Proximal Tibia Stress Fracture Caused by Severe Arthrosis of the Knee With Varus Deformity

Bilal Demir, MD, Sarper Gursu, MD, Ramadan Oke, MD, Kahraman Ozturk, MD, and Vedat Sahin, MD

Stress fractures, which can result from abnormal stress on normal bone, differ from insufficiency fractures, in which normal stress is applied to abnormal bone. Stress fractures of the tibia are relatively common in young people involved in military and sports activities.[1,2] Stress fracture of the proximal tibia, however, is a rare entity in the elderly and has been reported in association with varus gonarthrosis,[3-11] valgus gonarthrosis,[4,5,12,13] pyrophosphate arthropathy,[14] rheumatoid arthiritis,[15] osteoporosis,[1] Paget disease,[16] and knee deformities.[17,18]

In this article, we present 3 cases of stress fractures of the tibia in association with severe varus gonarthrosis of the knee. We have obtained written informed consent from all 3 patients for print and electronic publication of their case reports.

Cases and Methods

All patients had stress fractures of the proximal tibia. They were elderly women with bilateral osteoarthritis of the knee. Marked varus deformity in the knees was noted for all. No clinical or biochemical findings in favor of rheumatoid arthritis or pyrophosphate arthropathy could be found. Bone mineral density values were within the normal range for each patient's age.

Case 1

A woman in her late 70s presented with bilateral painful knees secondary to severe varus deformity on both sides. She said her complaints were suddenly aggravated 4 to 5 months before she was admitted to our institute. The patient had no history of trauma. Varus deformity of 23° was found on plain radiographs. Radiography also showed major degenerative changes in each knee and an undisplaced stress fracture in the uppermost third of the left tibia. Distance from joint line to fracture line was 9 cm (Figures 1A, 1B).

Total knee arthroplasty (TKA) with a long tibial stem bridging the fracture site was performed. The fracture healed completely in about 4 months, and the patient was fairly mobile and painless at her control examination 1 year after surgery (Figure 2).

Case 2

A woman in her mid-70s with pain in both knees for more than 10 years had a therapy history that included use of analgesics, use of anti-inflammatory drugs, physical therapy, and intra-articular hyaluronic acid injections. Onset of pain was insidious, particularly in the month before the patient presented to our hospital. She had no history of trauma. Radiographs showed bilateral varus gonarthrosis with gross degenerative changes and a long-standing undisplaced stress fracture of the left proximal tibial diaphysis (Figure 3). The fracture was 11 cm below the knee joint line. On the radiographs, varus deformity of 30° was found between the femoral and tibial mechanical axis.

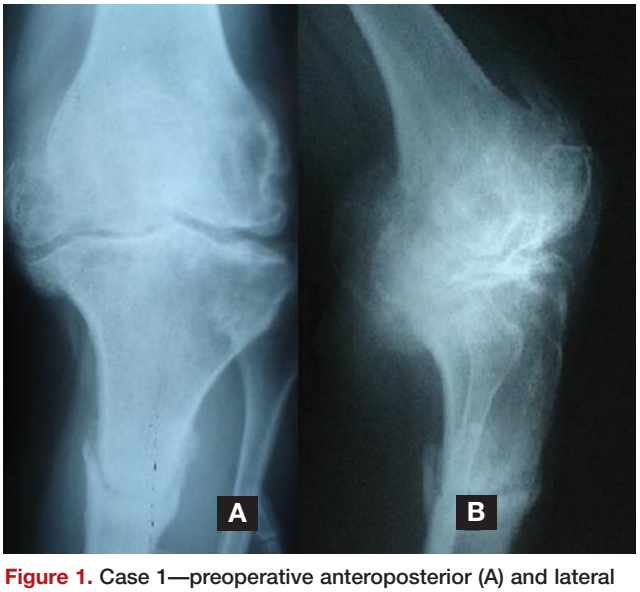

Figure 1. Case 1—preoperative anteroposterior (A) and lateral (B) radiographs.

