R. Pant · I. Ilyas · D. A. Younge

The supracondylar femoral nail in tibia

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Abstract We have found the intramedullary supracondylar femoral nail to be useful in special situations involving the tibia: proximal tibial fractures and nonunions, intercalary resections for tumors in the proximal or distal tibial diaphysis, and tibio-talo-calcaneal arthrodeses. We report on ten such cases.

Résumé Nous avons trouvé que le clou centromédullaire supracondylien fémoral pouvait être utile dans des situations particulières au niveau du tibia: les fractures et pseudarthroses proximales tibiales, les résections intercalaires pour tumeurs diaphysaires tibiales proximales ou distales et les arthrodèses tibio-astragalo-calcaneennes. Nous rapportons 10 cas illustrant ces situations.

Introduction

The intramedullary supracondylar nail, (IMSC nail, Smith and Nephew) was designed for distal femoral fracture fixation by Lucas et al [1] using a retrograde technique with an intercondylar portal in the knee. It is a relatively new concept that has been received with some enthusiasm for distal femoral fractures and nonunions, and for fractures above a total knee prosthesis in the distal femur [2, 3].

Our purpose is to illustrate the utility of this nail in the tibia in some special situations where nails normally designed for the tibia would be difficult or impossible to use. We have found it useful in the tibia in three situations: (1) Proximal tibial fractures and nonunions (Figs. 1a, b, and c); (2) after intercalary resections for

tumors in the proximal or distal tibial diaphysis (Figs. 2 and 3); and (3) hind foot arthrodesis (tibio-talo-calcaneal arthrodesis) (Fig. 3) for tumor, arthritic, or traumatic ankle problems.

Materials and methods

Over a 5-year period from July 1994 to June 1999, we used the IMSC nail 26 times in 24 patients. Sixteen nails were used in distal femurs and 10 in tibias. Its use in the tibia is the subject of this paper.

Technique

The entry portal in the proximal tibia was intraarticular and located just anterior to the tibial insertion of the anterior cruciate ligament. The nail was used in reverse for the tibia, with the bend on the nail facing posteriorly (Fig. 1c). When used for hindfoot arthrodesis, the insertion point on the calcaneus was in line with the tibia in the sagittal plane (Fig. 3). Of the tibial cases, three were for fractures or nonunions of the proximal tibia, three for proximal or distal tibial intercalary shaft resections for malignant tumors, and four for hindfoot arthrodeses because of distal tibia destruction from trauma or inflammatory conditions. In the fracture group, one patient presented with a primary injury while the other two were established nonunions. Of the intercalary resections, two were for malignant tumors of the proximal tibia—one fibrosarcoma of bone and one malignant fibrous histiocytoma—and a third for Ewing's sarcoma of the distal tibia. In all three cases, a nail-cement construction was used (Figs. 2 and 3), with bone grafting planned for later. In the hindfoot arthrodesis group, two (a bilateral case) were done for Charcot-type ankle instability in a patient with paraparesis, one was for a compound distal tibial pilon fracture with associated calcaneal fracture, and one was in a rheumatoid arthritic patient.

Results

Of our ten cases where the IMSC nail was used in the tibia, all cases were technically successful. Complications were related to infection and biological failure. All three proximal tibial fractures and nonunions healed uneventfully. The average time to healing was 16 weeks. In

R. Pant · I. Ilyas · D. A. Younge
King Faisal Specialist Hospital and Research Centre,
MBC 77, PO Box 3354, 3354 Riyadh, Saudi Arabia

R. Pant (✉)
Department of Orthopedic Surgery,
Singapore General Hospital,
Block 6, Level 7, Outram Road, 169608, Singapore
e-mail: rajpant@hotmail.com
Fax: +65-62262684

Fig. 1 **a** Nonunion of proximal tibia after failed lengthening. Previous plating had failed. The nonunion site was too proximal for fixation with a standard tibial intramedullary nail. **b** Healed nonunion, fixed with intramedullary supracondylar (IMSC) nail. Two locking screws close to the knee joint. **c** Lateral view of healed tibial nonunion

Fig. 2 Fixation with intramedullary supracondylar (IMSC) nail after resection of fibrosarcoma with temporary replacement with cement. Note two locking screws proximally

Fig. 3 Distal intercalary resection and cementing of Ewing's sarcoma. Note two screws in calcaneus and one in talus

the three intercalary proximal tibial shaft resections, the nail-cement reconstruction remained stable. The patient with fibrosarcoma of bone died of metastatic disease 12 months after surgery, the patient with malignant fibrous histiocytoma underwent an above-knee amputation for local recurrence at 10 months, and the patient with Ewing's sarcoma of the distal tibia had amputation for wound breakdown 6 months after surgery. In spite of

these failures, the IMSC nails held firm for the period stated.

For the hindfoot arthrodeses, in the paraparetic patient one arthrodesis healed, the other side did not but has remained stable enough to bear weight, though with some pain. The distal tibia fracture healed, and the rheumatoid patient with an unstable hindfoot went on to a solid fusion. Complications from implant failure did not occur. There were two patients who developed a stress fracture distal to the tip of the nail. This occurred in the rheumatoid and poliomyelitis patient and healed with closed treatment. There was one late infection in the patient with a compound tibial pilon-calcaneal fracture that resolved following implant removal.

Discussion

The usefulness of the supracondylar nail in the distal femur is now well established [2, 4, 6]. We have found ourselves implanting it often in the tibia for special situations. Because of the anatomy of the distal femur, i.e., the location of the "bare spot," the IMSC nail was designed with a slight angulation of 8°. The three holes for the locking screws are close together near the base (distal femoral end) of the nail. These two characteristics are what render it useful for the tibia. The design of a regular tibial nail makes it inappropriate for very proximal fractures or nonunions. If a standard tibial nail is introduced in the usual site, at most, one locking screw may be in the proximal fragment, and because of its angle [5], the normal tibial nail cannot be used intraarticularly. The IMSC nail has a lesser angulation, which is much closer to the proximal end (Fig. 1c). It can therefore be inserted from an intraarticular portal just anterior to the tibial insertion of the anterior cruciate ligament. The presence of three interlocking screws within the proximal five centimeters of the nail provides excellent fixation in a very short tibial segment. The advantages of a load-sharing

implant are thereby extended to include the proximal tibia.

This means that an intramedullary nail can be used for fractures or nonunions that are too proximal for the standard tibial nails. The same applies to very proximal intercalary resections for tumors where the remaining proximal tibial segment is only 2–5 cm (Fig. 2). For the distal tibia, the slight angle of the nail is ideal for placing the nail just anterior to the base of the calcaneum; the locking screws can be in the calcaneum or the talus or both (Fig. 3).

Using an intraarticular portal in the distal femur has not been a clinical problem [3]. The use of the anterior intraarticular portal in the tibia can be similarly justified in special cases. The stress fractures that occurred distal to the tip of the nail in two of our cases could perhaps be prevented by use of a longer version of this nail.

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