TROCHANTERIC GAMMA® LOCKING NAIL
Acknowledgements:

The Gamma® Locking Nail Operating Technique was compiled from the kind contributions of leading surgeons in many countries; the principal authors and commentators were:

Dr. G. Taglang, Dr. A. Grosse, Strasbourg, France
Dr. S.C. Halder, Halifax, UK
Dr. K.S. Leung, Hong Kong
Dr. S. Boriani, Bologna, Italy

Our thanks are due to the many surgeons whose work has helped to confirm the utility of the technique to present and future users of the Gamma® Locking Nail family.

Warning:

Bone screws referenced in this material are not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.
The Trochanteric Gamma® Locking Nail is the latest development in the continuing evolution of the Gamma® Locking Nail family. Like the original Gamma® and Long Gamma® Locking Nails, the Trochanteric Gamma® Locking Nail has been designed by surgeons. The requirement, based on the Gamma® experience of over three hundred thousand implants worldwide, was to develop an implant specifically for fractures in the trochanteric region, but with all the benefits of the existing Gamma® Locking Nail family.

The new Trochanteric Gamma® Locking Nail is shorter and simpler than the standard Gamma® Locking Nail, and has:

- only one distal locking screw
- only one distal diameter
- 180 mm overall length
- profile designed for rapid and secure fixation of fractures around the trochanter

The Trochanteric Gamma® Locking Nail uses the same award-winning instrumentation* as the standard and Long Gamma® Locking Nails, with the addition of new targeting sleeves. It combines the strength and biomechanical advantages of the existing Gamma® family with a small inventory and simplified technique. And, as the latest development of one of the world’s leading locking nails, the design of the Trochanteric Gamma® Locking Nail benefits from an unrivalled pedigree of clinical experience.

* Design-Innovation ’95, awarded for high design quality; Design Centre, Nordrhein Westfalen.

Published clinical studies for the Gamma® Locking Nail family are among the most extensive for any surgical implant currently available. They consistently illustrate how successfully this evolving range of implants has achieved the original design goals: to improve both the procedure and prognosis for all grades of femoral fracture by extending the application of the established intramedullary principle to set a new standard for treatment:

- Early weight-bearing1,2,3,4,5,6,7 through superior strength and stability
- Reduced trauma3,4 through closed operating technique3,4
- Low blood loss5,6, low level of wound problems5 and low risk of infection5
- More secure fracture fixation through better biomechanics7

The clinical objective of the Trochanteric Gamma® Locking Nail, as with the original and Long Gamma® Locking Nails, is:

Rapid mobilization, with fewer complications, for better patient rehabilitation7

The operating technique for the Trochanteric Gamma® Locking Nail is essentially the same as for the standard Gamma® Locking Nail, the main variation being in the simpler distal locking process. Instrumentation for the Trochanteric Gamma Nail is also the same as for the rest of the Gamma® family, obviating the need for further inventory and training for both the surgeon and the theatre team.

The aim of this surgical technique booklet is to provide you with a simple step-by-step operating guide to aid successful adoption of the Trochanteric Gamma® Locking Nail into your standard trauma practice.

Once the technique has been learned, you should find the operative procedures simple to implement. In fact, many of the basic principles for the Trochanteric Gamma® technique are those employed for all intramedullary closed locking nailing.

If you are in any doubt as to any part of the operating procedure, please contact your local Stryker Trauma representative or the office shown on the back cover.
REFERENCES:
Indications
Intertrochanteric fractures
Pertrochanteric fractures
High sub-trochanteric fractures

Anatomical efficiency
The Trochanteric Gamma® Locking Nail is designed for optimum efficiency both in operating technique and subsequent rehabilitation.

There are two basic components, universal in application to left or right hip fractures, and effective together in a very wide range of clinical situations and fracture complexity.

Insertion is entirely by closed surgical technique, minimizing trauma, blood loss and infection potential.

The Nail
The intramedullary nail itself integrates several important mechanical features. The anatomic design is universal for all indicated applications, with a profile specifically designed for trochanteric fractures, and is 18 centimetres long overall.

Variations in femoral neck anatomy are accommodated by a range of angles available for the lag screw entry (125°, 130°, 135°).

A single distal locking screw is used to prevent rotation in complex fractures. Cannulated for guide wire controlled insertion, and with a conical tip, the nail is available in a single distal diameter, 11 mm.

The Lag Screw
The lag screw, inserted through a small incision with the aid of a radiolucent targeting device, incorporates a special sliding lock to provide dynamic compression with axial stability.

After insertion, a set screw inserted through the proximal head of the nail engages in one of four grooves in the lag screw. As these are of asymmetrical depth profile, they allow the lag screw to slide in one direction, producing dynamic osteosynthesis by compression during early weight-bearing.

