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INFECTED NON-UNION OF THE TIBIAL SHAFT TREATED BY KÜNTSCHER INTRAMEDULLARY REAMING AND NAIL FIXATION

A Report of Four Cases

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Four cases of infected non-union of the tibial shaft treated by Küntscher intramedullary reaming and nailing are presented, and on the basis of these cases the indications and prerequisites for the method are discussed.

Key words: bone grafting; Küntscher nailing; osteomyelitis; pseudarthrosis

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Rigid fixation achieved by external or internal fixation, often combined with bone grafting, is the accepted method of treating non-union of shaft fractures. In infected non-unions, however, internal fixation is generally not recommended, and external fixation is mostly preferred (Karlström & Olerud 1974, Connes 1973, Weber & Cech 1973). Christensen (1973) reported 35 patients with non-unions treated by reaming and Küntscher nailing. Four of his cases were infected before and three after the operation, but they all healed eventually. Even if the usual methods of treating infected non-unions are successful in most cases, it sometimes happens that the fracture does not heal despite repeated operations. The purpose of this report is to discuss indications and technical problems on the basis of four consecutive cases of prolonged infected non-union of the tibial shaft, where reaming and Küntscher nailing was performed. Three of the cases had been treated for a considerable time with different methods before referral.

CASE REPORTS

Case 1

A 57-year-old male pedestrian was hit by a car and suffered a closed comminuted fracture of his right tibial shaft. He was treated with closed reduction and plaster of Paris. Because of poor alignment of the fragments, an open reduction and fixation with a plate was performed 2 weeks after the accident. The wound became infected and soon there was a large loss of skin over the plate, which was removed 2 months after the operation. The leg was kept in plaster of Paris, the wound was treated with daily dressings through a window and the patient received general antibiotic treatment. Because of instability and difficulties in keeping the fracture properly aligned, reaming and Küntscher nailing was carried out 5 weeks after the removal of the plate. Two weeks later the fracture was covered with skin by mobilizing the edges using a separate relaxing incision. A small fistula developed with increasing secretion, and after some months there were radiographic signs of infection all around the nail despite antibiotic therapy. Thirteen months after the accident the patient was finally operated on with removal of the nail, excision of the fistula, debridement of the fracture area with exci-

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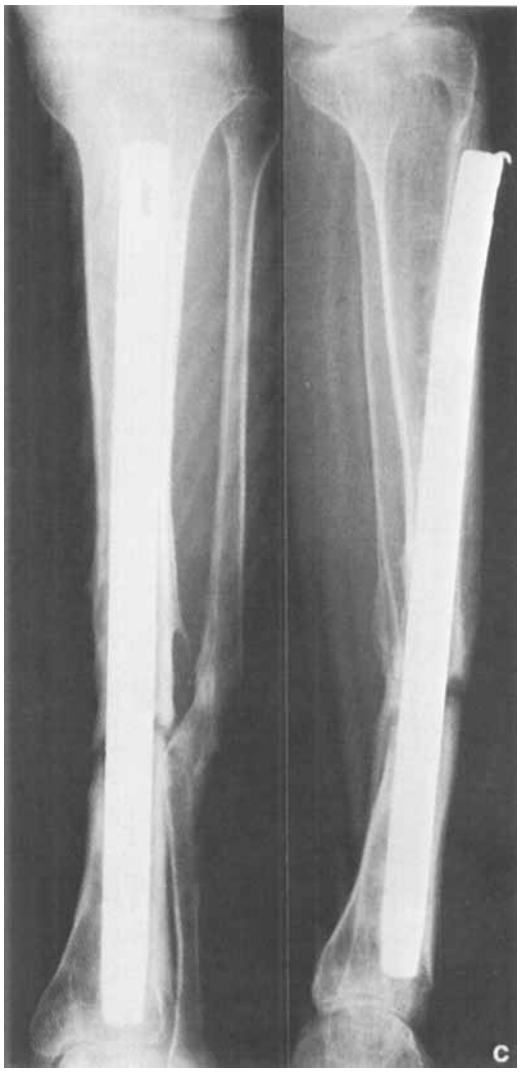
Figure 1. Case 2.
a) Atrophic non-union of the tibial shaft 17 months after injury.
b) A 14 mm nail has been inserted. Decortication of the tibia and an onlay osteotomy of the fibula has been performed.

sion of all granulation tissue and reaming of the marrow cavity. At operation the fracture was stable and healed dorsally. Postoperatively the leg was treated with irrigation-suction drainage. The wound now healed and the fracture became consolidated. There was no recurrence of the infection at the 4 years follow-up.

Case 2

A 15-year-old boy was injured in a traffic accident and sustained a pelvic fracture, a closed femoral and an open tibial fracture. The femoral fracture was plated and the tibial fracture treated with external fixation in a Hoffmann device. The pelvic and the femoral fractures healed uneventfully, but the tibial fracture became infected, and there was loss of skin over the fracture. The patient was treated with antibiotics and daily dressings. Six months after the injury the skin defect was successfully covered with a split-thickness skin graft. One month later bone grafting was performed through a dorsal incision. Postoperatively there was necrosis of the skin graft, and the infection flared up. The Hoff-



c) At 29 months an 18 mm proximally bent nail has been inserted.

mann device was removed 2 months after the bone grafting, and the leg was kept in plaster of Paris for a month and then in a brace. The fracture did not unite and the patient was referred to this hospital for further treatment. Eighteen months after the injury decortication of the tibia, osteotomy of the fibula and Küntscher intramedullary reaming and nailing with a 14 mm nail were performed. A coarser nail would have been desirable but was not available at that time. The shortest femoral nail was too long. After 4 months the nail was exchanged for a custom-made 16 mm nail (Orthopaedia, West Germany) because of lack of stability and sparse callus formation. Postoperatively the fracture was stable, but the stability gradually disappeared. After another 7 months the nail was finally exchanged for an 18 mm nail. After that the fracture united rapidly and the nail was removed after 6 months.

