Interlocking nailing

An Essay

Submitted for partial fulfilment of the master degree

in Orthopaedic surgery

By

Habib Younan Habib

M.B. B.CH

Supervisors

Prof. Dr. El Sayed Mohamed Wahb

Prof. of orthopaedic surgery

Faculty of Medicine

Ain Shams university

Dr. Nasser Hussin Zaher

Lecturer of orth. Surgery

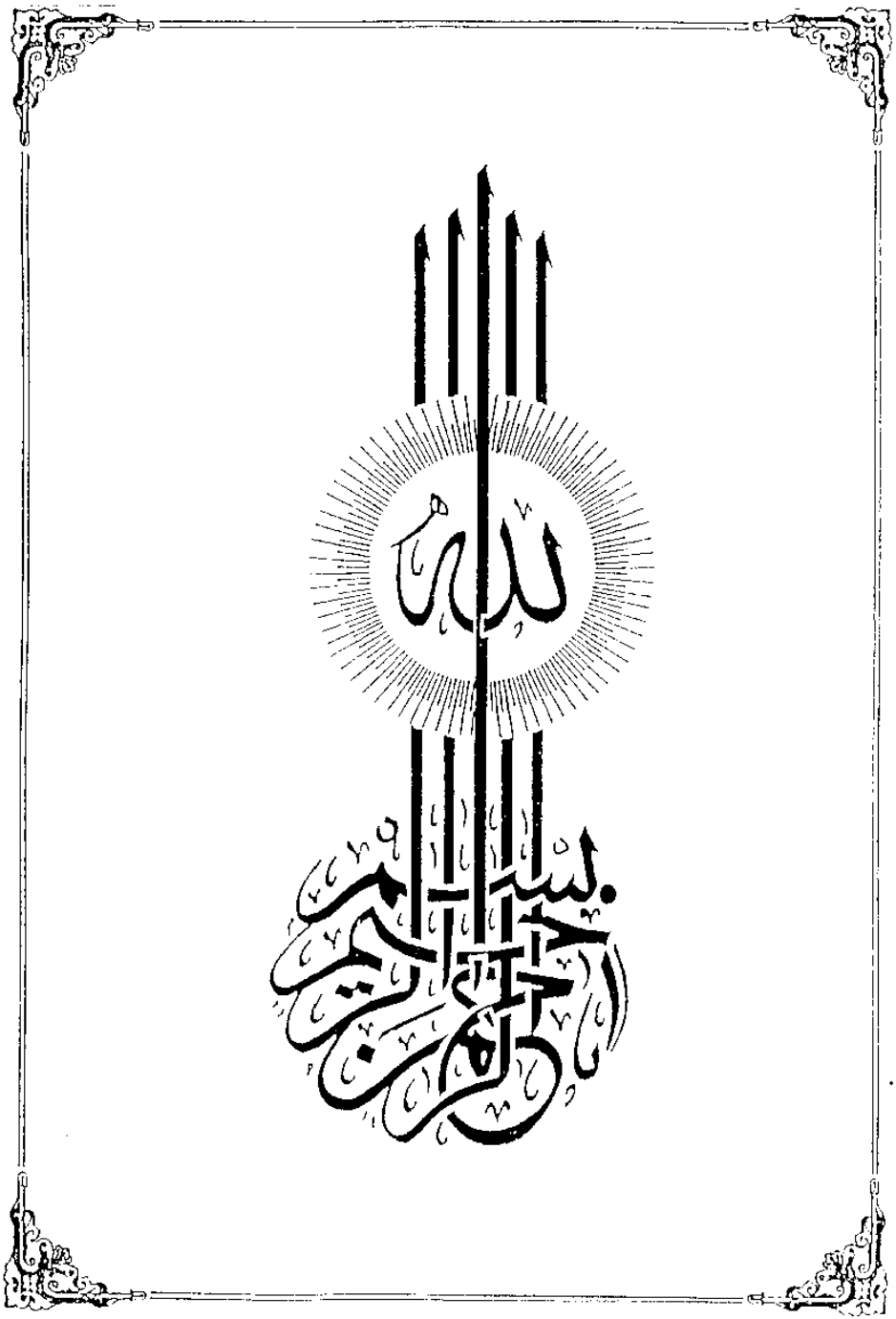
Faculty of Medicine

Ain Shams Univeristy

Orthopaedic surgery dep.

Ain Shams University

Content



Introduction

Introduction

HISTORICAL REVIEW

in 1940 at the Congress of the German Society for Surgery in Berlin , Gerhard Kuntscher introduced osteosynthesis of fractures of the shaft of the femur through his intramedullary nail. A unique feature was the achievement of stability by means of elastic impingement afforded by the cloverleaf profile of the nail. Until the time of his death, Kuntscher thought to extend the indication for intramedullary nailing so as to include all fractures of the diaphysis of long bones. One important improvement was progressive flexible reaming of the medullary canal so that elastic impingement for fixation could be achieved in the entire middle third segment of the femoral shaft. Nevertheless, reliable stability was usually possible only in transverse and short oblique fractures. In spiral, comminuted and segmental fractures and those in the proximal or distal third segment of the bone, rigid fixation could not be achieved with his conventional nail. It is as a result of these limitions that other methods, notably plating, have for some time supeneded intramedullary nailing .

