

Bone Graft Extruded From an Intramedullary Nail Tract in the Tibia

Penelope J. Galbraith, M.D., and Felix S. Chew, M.D.

A 33-year-old man presented for follow up radiographs of the lower leg revealing dense material in the soft tissues of the ankle. These could be traced to a track in the adjacent tibia created by removal of an intramedullary nail and locking screws. This too contained dense bone graft material. The graft had migrated from the locking screw holes in the proximal tibia which had been filled approximately 2 months previously.

Case Report

A 33-year-old man sustained a fracture of the right tibia while rollerblading approximately 18 months prior to the reported radiograph. This had been treated with an intramedullary (IM) nail. The proximal locking screws had been removed after about one year due to local pain, with good relief. Six months later the patient elected to have the nail and distal locking screws removed because of further pain, especially when kneeling. This was accomplished without complication and the proximal tibial defect was filled with a combination of synthetic bone void filler (chronOS, Synthes (USA), Paoli, PA) and demineralized bone matrix (Fig. 1). Routine follow-up radiographs ob-

tained 2 months following this second procedure revealed the presence of new dense material in the soft tissues of the ankle. The distal portion of the intramedullary nail track also contained the same dense granular material, but the bone graft material was not present proximally (Fig. 2). Evidently, the bone graft material had migrated distally down the intramedullary nail tract during the intervening time, undoubtedly aided by weight-bearing activity, and then out into the soft tissues through one of the distal locking screw tracts.

Discussion

It has been shown that the screw hole is an important site of weakness following removal of hardware [1, 2]. Rosson showed that bone mass remains reduced at 18 weeks after screw removal, indicating that bone ingrowth occurs more slowly in an experimental model than in man [3]. Treatment of screw hole defects using bone graft materials has been performed. Following grafting of screw holes in dogs, the holes filled with graft material, in every case, had more bone histologically than the controls. The graft types comprised autogenous bone graft, allogenic bone graft, combined autogenous and allogenic graft and autogenous bone combined with Collagraft (porous beads containing hydroxyapatite, tricalcium phosphate and fibrillar collagen) [4].

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Abbreviations: IM, intramedullary

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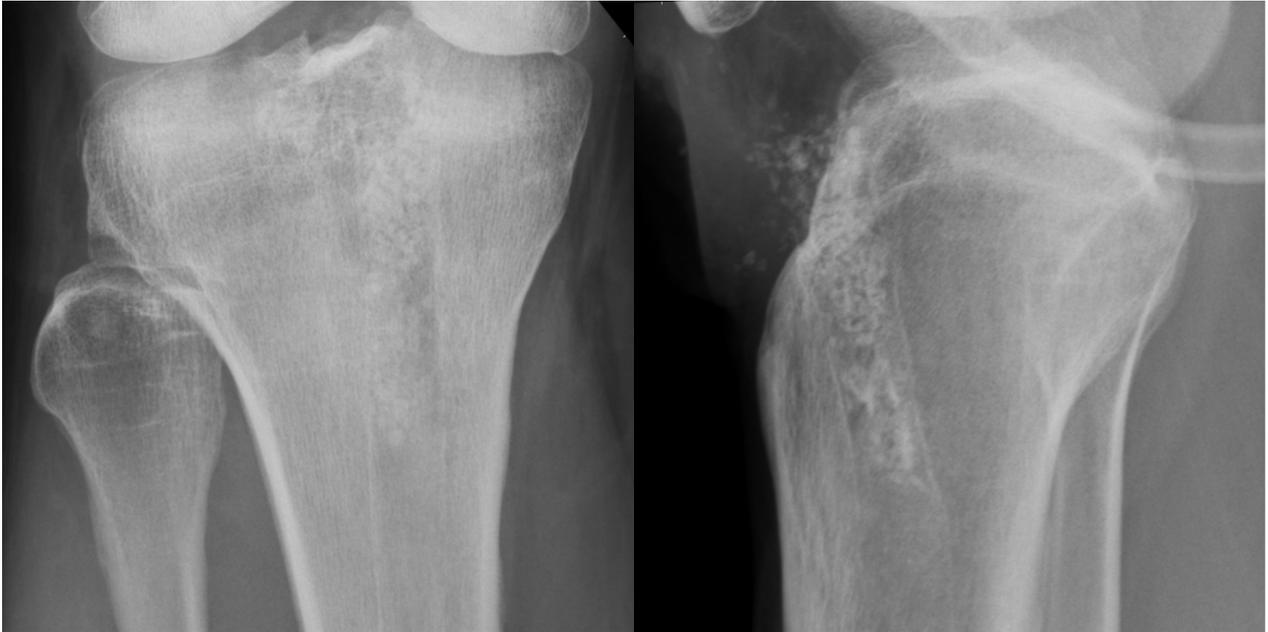