Case 3

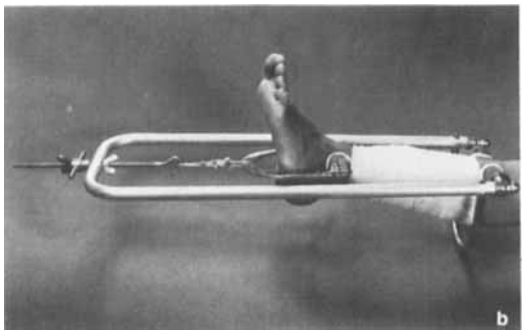
A 16-year-old boy was injured in a traffic accident and sustained an open tibial fracture. The leg was treated with traction and the wound was debrided and sutured primarily. It soon became infected and after further debridements there was a large skin defect over the fracture. After 2 weeks the bone was covered with a transposition flap and the secondary defect with a split-thickness skin graft. After that the skin healed, and the leg was kept in plaster of Paris. The fracture did not unite, and 14 months after the accident a sliding inlay graft, completed with cancellous bone grafting from the iliac crest, was performed. The wound was infected, and a part of the old transposition flap became necrotic. The patient was now referred to this hospital and treated with antibiotics, and the fistulas were allowed to heal secondarily. When there were no signs of infection, and the skin was healed, the fracture was still not united and it was finally operated on 20 months after the accident with Küntscher intramedullary reaming and nailing with a 14 mm nail, which gave sufficient stability. After that the fracture united and the nail was removed one and a half years later.

Case 4

A 17-year-old boy was injured in a traffic accident and sustained an open fracture of the tibial shaft. He was treated by debridement of the wound and primary suture, closed reduction and fixation in plaster of Paris. There was marginal wound necrosis, which was excised and the wound healed secondarily. The leg was kept in plaster of Paris for 8 months. After that, partial weight-bearing was allowed. Fourteen months after the accident there were radiographical signs of non-union and the fracture was clinically unstable. The fracture was then treated with different kinds of plaster of Paris and braces for 2 years but it still did not unite. Therefore Küntscher intramedullary reaming and nailing with a 14 mm nail was performed. Postoperatively there was skin necrosis over the fracture area which resulted in deep infection. When the nail was removed after one and a half years there was still fistulation and non-union. Half a year later the pseudarthrosis was resected and the gap was filled with bone chips. After that there was another flare up of the infection but after treatment with antibiotics the wound healed and the drainage ceased. Still the fracture did not unite, and the patient was referred to this hospital. Because of the poor skin condition the fracture area was first covered with a full-thickness cross-leg skin flap. Then Küntscher in-

Figure 2. Case 4.
a) Hypertrophic non-union of the tibial shaft with shortening and angulation 6 years after injury.

c) After distraction there is better alignment of the fracture.



b) The Küntscher distractor device.

tramedullary reaming and nailing with an 18 mm straight nail was performed now 6 years after the accident. The nailing was completed with cancellous bone grafting, and before the operation the leg was treated in a Küntscher distractor (Christensen 1970) to ensure better alignment. After the last operation there was rapid bone healing with radiographic bridging of the fracture and the patient has started working.

DISCUSSION

Certain prerequisites that must be fulfilled for the success of this method are all illustrated by the cases described. The fracture area must be covered by skin of good quality. In the first case

d) An 18 mm straight nail has been inserted.

there was no skin cover, which led to persistent infection. In the fourth case the skin was in a bad condition. Reaming is a traumatic procedure and can result in skin necrosis. Therefore the fracture was first covered by a full-thickness skin flap, which probably explains the uneventful course. If the fracture is covered by a skin flap, the incision should be carefully planned. In the third case an incision was made straight across the flap, which resulted in skin necrosis.

The infection should be under control (Hedström et al. 1981). If not, reaming and nailing might lead to a flare up and spreading of the infection along the marrow cavity as happened in the first case.

The nail must give sufficient stability. The coarsest Küntscher tibia nail is 14 mm. In cases of prolonged non-union, there is always bone resorption with thinning of the cortical bone, which might make a coarser nail necessary, as in two of our cases. If a coarser nail is used it must be straight. If not it will protrude above the ventral cortex proximally. The size and length have to be measured on the radiograms preoperatively and custom-made nails ordered.

Küntscher intramedullary reaming and nailing in infected pseudarthrosis is an alternative to other methods, e.g. external fixation, especially if these other methods have failed. The Küntscher nail has certain advantages. During reaming the fracture area is filled with bone material which acts as a bone graft, often making further grafting unnecessary (Christensen 1973). In cases of atrophic non-union, however, the reaming should be completed with spongious bone grafting (Bohr et al. 1968). External frames are also rather uncomfortable for the patient especially if they need to be carried for a long time.

If there are signs of persistent infection after the nailing, the nail can be left in place until the fracture has healed, provided it gives sufficient stability and the infection is treated generally or possibly locally (Macausland & Eaton 1963, Christensen 1973, Hedström et al. 1980). The nail should always be extracted when the fracture has healed and the medullary cavity cleaned by reaming it out with an instrument the same size as the nail to eradicate any remaining infection.

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