Dr. Demir, Dr. Gursu, and Dr. Oke are Orthopaedic Surgeons, Baltalimani Metin Sabanci Bone and Joint Diseases Education and Research Hospital, Istanbul, Turkey.
Dr. Ozturk is Orthopaedic Surgeon, Vakif Gureba Education and Research Hospital, Istanbul, Turkey.
Dr. Sahin is Associate Professor and Orthopaedic Surgeon, Baltalimani Metin Sabanci Bone and Joint Diseases Education and Research Hospital, Istanbul, Turkey.

Address correspondence to: Bilal Demir, MD, Baltalimani Metin Sabanci Bone and Joint Diseases Education and Research Hospital, 67 Ada. Kardelen 4/11 D.19, Atasehir/Istanbul, Turkey (tel, 90-554-4518223; fax, 90-212-3237082; e-mail, demir.bilal@yahoo.com).

Am J Orthop. 2009;38(9):457-459.

Figure 2. Case 1—postoperative radiograph.

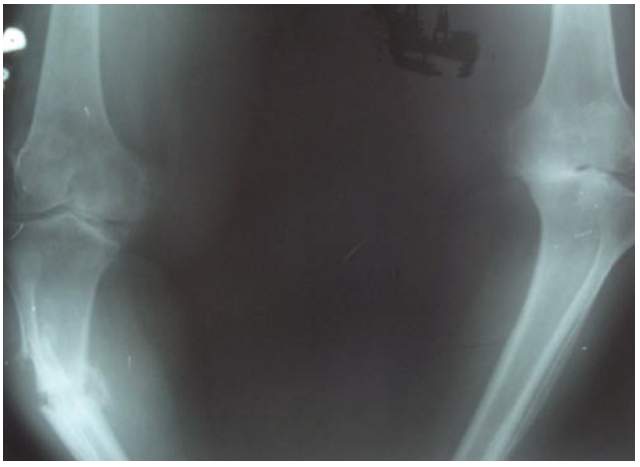

Figure 3. Case 2—preoperative radiograph.

The initial treatment plan was TKA with a long tibial stem bridging the fracture site, but the patient refused to have the procedure. Therefore, an interlocking nail was used for osteosynthesis. Partial weight-bearing was allowed immediately after surgery, and full weight-bearing was allowed when first radiologic proof of fracture healing was seen on radiographs. Two years after surgery, the fracture was completely healed. The patient continued to have severe knee pain but still refused TKA (Figures 4A, 4B).

Case 3

A woman in her late 80s with bilateral knee pain for almost 20 years was referred to our institute. She had no history of trauma. Physical examination revealed bilateral genu varum and local tenderness 4 cm below the right knee joint line. Radiographs showed bilateral severe gonarthrosis and a stress fracture of the proximal tibial diaphysis. TKA with a long tibial stem extending below the fracture site was planned, but the patient refused all surgical treatments and continued use of analgesics and rest. An above-knee cast was made, and the fracture united within 4 months. She continued to have knee pain, caused by arthrosis (Figures 5A, 5B).

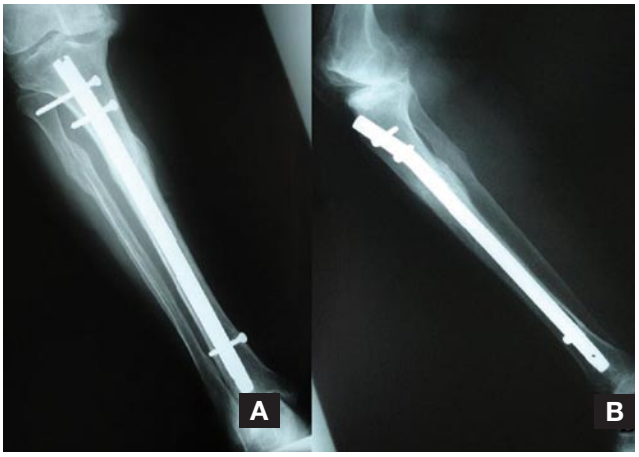

Figure 4. Case 2—postoperative anteroposterior (A) and lateral (B) radiographs.