Figure 1 A-B. Initial bone graft placement to fill IM nail tract. A-B, AP and Lateral radiographs of proximal tibia show bone graft material filling the proximal portion of the IM rod tract, with some pieces in the adjacent soft tissues.

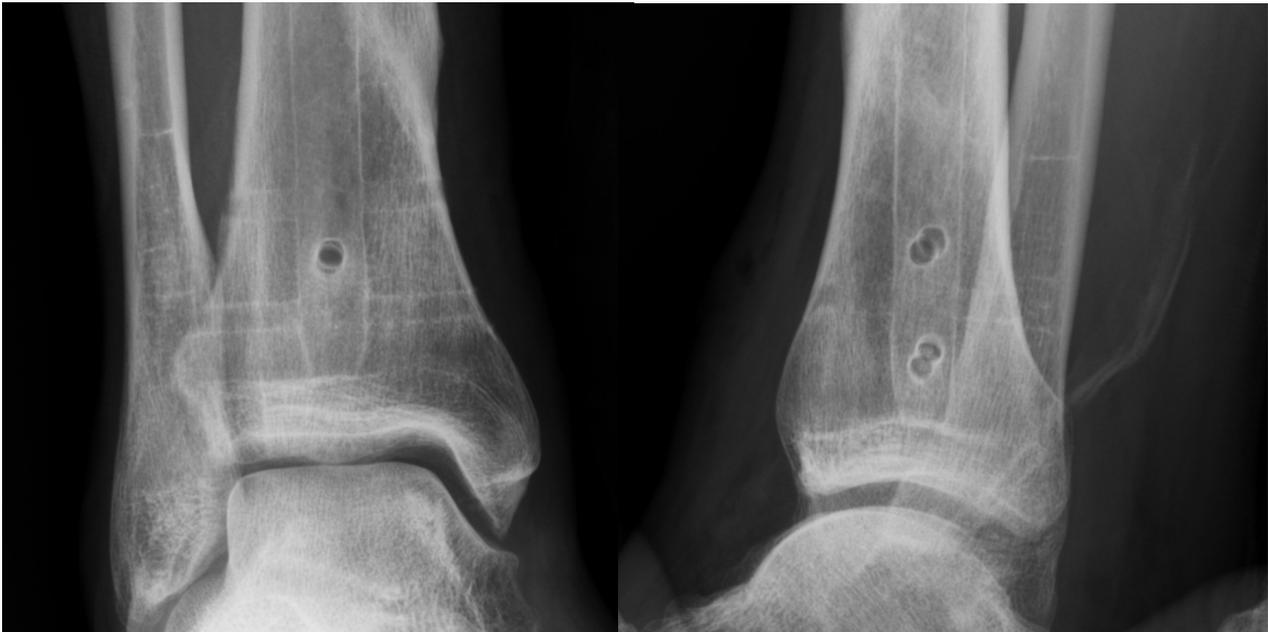


Figure 1 C-D. C-D, AP and Lateral radiographs of the distal tibia show the distal portion of the IM nail tract with distal locking screw tracts.

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A wide variety of graft material is available. Three properties are ideal when considering a graft material: (1) an osteoconductive matrix which acts as a scaffold on which the process of bone formation occurs; (2) osteoinductive factors to induce osteoblast precursors to form mature bone forming cells; and (3) osteogenic cells which directly lay down new bone matrix. Autogenous bone graft has all three properties, but the disadvantages of harvest requirement and complications [5].

Deminerlized bone matrix has been used alone and in combination with a variety of other agents in order to achieve a greater balance of these three properties. It has been combined with autologous bone graft [6], and aspirated bone marrow [7-9]. It has also been combined with cancellous allograft [10, 11], and with calcium sulfate and calcium phosphate [12-14]. In our patient it was combined with Chronos (synthetic cancellous bone graft substitute containing porous beta tricalcium phosphate.)

