Anatomical Nail for Reamed and Nonreamed Technique, Choice for Locking and Lateral Entry Point
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Surgical Technique
Positioning of the Patient

The patient is placed on the operating table in the supine position. The unaffected leg is flexed 90° at the hip and placed abducted in a leg holder.

After the patient is in the correct position, the C-arm must be adjusted so that the femur can be imaged in a lateral and anterior-posterior view along its whole length.

In the same position an extension table can be used if needed.

NOTE
Alternatively a lateral positioning of the patient can be chosen.
Opening of the Medullary Canal

**Incision of the skin**

Extending the femoral shaft axis about 70mm proximal to the tip of the trochanter, a longitudinal incision of about 40mm is made. The fascia is split longitudinally in the direction of the tip of the trochanter, so that the greater trochanter can be palpated with the fingertip.

**Entry point of the nail**

The entry point of the intramedullary nail lies transversely in the extension of the axis of the medullary canal, directly lateral to the tip of the greater trochanter.
1. Insertion of the guide rod

The guide pin Ø 3.0mm, length 365mm, is clamped into a drill or into the universal chuck and, with the help of the image intensifier, placed at the correct point of entry. It is then pushed forward with oscillating movements about 150mm into the medullary canal. Next, the drill or universal chuck is removed and the correct position of the guide rod confirmed in both planes with the image intensifier.
2. Opening of the medullary canal

Slide the tissue protection sleeve (Ø 13mm) over the inlying guide pin (Ø 3.0mm, length 365mm). The cannulated awl (Ø 13mm) is pushed forward over the guide rod using light rotating motions until the stop on the tissue protection sleeve is seated.

2a. Alternative method for opening of the medullary canal

In case of dense or hard bone, the medullary canal can be opened with the Flexible Shaft Cannulated Trochanteric Reamer (Ø 13mm). The medullary canal is predrilled until the stop on the tissue protection sleeve is seated.
Nonreamed Method

**Insertion of the guide wire**

Remove all entry point opening instruments, except the tissue protector. Insert the guide wire (Ø 3.0 mm, length 100cm) through the tissue protection sleeve into the medullary canal with the universal chuck. The correct position of the guide wire should be checked by using the image intensifier in both planes.

For further procedures go to page 11.

**NOTE**

To simplify the insertion into the distal fragment in the case of a difficult reduction, the tip of the guide wire can be slightly bent. In addition, the usual reduction techniques can be used. Especially in difficult cases, the joystick technique might be a reasonable option.

In the distal metaphyseal area of the femur, attention should be paid to place the guide wire centrally in the medullary canal in both planes.
NOTE
For the reamed method, the instrumentation for intramedullary reaming is needed.

1. Insertion of the reaming rod

The tissue protection sleeve (Ø 13mm) used in the opening of the medullary canal is left in position. The awl or flexible shaft trochanteric reamer and the guide rod are removed. The reaming rod with ball tip (Ø 3.0mm) is inserted using the universal chuck and the image intensifier. The correct position of the tip of the reaming rod and the correct reposition of the fracture is then confirmed in both planes.

In cases of difficult reduction, the usual reduction techniques can be used. In particular the joystick technique might be a good option.

In the distal metaphyseal area of the femur, attention should be paid to place the reaming rod centrally in the medullary canal in both planes.
2. Reaming the medullary canal

The medullary canal is reamed in 0.5mm increments over the reaming rod with ball tip (Ø 3.0mm). To prevent thermal necrosis, reaming must be carried out with sharp intramedullary reamers (Zimmer Pressure Sentinel® Intramedullary Reaming System Reamers are recommended). Excessive pressure must be avoided.

It is recommended to ream 1mm larger than the chosen nail diameter.

3. Replacement of the reaming rod with ball tip with the smooth guide wire

The reaming rod with ball tip is replaced with the smooth guide wire. To prevent dislocation of the bone fragments during this process, the medullary exchange tube is pushed over the reaming rod with ball tip. The reaming rod is then removed and replaced with the smooth guide wire (Ø 3.0mm) length 100cm. Finally, the medullary exchange tube is removed.
NOTE
The Sirus Intramedullary Nail has an anatomical shape. Therefore there are different nails for left and right. Nails marked LEFT must be used for the left femur only. Nails marked RIGHT must be used for the right femur only.

1. Attaching the targeting device

The length and diameter of the intramedullary nail are determined intraoperatively using the measuring device or preoperatively using the X-ray templates.

