FRACTURE ON REMOVAL OF THE ACE TIBIAL NAIL

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We report four patients who sustained secondary fractures of the posterior wall of the tibial shaft during the removal of one pattern of intramedullary nail after fracture healing. The cause of this complication is discussed.

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Fractures of the tibial shaft are often treated by intramedullary nail fixation. We have made some use of the ACE pattern of tibial nail and have encountered some unusual posterior refractures during the later removal of the nails.

We have reviewed our series in order to discover the cause of these secondary fractures and to make suggestions concerning the use of this type of nail.

PATIENTS AND METHODS

Between September 1992 and March 1995 we treated 21 patients with fractures of the tibial shaft using an ACE intramedullary nail. Of these, 19 had the nail removed later, which is commonly requested by Japanese patients. There were 18 men and one woman; their mean age was 35.7 years (18 to 59). The original fracture had been in the upper third of the shaft in one, the middle third in 11, and the lower third in seven.

Nails designed for unreamed insertion were used in four patients; one was 8 mm in diameter and three were 9 mm, but one of the 9 mm nails required some reaming. We used the larger reamed-type nails in 15 patients; four were 10 mm in diameter, nine were 11 mm and two were 12 mm. They were inserted after reaming the tibia to 1 mm greater in diameter. Postoperative radiographs were satisfactory in all cases with no significant malalignment.

Posterior refractures. Local posterior refractures occurred during the removal of the nail in four of the 19 patients (21%). There was considerable difficulty in removal of each of the nails and the pattern of the fracture was very similar in all four. The fracture line was fissured, involving from one-quarter to one-third of the local circumference of the tibia which was displaced posteriorly. The injury was in the middle third in two patients and in the lower third in two. All followed the use of reamed nails which were 11 mm in diameter in three patients and 12 mm in one. In each case the pattern of fracture was confirmed by CT scans.

The patients all complained of some pain but were successfully managed by partial weight-bearing on crutches for three to four weeks. Bridging callus appeared in them all and there was satisfactory healing.

Timing of nail removal. In the four patients who sustained posterior fracture, bony union had been seen radiographically at a mean of 10.5 months (6 to 16) and the nails had been removed at a mean of 20.5 months (16 to 30). In the 15 patients who did not sustain a secondary fracture during removal union had been apparent at a mean of 8.1 months (6 to 12) and removal was at a mean of 15.7 months (11 to 12).

Illustrative case report. A 21-year-old man sustained an open fracture in the lower third of the right tibia (Gustilo II). At operation this was reduced and the canal reamed to 12 mm before the insertion of an 11 mm diameter nail. Two fixation screws were used at each of the proximal and distal ends (Fig. 1). Radiographic union was diagnosed at seven months and the nail was removed at 12 mm before the insertion of an 11 mm diameter nail. Two fixation screws were used at each of the proximal and distal ends (Fig. 1). Radiographic union was diagnosed at seven months and the nail was removed at 17 months. There was considerable resistance and a secondary fracture was caused (Fig. 2). A square block of impacted bone from the slot of the nail was visible on the CT scan (Fig. 3). Union of the secondary fracture was uncomplicated.

DISCUSSION

The ACE tibial nail is made of titanium alloy and has a 10° bend proximally with a 5° bend of the distal few centimetres to facilitate insertion. The reamed-type nails of 10 mm or more in diameter have a slot in the posterior aspect of the main part of the nail, but this stops at the level

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The 5° bend at the distal end of the slot means that after healing the anteroposterior space taken up by the angled portion of the nail during removal is larger than the originally reamed canal. This factor and the design of the poster-
or slot will cause a progressive build-up of bone fragments at its lower end during removal. It appears that the fractures which we saw were caused by the pressure of tightly-packed bone fragments collected at the lower end of the slot. This was confirmed by the CT appearance of the secondary fractures and by the finding of tightly impacted bone within the lower end of the posterior slot in some extracted nails.

It is also of interest that the fractures were all in the patients who had relatively late removal of a slotted nail; the delay probably allowed more healing and bone formation around the nail and within the slot. Our experience leads us to advise caution and patience in the removal of slotted tibial nails which have a distal bend.

Correspondence with the manufacturers of the ACE tibi-
al nail has revealed that other similar cases had been reported. The manufacturers reported that they were conducting research on this aspect of nail design but had not yet made a decision on modifications (Sohngen, ACE Medical Company, personal communication).

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