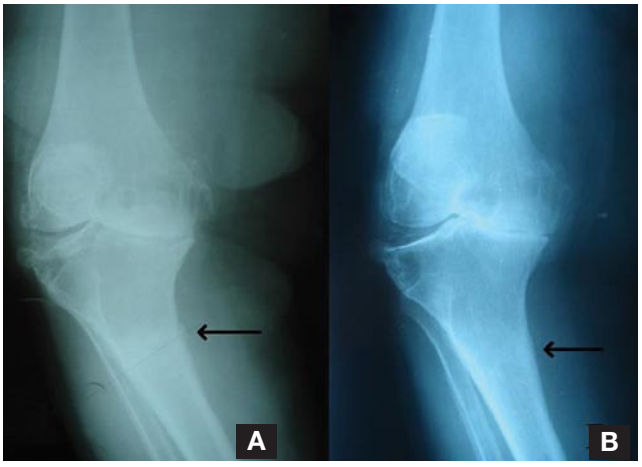

Figure 5. Case 3—radiographs before (A) and after (B) casting.

Discussion

There are 2 types of stress fractures: fatigue and insufficiency. *Fatigue fractures*, which occur when repetitive submaximal forces are applied to healthy bone, are uncommon in the elderly but common in young people involved in military and sports activities.[1,2] *Insufficiency fractures* are most commonly found in older women and are caused by the normal activity of muscles on deficient bone.[19] It is unusual that the 3 elderly female patients described in this article had fatigue fractures.

The clinical presentation of stress fractures is very typical: insidious onset of pain without trauma. Physical examination reveals marked tenderness at the fracture site. Radiographs can be normal in the early stages, so, when there is suspicion of a stress fracture, bone scintigraphy should be considered.[20,21] Bone scintigraphy was deemed not necessary for our 3 patients, as their cases were late cases, with obvious fractures plainly evident on plain radiographs.

When a tibial stress fractures is found, several etiologic factors should be kept in mind: pyrophosphate arthropathy,[14] rheumatoid arthiritis,[15] osteoporosis,[1] Paget disease,[16] and varus or valgus gonarthrosis.

Proximal tibial stress fractures have numerous treatment options. Satku and colleagues[11] treated 3 patients with

analgesics and rest. Sawant and colleagues[12] and Haspl and colleagues[4] performed TKA using a long tibial stem bridging the fracture site and reported good functional results. Moskal and Mann[22] treated 3 patients with TKA using a long uncemented stem along with bone grafting at the nonunion site and supported fixation using a unicortical plate. Sy and colleagues[6] preferred fixation of the tibial stress fracture with a compression plate and bone grafting. Tomlinson and colleagues[23] treated 5 patients with arthroplasty and intramedullary fixation.

In our case 1, TKA with a long tibial stem bridging the fracture site was performed. The fracture healed completely in about 4 months, and the patient was fairly mobile and pain-free at her control examination 1 year after surgery. Case 2 was treated with intramedullary fixation using an interlocking nail. The preferred treatment in this case was TKA with a long tibial stem bridging the fracture site, but the patient refused TKA. The fracture united, but her knee pain persisted. In case 3, again the preferred treatment was TKA with a long tibial stem, but, as this patient also refused surgery, she was advised to use analgesics and rest, and an above-knee cast was made.

Conclusions

TKA with a long stem extending below the fracture site seems to be the treatment of choice for stress fractures with varus gonarthrosis. This procedure has the advantage of treating 2 pathologies in a single stage. Distance from fracture site to knee joint line is an important factor in decisions to perform this procedure. If the distance is too much for a tibial stem to achieve stable fixation, or if the patient refuses TKA, then intramedullary fixation using a interlocking nail should be considered.

Authors' Disclosure Statement and Acknowledgments

The authors report no actual or potential conflict of interest in relation to this article.

The authors obtained written informed consent from these 3 patients to present the text and images documenting their cases for both print and electronic publication.

