MECHANICAL FAILURE OF INTRAMEDULLARY NAILS AFTER FRACTURE UNION

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The case reports of four patients with breakage of the intramedullary nail of the femur are presented. In all four patients the nail broke after consolidation of the fracture of the femoral shaft. All the nails broke at the same place: the junction between the round cross-section and the cloverleaf cross-section.

Mechanical failure of the material used for osteosynthesis is one of the complications of the operative treatment of fractures. Breakage of a stainless steel implant has been demonstrated to be due to metal fatigue resulting from instability of the bony fracture (Pohler and Straumann 1980). Fatigue fracture of an intramedullary nail is a rare complication (Dencker 1964; Kootstra 1973). Kuntscher (1962) was of the opinion that a nail would break only if it were too thin.

We were surprised to find that in the period from 1979 to 1981 we had had to remove four broken nails: in two we found a crack and in the other two the break was complete. In all four patients we had used ASIF/AO intramedullary nails, introduced in accordance with the ASIF principles and using the correct instruments. The nail always yielded after union of the bony fracture. All the nails broke at the junction between the round and the cloverleaf cross-section. We could find no publication about nails breaking after bony union.

We present the case reports of these patients.

CASE HISTORIES

Case 1. A 17-year-old boy was treated in August 1976 for a transverse fracture of the left femur. After 10 days an intramedullary nail was inserted (ASIF 12 × 400). The postoperative course was uneventful. Five months after the operation the radiological follow-up showed satisfactory union of the bone. The nail appeared to be normal. Thirty-eight months after the accident the intramedullary nail was removed. The radiograph before removal showed a semicircular crack at the junction of the circular and the cloverleaf cross-section (Fig. 1).

Case 2. A 33-year-old woman was treated in December 1977 for a refracture of the right femoral shaft. The fracture had occurred two months after the removal of previous osteosynthesis material—a plate and screws. Two days after the refracture osteosynthesis was performed using an intramedullary nail (ASIF 14 × 400). The postoperative course was uneventful. Eleven months after the operation radiological follow-up showed complete union (Fig. 2). Six months later further radiographs showed a crack in the nail (Fig. 3), which progressively developed until it was complete. Thirty-seven months after the operation the nail was removed (Fig. 1).

Case 3. A 28-year-old man was treated in April 1978 for a transverse fracture of the right femur. Eight days after the accident osteosynthesis was performed using an intramedullary nail (ASIF 14 × 440). The postoperative course was uneventful. Follow-up radiographs nine months later showed a complete union of the fracture (Fig. 4). Fifteen months after the operation a radiograph revealed a broken nail (Fig. 5). Thirty-three months after the operation the intramedullary nail was removed (Fig. 1).

Case 4. A 24-year-old man was treated in October 1978 for a fracture of the left femoral shaft. Eight days after the injury an intramedullary nail was inserted. The postoperative course was uneventful. Twenty months after the operation radiographs showed complete union of the fracture. Three months later further investigation showed a crack in the nail. Thirty-three months after the injury the nail was removed (Fig. 1).

DISCUSSION

In a three-year period four medullary nails were removed from four patients; these nails were all cracked in the same place, at the junction between the round cross-section and the cloverleaf cross-section. A total and stable reduction of the fracture without bony defects, together with a stable osteosynthesis, had taken place in all four patients. There were no pathological fractures.

Fig. 1

The proximal end of four intramedullary femoral nails (ASIF). From left to right, the intramedullary nails from Cases 1, 4, 2 and 3. Note the break in each nail at the same place—the junction of the round and the cloverleaf cross-section.
fracture healing occurring without osteitis. The indications for, and the technique of, the operations were standard and failure of the material occurred a considerable time after radiological union had been demonstrated (Table I).

Table 1. Relative times of radiographic consolidation, failure of osteosynthesis material and its removal (in months)

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<th>Case</th>
<th>Consolidation</th>
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<td>1</td>
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It seems that the breakage of the intramedullary nail occurs through abnormal tension on the nail in physiological movements of the intact femur. Material failure starts in the nail where it cannot withstand the tension, at the change in cross-section. Biomechanical investigation will be undertaken.

The removal of a completely broken nail can be difficult, because the standard instruments can only remove the proximal circular portion. In two patients (Cases 2 and 3) the residual part of the nail had to be removed by a specially made long hook. It is therefore recommended that after using an intramedullary nail and after union of the fracture the patient should undergo radiography from time to time to visualise the proximal end of the nail. When signs of a crack are seen, the nail should be removed without delay, because it would appear that in the course of time this crack will go completely through the nail, making removal difficult.

REFERENCES