In 1968, Kuntscher reported his experience with comminuted fractures of the femoral shaft in which stability

Intramedullary devices

Intramedullary Devices

Intramedullary devices for fracture have been advocated since 1940s , these devices fall into two major classes that act as an internal splint and those that offer more rigid fixation .

The internal splints include such implants as Rush rods , small diameter intramedullary nail and Ender rods. The pepularity of these flexiable rods is based on several theoretical physiological and mechanical consideration . Reaming of intramedullary canal is avoided , and there is thought to be less disterbance of intramedullary blood supply .(Levy-Goldbergi Stern 1980)

The surface area of bone contact at the fracture site is also not lessened by reaming and cyclic loading of the fracture can occure . When applied to simple and transverse and short oblique fracture of the midshaft , internal splints are effective in maintaining satisfactory alignment during fracture healing .

Spiral fracture , comminuted fracture are often complicated by shortening , angulation and malrotation when treated with nonrigid intramedullary implant .

These devices therefore play only a peripheral role in current treatment of most femoral fractures .

Intramedullary nailing implies broad cortical impingement of the implant on the endosteal surface of both proximal and distal fragments . Nailing may be performed in closed fashion or by an open method with exposure of the fracture fragments .

A number of nails are in common use including kuntscher , ASIF , Schneider and Hansen - street nail and various inter-locking nail designs .

Although they differ in their cross-sectional geometry , basic design , method of insertion and biomechanical properties , they all do provide stable osteosynthesis . The advantages of an intramedullary nail over an intramedullary splint include greater fatigue strength , improved stability in rotation , bending and axial compression . and the potential benefit of cortical reaming deposited at the fracture acting as a bone graft. Intramedullary nailing with a cannulated , prebent nail that conferms to the normal anterior femoral shaft curvature , has significantly more potential to maintain normal anatomy than does the use of an internal splint . (Senn .1989) .

The theoretical benfits of a more elastic form of fixation with an intramedullary splint , appeare to be of no practical importance , since osseous healing proceeds at a predicatably rapid rate with all intramedullary devices . (Molester.et al 1982).

The types of interlocking nails are

1- The Klemm and Schellmann nail .

The nail is cloverleaf in shape , curved anteriorley to comform the normal anterior bowing of the femoral shaft . At its proximal end , there is an oblique threaded hole , from lateral to medial at an angle 150° with horizontal line , for screw fixation in the trochanteric region , this dictates a need for right and left nails .

At the distal end , there are rwo transverse unthreaded holes which are 4 and 7 cms from the distal end of the nail for fixation of distal fragments .

A set of 16 nails for each side is required ; the diameters are 12 , 13 , 14 and 15 mm , while the lengths are 360 - 460 mm in 20 mm increments . The oblique screw is fully threaded and has a diameter of 6.35 mm , and a shaft length of 60 , 90 or 100 mm . The transverse screws for distal fixation are 6 mm in diameter , half

threaded and the shaft length is 25 - 70 mm in 5 mm increments .

instruments necessary for insertion of the nail include a combined impactor and proximal guide unit , the latter is used for aligning the oblique screw in the threaded hole after insertion of the nail . A separate target device is used under radiographic image intensification for the insertion of the distal screws . (Klemm and Schellmann 1972) .

2 - The Grosse and Kempf nail

(Grosse . et al 1978) .

It is similar in design to the AO nail . It has a cylindrical portion welded onto the cloverleaf section with the open section positioned in the posterior aspect . The metal used to manufacture these nails is somewhat thicker and stiffer than the AO nails . In the proximal end of the cylindrical portion of the nail,there is an internally threaded core that permits attachment of the drivers and target devices . This threaded section is inset several centimeters beyond a slightly enlarged and faced mouth of the nail ,which permits rotational control of attached devices .

This nail is a curved , bullet-nosed Kuntscher nail is curved only in the sagittal plane and contains a threaeded diagonal hole through the proximal cylindrical portion that runs from proximal laterally to distal medially at an angle 130° with horizontal line . The use of this diagonal screw path does necessitate the provision of right and left-sided nails . The screw inserted through the proximal diagonal hole is 6.5 mm in diameter and threaded throughout its length . This screw is inserted through a 5'mm hole and gains purchase in the bone and nail .

