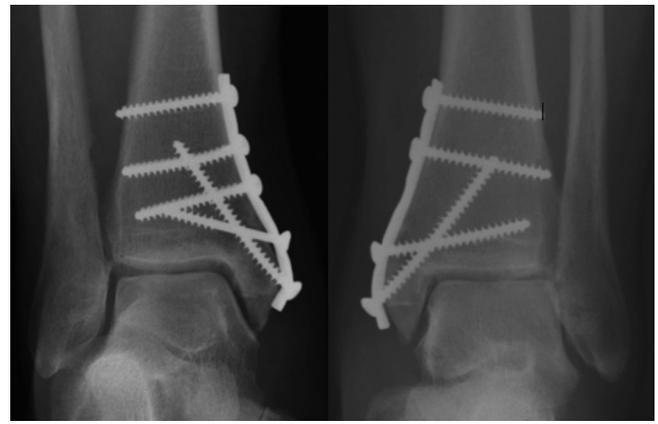


Fig. 3. Three months post-op radiograph showing both fractures well healed.

showed severe medial tibiofemoral compartment osteoarthritis. Bone profile was normal.

Open reduction and internal fixation of bilateral medial malleoli was performed with 1/3 semitubular plates. For the first 2 weeks post operative, she was immobilized in non-weight bearing short leg cast, which was subsequently changed to Range of Motion Boot for 4 weeks. Medial malleoli fractures were clinically and radiologically united at 3 months post operatively (Fig. 3). Subsequently, the patient underwent cruciate-retaining, fixed bearing bilateral simultaneous total knee replacements (TKRs) using DePuy PFC Sigma system (DePuy International, Leeds, UK) with TruMatch Personalized Solutions (DePuy Orthopedics, Inc., Warsaw, USA). Patient was completely asymptomatic and mobile with no walking aids at 6 monthly follow up. Postoperative long leg alignment views show restoration of near normal mechanical axis with bilateral TKRs in situ and well-healed medial malleoli fractures (Fig. 4).

### 3. Discussion

Stress fractures are the result of repetitive abnormal mechanical loading of normal bone. They are commonly seen in athletes and military recruits.<sup>3</sup> With increasing emphasis on exercise in the elderly and increasing life expectancy, more stress fractures are reported in this subgroup. Although stress fractures are described in nearly every bone, they are more common in the weight bearing bones of the lower extremity, with tibia being the most commonly involved. Risk factors for stress fractures can be broadly divided into three groups: activity related, which include poor footwear, excessive training and irregular terrain; biomechanical factors including inflexible or weak calf muscles, unequal leg length, flat or high-arched feet, forefoot varus, subtalar varus, and tibia vara; and metabolic factors like hormonal imbalance, osteoporosis, renal osteodystrophy, nutritional deficiencies, rheumatoid arthritis and osteoarthritis.

Medial malleolar stress fractures account for 10% of all stress fractures of the foot and ankle.<sup>4</sup> They are almost exclusively described in athletes involved in jumping and running activities.<sup>1,5,6</sup> This fracture has also been associated with tibia vara. The abnormally small angle between the tibial shaft and tibial plafond increases stress transmission to the medial malleolus.<sup>7</sup> Tibia vara can also lead to increased force transmission across the ankle joint by escalating the varus moment between talus and medial malleolus.<sup>6</sup> The fracture pattern in our patient was similar to what has been described by various authors in the young athletic population. The vertical fracture line from the junction of the tibial plafond and the medial malleolus curving slightly obliquely at the distal tibial metaphysis is classically described as medial malleolar stress fracture.



Fig. 4. Post-op long leg radiograph showing improvement in mechanical axis.

We believe that the cause of stress fractures in our patient was a combination of an altered weight-bearing axis due to knee osteoarthritis and decreased bone mineral density (BMD). Symptoms can be variable in patients with osteoarthritis as our patient had minimal knee symptoms. It has also been shown that individuals with medial knee osteoarthritis have greater adduction moment at the knee compared to healthy controls.<sup>8</sup> As the tibial mechanical axis is deviated from vertical, there is an associated compensatory rearfoot pronation to obtain a plantigrade foot. Another possible consequence of varus angulation at foot strike is

that the applied force to ground is directed more medially, resulting in an increased lateral ground reaction force.<sup>5</sup> All these factors might have led to increased stress transmission to the medial malleolus and eventually stress fracture.

The treatment of any stress fracture aims to decrease abnormal stresses on the bone to a level within physiological limits of the bone. This entails identifying and correcting any predisposing factor, which in our case was knee osteoarthritis. As we were dealing with bilateral fractures, we opted for 2-stage surgery. As a first stage, we performed bilateral medial malleoli fixation with buttress plates. The reason for buttress plating was to provide a biomechanically stronger construct as higher shear forces are involved in this vertically orientated fracture pattern. We acknowledge that treatment with two cancellous screws in similar fracture pattern has been associated with a good outcome in young athletic individuals.<sup>3,6</sup> The second stage involved bilateral TKRs. As maintenance of correct mechanical axis was of paramount importance, we opted for customized patient instrumentation (CPI) using TruMatch Personalised Solutions (DePuy Orthopedics, Inc.). We believe that the CPI instrumentation is particularly useful in bilateral surgery, as it has shown to result in a decrease in surgical time by around 11 min.<sup>9,10</sup>

#### 4. Conclusion

We presented a case with bilateral medial malleoli stress fractures due to varus malalignment secondary to medial tibiofemoral osteoarthritis of both knees. Although, these fractures are common in physically active individuals, it could also be found in elderly patients with altered lower extremity alignment. A high index of suspicion is recommended in this subgroup of patients.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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