Deminerlized bone matrix is produced by acid extraction of bone. It acts primarily to provide osteoinductive growth factors and is more osteoinductive than ordinary allograft. Some osteoconductivity can be present depend-

ing on the exact details of manufacture [5, 15].

The importance of the osteoconductive scaffold has been underemphasized [16]. Good osteoconductive properties are provided by synthetic ceramics, which provide an osteoconductive scaffold to which circulating proteins such as mesenchymal stem cells and osteoinductive growth factors can adhere. They bypass the risks of allograft including immunogenic response and disease transmission [17]. Mineralization occurs and the new bone undergoes remodeling [16]. Tricalcium phosphate, has been used alone [18, 19] and has been shown to be superior to autograft in certain instances [20]. The porosity of the structure determines the surface area exposed and increases the speed of bone formation. Ultraporous tricalcium phosphate exposes the largest surface area to cells and nutrients [16, 17]. The resorption of tricalcium phosphate is approximately 10% per month with complete resorption at 6- 24 months [21].

In summary, our patient had migration of bone graft material from the proximal tibia down a nail track and into the soft tissues of the ankle. This represents a newly described cause of soft tissue heterotopic bone.

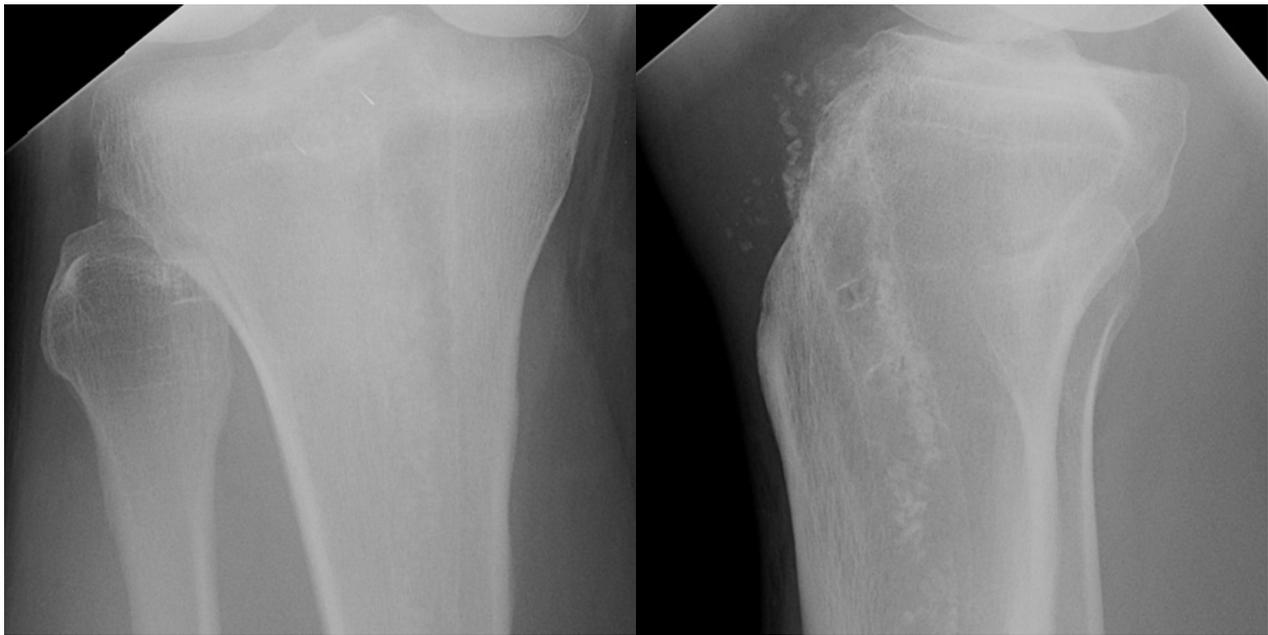


Figure 2 A-B. Heterotopic bone graft extruded through IM nail tract. A-B, AP and Lateral radiographs of the proximal tibia show that most of the bone graft material has disappeared.

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Figure 2 C-D. C-D, AP and lateral radiographs of the distal tibia show that the bone graft material has migrated to the distal portion of the IM nail tract, and that some of it has extruded through one of the distal locking screw tracts into the adjacent soft tissues.

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