At the distal end of the nail there are two 6.5 mm holes. Transverse screws intended for insertion through these holes have a 6 mm diameter and a small length of self-tapping cortical threads at the screw tip . These screws are introduced through a 6 mm gliding hole in the lateral cortex and slide through the nonthreaded holes in the distal end of the nail to purchases on the medial cortex only . The cylindrical screw heads and screw driver shank are designed to fit into the target devices to ensure proper alignment during screw insertion . The screw driver tip is hexagonal in design, offering enhanced screw purchase (Broner , 1984)

All these various types of nails had a special impactor , proximal guide device for proximal locking and distal target device for distal locking ; some of them had external mounting device , applied at the proximal end of the nail , for distal locking . (Grosse . et al 1978) .

3 - THE RUSSELL-TAYLOR TIBIAL NAIL

The Russell - Taylor tibial nails are available in diameters of 11,12 , 13 and 14mm. The nails contain a 15° anterior bend at a point 45mm from the top of the nail. This allows the nail to enter the anterior proximal portion of the tibia. There is a 3°anterior bend in the distal 64mm of the nail that serves as a "ramp" for the nail during insertion,thereby reducing the chance for posterior cortical comminution. Proximally and distally the tibial Nail uses 5.0 mm fully threaded, self-tapping bone screws. These allow for bi-cortical fixation in order to reduce the possibility of the screws backing out. All unstable fractures should be locked with two screws distally and proximally, thereby maintaining length and preventing rotation. The tibial Nail has a unique Proximal Drill Guide that allows for accurate nail insertion and placement of the proximal screws. Designed to address the widening spectrum of indications for nailing fractures of the tibia, the tibial Nail allows for the

intramedullary fixation of tibia shaft fractures including those that are segmental or severly comminuted. If the canal is large enough, the tibial Nail, 11-14 mm diameter, may be inserted without reaming. (Whittle A. P et al 1991)

4 - THE RUSSELL-TAYLOR DELTA TIBIAL NAIL

The Russell - Taylor delta tibial Nails are available in shaft diameters of 8,9 and 10 mm. The proximal end of these nails is tapered to 12 mm to give the extra stength necessary for nail insertion and proximal interlocking. The nails contain a 15^{0} anterior bend at a point 45mm from the top of the nail. This allows the nail to enter the anterior proximal portion of the tibia. There is a 3^{0} anterior bend in the distal 64 mm of the nail that serves as a "ramp" for the nail during insertion, thereby reducing the chance for posterior cortical comminution. proximally and distally the delta tibial Nail uses 4.5mm fully threaded, self-tapping bone screws. These allow for bicortical fixation in order to reduce the possibility of the screws backing out. all unstable fractures should be locked with two screws distally and proximally, thereby maintaining length and preventing rotation. Delta tibial Nail uses the same proximal Drill Guide as the tibial Nail; it allows for accurate nail insertion and placement of the proximal screws. Designed to address the widening spectrum of indications for nailing fractures of

the tibia, the delta tibial ibial Nail allows for the intramedullary fixation of tibial shaft fractures including those that are segmental or severely comminuted.The delta tibial Nails may be inserted reamed or unreamed. The unique combination of strength and smaller size offered in this implant gives particular advantages in the treatment of open fractures, patients with small medullary canals, and congenital problems. If the canal is large enough, a standard tibial Nail, 11-14mm diameter, may be inserted without reaming. (Whittle et al 1991)

5 - THE RUSSELL-TAYLOR RECONSTRUCTION NAIL :

The Russell - Taylor reconstruction Nail are available in shaft diameters of 12,13,14 and 15 mm. The proximal 8 cm of these nails is expanded to 15mm to give the extra strength necessary for the proximal lag screws used for fixation in the femoral head. The inferior screw is 8.0 mm in diameter and the superior screw is 6.4 mm in diameter. Both screws are self-tapping and are partially threaded to allow for sliding compression. Distally the Reconstruction Nail uses 6.4mm fully threaded, self-tapping bone screws. These allow for bi-cortical fixation in order to reduce the possibility of screws backing out. Depending on the indications, one or two proximal and/or distal screws are used to secure the nail in the fractured femur, reducing the

potential for rotation, shortening, and displacement of fragments. The Reconstruction Nail has a unique Proximal Drill Guide that allows accurate nail insertion and placement of the proximal screws. Designed for intramedullary fixation and "reconstruction" of severely comminuted femoral fractures, the Reconstruction Nail offers advantages in the treatment of subtrochanteric fractures, ipsilateral neck and shaft fractures, and impending pathologic fractures of the femur.

NOTE :

The Reconstruction and DELTA Nails have an increased wall thickness and a correspoding increase in strength to treat the complex fractures for which this implant is indicated. In cases where this extra stength is needed yet femoral neck screws are not indicated (e.g., distal fractures in very obese or noncompliant patients), a left Reconstruction Nail can be placed in right femur (or a right nail in a left femur) and the special top hole in the Proximal Drill Guide may be used to insert the appropriate screw diagonally from the greater trochanter toward the lesser trochanter . (Brumback R . J . 1988)