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Case Report

Metaphysiodiaphyseal Insufficiency Fracture of Tibia Failure of Biology and Mechanical Stability: A Case Report

Prahalad Kumar Singhi*, Sivakumar Raju, Atmaram Gadgil and Somashekar V

Senior Consultant, Department of Orthopaedics, Preethi Hospitals Pvt. Ltd, Madurai, Tamilnadu, India

***Corresponding Author:** Prahalad Kumar Singhi, Department of Orthopeadic, Preethi Hospitals Pvt Ltd, Madurai, Tamil Nādu, India.

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Abstract

Insufficiency fractures are seen when physiological stress given to pathological bone and needs to be differentiated from fatigue fracture. Management of these stress fractures depends on etiology, location and radiographic findings. Surgeon should address both biology and stability for satisfactory outcome.

A 54-year-old postmenopausal woman, presented with knee pain diagnosed with tibial meta-diaphyseal insufficiency fracture, treated conservatively with cast, but lost to follow up, subsequently she developed malalignment for which she underwent open reduction deformity correction and fixation elsewhere with an anterolateral plate. Later she presented to us with deformity, broken plate and non-union. Dual plating with bone grafting was done to achieve desired outcome.

Conclusion: An osteoporotic Insufficiency fracture if not appropriately evaluated and treated may end up in problems. So addressing both biology and stability is key.

Keywords: Metaphysiodiaphyseal Insufficiency Fracture; Failure of Biology; Mechanical Stability

Introduction

Breithauptin [1] in 1855 first described stress fracture in Prussian soldiers. Stress fractures can be caused by either abnormal repetitive stresses placed on a normal bone (Fatigue fracture), or by normal stresses placed on a deficient or pathological bone (Insufficiency fracture). Insufficiency fractures occur in a bone that is mechanically compromised and generally presents low bone mineral density [2]. The imbalance between the bone that is formed, remodeled and the bone that is reabsorbed will result in discontinuity of the bone at the site affected [3,4]. Insufficiency fractures can be due to osteoporosis, post-radiation therapy, metastatic disease and medications such as bisphosphonates, corticosteroids and methotrexate [5]. Insufficiency fractures are most often seen in elderly females who have postmenopausal osteoporosis [6].

They present usually with insidious onset of pain with no history of trauma, relieved by rest and analgesia. These fractures can be divided into high risk and low-risk groups by multiple authors [7-9].

Management of high-stress fractures depends on etiology, location and radiographic findings; Insufficiency fractures in proximal

tibia can be seen in condylar region, metaphyseal or metaphysiodiaphyseal junction. Such fractures are prone to non-union if not treated properly. SONK (spontaneous osteonecrosis of knee) or SIFK (subchondral insufficiency fracture of knee) are Intraarticular insufficiency fracture with different etiopathogenesis. Here, we are presenting a case of metaphysiodiaphyseal junction insufficiency fracture, which went for malaligned healing, inappropriate intervention resulted in non-union of the tibia with a broken plate. It was successfully treated with dual plating.

Case Report

History

Fifty-four years old household lady, presented to us with localized insidious onset pain over right leg since 4 weeks, she was able to walk with pain, and her radiograph of tibia shows incomplete insufficiency fracture with broken posterior cortex and intact anterior cortex. She was advised work up for metabolic bone disease casting and regular follow up. But she didn't turn up for further management and lost to follow up. Meanwhile patient underwent fracture fixation with anterolateral locking plate elsewhere. She presented to us again after 6 months with pain, swelling deformity, crepitus and restricted range of movement at knee. She was unable to walk for last 5 months and her radiograph showed a broken plate with non-union at the meta-diaphyseal junction of the right tibia.

Her blood reports showed, vitamin D3 was 19.4IU, serum calcium 9mg/dl, she was HbsAg reactive and all other parameters were within normal limits. The patient was evaluated for surgical fitness and she underwent surgical fixation under universal safety precautions. We removed broken plate and screws through the previous surgical anterolateral scar, fracture ends were exposed and debrided, fracture fixed with dual plating (anteromedial and anterolateral plating) and bone grafting along with fibular osteotomy. She was also supplemented with calcium and Vitamin D3. Fracture united well by 24 weeks and at the latest follow up after 2 years, she regained complete ROM and was pain free, IKDC score and Lysholm score were excellent.

Discussion

Insufficiency fractures are most commonly seen in defective mineralization or osteoporotic bone. Skeletal system fails to bear normal physiological body weight due to imbalance in an osteoblastic and osteoclastic activity. It is seen in various conditions such as osteoporosis, radiation therapy and malignancy, chronic bisphosphonates intake, steroid consumption. Insufficiency fractures are most commonly seen around pelvic ring followed by tibia, spine, it also can be seen in ribs, sternum, talus, medial femoral condyle [10].

Post-menopausal women are prone to osteoporosis and subsequently insufficiency fractures. Insufficiency fracture present with gradual onset pain aggravated on weight bearing progressing to complete fracture, and maybe this was the cause in our case. Treatment depends on cause and location of the fracture especially high-risk stress fractures such as Femoral Neck (Tension Side) Patella (Tension Side) Anterior Tibial Cortex, Medial Malleolus and talar neck [11]. Low-risk stress fractures can be managed conservatively include the femoral shaft, medial tibia, ribs, ulnar shaft, and first through fourth metatarsals.

Plain x-rays usually look normal in early course of a stress fracture, especially in the first 2 to 3 weeks [12,13]. Bone scintigraphy is nearly 100% sensitive for stress injuries of the bone, but with lower specificity than magnetic resonance imaging (MRI) [14,15].

In our case initially fracture was treated conservatively, the patient continued to have symptoms and developed complete fracture, healing in malposition, which was fixed with anterolateral plate. Subsequently, fracture lead to non-union and implant breakage, due to deficient medial bone continuity, failure of biology and stability. Finally fracture was successfully treated with dual plating bone grafting and fibular osteotomy. If we retrospectively analyze this case, patient was non-complaint during her conservative management, which led to malalignment and tibia vara. Later addressing this problem with anterolateral plating was difficult to explain and inadvertently failed within 3 months. In this case reason for non-union was not only metabolic problems but also medial bone loss. Insufficiency fractures in metadiaphyseal junction of the tibia with medial bone loss will have better results with Medial plating with or without bone grafting depending upon the size of the correction. We had to do dual bicolumnar plating as it was complete fracture and bone grafting was needed to maintain the correction of the deformity.

Figure 1: Insufficiency fracture posterior cortex of metadiaphyseal junction.

Figure 3: Fracture fixed with anterolateral plating (non-anatomical and inadequate mechanical stability.

Figure 2: Insufficiency fracture healing with malalignment.

Figure 4: Non-union with recurrence of deformity and broken implants.

Figure 5: Revised correction of the alignment, dual plate fixation with medial wedge bone grafting.

Figure 6: Well-aligned and healed fracture.

Figure 7: Excellent clinical outcome.

Conclusion

An osteoporotic stress fracture of tibia if not evaluated and treated appropriately may result in problems. So addressing both biology and mechanical stability is key.

Highlights

- Stress fractures can be Insufficiency fractures or fatigue fractures
- Management of these stress fractures depends on etiology, location and radiographic findings
- Common causes are postmenopausal osteoporosis, post-radiation therapy, metastatic disease and medications such as bisphosphonates, corticosteroids and methotrexate.
- Intraarticular insufficiency fracture presents as SONK (spontaneous osteonecrosis of knee) or SIFK (subchondral insufficiency fracture of knee) missed often, metaphyseal or metaphysiodiaphyseal junction fractures are prone to non-union if not treated properly.

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