References

1. Devas M. *Stress Fractures*. Edinburgh, Scotland: Churchill Livingstone; 1975.
2. Giladi M, Ahronson Z, Stein M, Danon YL, Milgrom C. Unusual distribution and onset of stress fractures in soldiers. *Clin Orthop*. 1985;(192):142-146.
3. Chen WM, Huang CK, Chen TH, Chiang CC, Lo WH. Bilateral proximal tibial stress fractures in osteoarthritic knee treated with simultaneous corrective osteotomy and internal fixation. *J Chin Med Assoc.* 2004;67(1):48-50.
4. Haspl M, Jelić M, Pećina M. Arthroplasty in treating knee osteoarthritis and proximal tibia stress fracture. *Acta Chir Orthop Traumatol Cech.* 2003;70(5)303-305.
5. Kopacz J, Warda E, Mazurkiewicz T. Stress fractures of the tibia in elderly women [in Polish]. *Chir Narzadow Ruchu Orthop Pol.* 2002;67(5):515-520.
6. Sy MH, Diouf S, Ndoye A, Coumé M. A new case of tibial stress fracture as a complication of knee osteoarthritis [in French]. *Rev Chir Orthop Reparatrice Appar Mot.* 1995;81(5):445-448.
7. Cameron HU. Double stress fracture of the tibia in the presence of arthritis of the knee. *Can J Surg.* 1993;36(4):307-310.
8. Learmonth ID, Grobler G. Sequential stress fractures of the tibia associated with osteo-arthritis of the knee. A case report. *S Afr J Surg.* 1990;28(2):75-77.
9. Gacon G, Barba L, Lalain JJ, et al. Stress fractures of the tibia: uncommon mechanical complication of osteoarthritis of the knee. Report of 3 cases [in French]. *Rev Chir Orthop Reparatrice Appar Mot.* 1990;76(3):209-214.
10. Tey IK, Chong KW, Singh I. Stress fracture of the distal tibia secondary to severe knee osteoarthritis: a case report. *J Orthop Surg (Hong Kong).* 2006;14(2):212-215.
11. Satku K, Kumar VP, Pho RW. Stress fractures of the tibia in osteoarthritis of the knee. *J Bone Joint Surg Br.* 1987;69(2):309-311.
12. Sawant MR, Bendall SP, Kavanagh TG, Citron ND. Nonunion of tibial stress fractures in patients with deformed arthritic knees. Treatment using modular total knee arthroplasty. *J Bone Joint Surg Br.* 1999;81(4):663-666.
13. Hendel D, Velan GJ, Weisbort M. Intra-articular tibial plateau stress fracture associated with osteoarthritis and valgus knee deformity. *J Arthroplasty.* 1997;12(6):713-715.
14. Ross DJ, Dieppe PA, Watt I, Newman JH. Tibial stress fracture in pyrophosphate arthropathy. *J Bone Joint Surg Br.* 1983;65(4):474-477.
15. Young A, Kinsella P, Boland P. Stress fractures of the lower limb in patients with rheumatoid arthritis. *J Bone Joint Surg Br.* 1981;63(2):239-243.
16. Grundy M. Fractures of the femur in Paget's disease of bone. Their etiology and treatment. *J Bone Joint Surg Br.* 1970;52(2):252-263.
17. Reynolds MT. Stress fractures of the tibia in the elderly associated with knee deformity. *Proc R Soc Med.* 1972;65(4):377-380.
18. Kelly JM. Stress fractures in the tibia associated with knee deformities. *J Ir Med Assoc.* 1974;67(4):97-99.
19. Bucholz RW, Heckman JD, eds. *Rockwood and Green's Fractures in Adults*. Vol 2. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2001.
20. Geslien GE, Thrall JH, Espinosa JL, Older RA. Early detection of stress fractures using 99mTc-polyphosphate. *Radiology.* 1976;121(3 pt 1):683-687.
21. Prather JL, Nusynowitz ML, Snowdy HA, Hughes AD, McCartney WH, Bagg RJ. Scintigraphic findings in stress fractures. *J Bone Joint Surg Am.* 1977;59(7):869-874.
22. Moskal JT, Mann JW 3rd. Simultaneous management of ipsilateral gonarthrosis and ununited tibial stress fracture: combined total knee arthroplasty and internal fixation. *J Arthroplasty.* 2001;16(4):506-511.
23. Tomlinson MP, Dingwall IM, Philips H. Total knee arthroplasty in the management of proximal tibial stress fractures. *J Arthroplasty.* 1995;10(5):707-713.