The targeting device is placed on the selected intramedullary nail for femur and fixed with the connection screw for the targeting device. When doing this, the cams of the targeting device have to be engaged in the grooves of the intramedullary nail and the connection screw firmly tightened.
2. Insertion of the intramedullary nail for femur with the targeting device

Due to the anatomical nail shape the nail must be rotated approximately 90° during insertion. By applying this technique, stress peaks in the bone can be avoided.

The intramedullary nail for femur and targeting device unit is inserted over the smooth guide wire (Ø 3.0mm) into the medullary canal by hand using light pressure with the targeting device oriented anteriorly. Since the patient is in the supine position, the targeting device therefore points upwards.

After passage of the proximal metaphysis the targeting device is slowly rotated by pushing the nail further down the intramedullary canal. At the end of the insertion the targeting device is rotated by approximately 90° and lies in a lateral direction.
2a. Insertion of the intramedullary nail for femur

If necessary, the intramedullary nail can be driven with light, controlled blows into the medullary canal. To do this, the Ram (Slaphammer) guide is screwed onto the connection screw and the Ram (Slaphammer) then mounted onto the guide. Finally the driving head is screwed onto the Ram (Slaphammer) guide.

NOTE
It is important that the nail advances into the medullary canal with each blow. If this is not the case, the impaction must be stopped and the cause determined using the image intensifier. If necessary, a nail with a smaller diameter must be used or the medullary canal reamed larger.

After nail insertion, the Ram (Slaphammer) guide assembly is removed from the connection screw. The connection screw remains firmly attached to the intramedullary nail and the targeting device.

3. Removal of the smooth guide wire (Ø 3.0mm, length 100cm)

4. Confirmation of the final position of the intramedullary nail for femur

The final position of the intramedullary nail must be checked in both planes with the image intensifier. In particular, the correct rotation of the extremity must be checked at this time.
Options for Proximal Locking

NOTE
The reaming rod or guide wire must be removed before locking the nail.

Standard proximal locking

The standard proximal locking can be carried out statically or dynamically depending on the type of fracture.

The hole on the targeting device marked with STAT is used for the static locking.

The hole on the targeting device marked with DYNAM is used for the dynamic locking.

NOTE
If the cervical screws are inserted proximally, dynamic locking cannot be used. However the combination of the cervical screws with the proximal static locking screw is possible.
Cervical screw locking

In the case of subtrochanteric fractures, the proximal region can be locked with up to three special cervical screws.

NOTE
If inserting the cervical screws, at least two screws must be inserted in the nail. It is recommended, especially with ipsilateral femoral neck fractures, to insert the third cervical screw on the anterior side.

An additional targeting module is screwed onto the targeting device and serves as a guide when inserting the cervical screws.
It is recommended to do the proximal locking first since the targeting device may irritate the soft tissue. In addition, the distal locking without the targeting device attached is easier to carry out because the leg can be positioned in abduction if needed.

However, if compression of a shaft fracture is required, distal locking should be achieved first and then slight extracting motions should be applied before removing the Ram (Slaphammer) guide assembly.

NOTE
If using the dynamic locking, the cervical screws cannot be used.

1. **Removal of the guide wire**
   (Ø 3.0mm, length 100cm)

   Before locking, the smooth guide wire must be removed. Check to make sure that the connection screw is firmly attached to the nail. If not, the screw needs to be retightened.

2. **Insertion of the tissue protection sleeve with the trocar**

   The tissue protection sleeve (Ø 10.0/8.0mm) with inserted trocar Ø 8.0mm is introduced into the appropriate guide hole, marked STAT or DYNAM. The skin is incised at the appropriate site and dissected bluntly to the bone. The tissue protection sleeve together with the trocar are inserted until the trocar touches the bone surface. The trocar is then removed.
3. Drilling of the locking holes

The drill guide Ø 8.0/4.0mm is inserted into the tissue protection sleeve. Using the three-fluted drill bit Ø 4.0mm, both cortices are drilled through.

NOTE
Before drilling, ensure the guide wire (Ø 3.0mm, length 100cm) has been removed.

4. Measuring of the screw length

The screw length is determined with the measuring device for locking screws.

NOTE
Drill guide Ø 8.0/4.0mm must be removed before depth gauge is used.

Alternatively, the screw length can be read directly from the drill. It is important that the tissue protection sleeve touches the bone when the screw length is being read from the drill.