Nonunion of tibial stress fractures in patients with deformed arthritic knees

TREATMENT USING MODULAR TOTAL KNEE ARTHROPLASTY

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In two years we treated four women with ununited stress fractures of their proximal tibial diaphyses. They all had arthritis and valgus deformity. The stress fractures had been treated elsewhere by non-operative means in three patients and by open reduction and internal fixation in one, but had failed to unite. After treatment with a modular total knee prosthesis with a long tibial stem extension, all the fractures united.

A modular total knee prosthesis is suitable for the rare and difficult problem of ununited tibial stress fractures in patients with deformed arthritic knees since it corrects the deformity and the adverse biomechanics at the fracture site, stabilises the fracture and treats the arthritis.

Case reports

All four patients were elderly women who had stress fractures of the proximal tibia with minimal displacement. They all had arthritic knees with valgus deformity. Bone densitometry was not carried out, but all patients had radiological evidence of osteoporosis.

Case 1. An 84-year-old woman with osteoarthritis of the left knee and a valgus deformity of 18° was referred with an ununited tibial fracture. This was treated in a long-leg cast for two months, but the fracture failed to unite. We then treated her with a modular total knee replacement (TKR) and the fracture united (Fig. 1c) relieving the pain and restoring mobility.

Case 2. A 72-year-old woman with rheumatoid arthritis and valgus deformity of 20° was referred with an ununited tibial fracture. This was treated in a long-leg cast for two months, but the fracture failed to unite. We then treated her with a modular total knee replacement (TKR) and the fracture united allowing full eight-bearing.

Case 3. A 64-year-old woman with osteoarthritis of the left knee and a valgus deformity of 14° was referred with an ununited fracture of her left tibia. The stress fracture had been diagnosed four months previously when radiographs...
had been taken for increasing pain in her knee and leg. It had been treated in a plaster cast but had failed to unite. The fracture was treated using a semiconstrained TKR with an extension to the tibial stem which bridged the fracture site. Osteotomy of the fracture callus was needed to correct the angulation at the site of the fracture which united relieving her pain.

**Case 4.** A 68-year-old woman with long-standing osteoarthritis of her knee and a valgus deformity of 15° presented with pain in the right proximal tibia. Radiography revealed a fracture of the proximal tibial diaphysis. She was initially treated in a long-leg plaster cast, but the fracture failed to unite. She then had internal fixation of her tibia with a plate. Two months later the fixation became loose and the fracture had not united. She was treated using a modular TKR with a long tibial stem. By three months the fracture had united relieving her pain and restoring mobility.

**Discussion**

Stress fractures of the tibia in the elderly are well described,1,4-13 but are uncommon. One of the reasons for this could be the success of TKR which is often carried out on arthritic knees before gross deformity has developed. Advances in the medical management of osteoporosis may also be a contributing factor. Our four patients had considerable valgus deformity of the knee and all had radiological evidence of osteoporosis. Deformity of the knee will produce abnormal loading of the tibia although this is not widely recognised. Eccentric loading of a long bone sets up tension stresses on its convex side and compresses the concave aspect.14 A considerable valgus malalignment at the knee may produce abnormal stresses in the tibia leading to a stress fracture (Fig. 2). Fracture repair is stimulated, as seen from the formation of callus in our cases, but as long as the deformity at the knee and hence the abnormal biomechanical forces (Fig. 2b) persist, union of the fracture is prevented.

Because of the stiffness at the adjacent arthritic joint the proximal lever arm acting on the fracture is effectively lengthened and increases the deforming force causing stress at the site of the fracture.

In our patients the use of a modular TKR (Fig. 3) to replace the arthritic joint restored a good range of movement. It corrected the malalignment at the knee and converted tension stresses across the proximal tibia into compression forces. The use of a modular prosthesis allowed the tibial stem to be extended to bridge the fracture and act as an intramedullary splint providing stability. After

![Fig. 1a](image1.png) ![Fig. 1b](image2.png) ![Fig. 1c](image3.png)

Radiographs showing a) an ununited tibial stress fracture below a valgus arthritic knee, b) after treatment with a modular TKR with a long tibial stem bridging the site of the fracture and c) the united fracture.
operation external splintage was not used for the leg and the patients mobilised as pain allowed. In all four cases there was radiological evidence of union of the fracture after a mean time of 3.6 months (3 to 4.5). These cases illustrate that when faced with a fracture of the tibia below an arthritic knee with valgus deformity, presumably due to tension stress on the bone, the surgeon should provide for correction of the malalignment of the limb, stabilisation of the fracture and replacement of the arthritic joint. A modular TKR with a long extension of the tibial stem allows these objectives to be met and is a safe solution for this difficult problem.

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References