The lag screw incorporates a rounded nose profile and self-tapping thread designed for easy insertion and resistance to cut-out.
The Gamma® advantage – strength and stability

The Trochanteric Gamma® Locking Nail offers significantly greater strength and stability in clinical use through the inherent biomechanical advantage of the intramedullary system.

The biomechanical advantage

As the load-bearing axis of the Trochanteric Gamma® Locking Nail is closer to the hip joint fulcrum, the effective lever on the implant and femur is significantly less than with an external plate, reduced by a factor equivalent to $d/D$ in the diagram (approximately 25%*).

The resultant force is transmitted directly down the centre of the femur rather than through the many bone-weakening screws used in the side-plate system, increasing both the strength and reliability of the mechanical repair.

The rehabilitation advantage

The extra strength effectively gained by the biomechanical advantage of the Trochanteric Gamma® Locking Nail, combined with improved control of axial telescoping and rotational instability, allows early weight-bearing even in complex or unstable proximal fractures.

Earlier mobilization, combined with dynamic compression and less traumatic operative technique, increases the chance of successful patient recovery and reliable repair.

* Leung K.S., The Chinese University of Hong Kong: Gamma® AP Anthropometric Study of Proximal Femur, Jan 1991; Data on file, Stryker Trauma.
This surgical technique has been devised in consultation with leading surgeons in many countries to be a basic guide, particularly for less experienced users of the Trochanteric Gamma® Locking Nail.

It is acknowledged that several alternative approaches to certain elements of the procedure are practised, and may have advantages for particular situations or surgeons. Parts of this guide may seem simplistic or redundant for experienced readers, but are included for the guidance of more junior staff.

A chart of the complete operating instrumentation is folded into the back of this Operating Guide, and can be folded out for easy reference in conjunction with the text that follows. For easy identification, each instrument referred to in the guide is keyed to the chart by a reference number, and contains pictures of the Instrumentation and Implant cases, shown on page 30 and 31 complete with the catalogue numbers of each item.
In the majority of patients the standard 130° neck angle can be used without difficulty. The 125° neck angle may be needed in osteoarthritic coxa vara, and the 135° in coxa valga. Where such variations in femoral anatomy require an alternative, the following method may be used to confirm the nail angle selection:

**Implant Selection**

X-ray templates are very helpful during preoperative planning. Use the X-ray Templates for short and long nails to select the correct implant and the optimal implant size. These templates show the true implant size at a magnification of 15%. The X-rays should be taken at this magnification (15%) for an optimum surgical outcome. If accurate anatomical reduction has been achieved, the X-ray can be taken from the fractured hip or from the contralateral side.

**NOTE:** Please ensure precise alignment of the affected hip joint when using these templates. Template magnification is 15%. All dimensions (target angle and implant sizing) resulting from using these templates must be verified intraoperatively to ensure proper implant selection.
Image intensifier positioning
The image intensifier is positioned so that anterior-posterior and mediolateral views of the trochanteric region of the affected femur can be easily obtained. This position is best achieved if the image intensifier can be positioned so that the axis of rotation of the intensifier is centred on the femoral neck of the affected femur.

It is important to ensure that a view of both the distal and proximal tips of the nail can be obtained during the procedure without obstruction by the traction table.

Fracture reduction
The patient is placed in a supine position on the fracture table and closed reduction of the fracture is obtained as shown in figure 1.

Traction is applied to the fracture, keeping the leg straight.

Maintaining the traction, the leg is internally rotated 10-15 degrees to complete the reduction of the fracture; the patella should then be either horizontal or slightly internally rotated.

IMPORTANT
Reduction should be achieved as anatomically as possible. If this is not achievable, reduction in one plane should be achieved, leaving reduction in the other plane to be achieved with the Trochanteric Gamma® Locking Nail during insertion.

The unaffected leg is abducted as far as possible in order to accommodate the image intensifier.

The patient is then prepared and draped as for standard hip fracture fixation, but bear in mind that the incision is rather more proximal when positioning the drapes.
Anteversion guide insertion

With the image intensifier C-arm in the horizontal position to give the lateral view of the femoral neck and head, a 2 mm Kirschner wire is inserted percutaneously, anterior to the shaft and parallel to the axis of the femoral neck and head. This is to provide a guide to the angle of anteversion of the femoral neck during later insertion of the nail, during which the targeting device is kept parallel to the Kirschner wire in the coronal plane (Figure 3).

Alternatively, the guide wire can be inserted after the lag screw guide sleeve is placed in position (see page 15).
INCISION & ENTRY POINT

INCISION

Determination of the soft tissue incision position
With experience, the tip of the greater trochanter can be located by palpation, and a horizontal skin incision of approximately 5 cm is made from the greater trochanter to the iliac crest. The incision is deepened through the fascia lata, splitting the abductor muscle for approximately 3 cm immediately above the tip of the greater trochanter, thus exposing its tip. A self-retractor is put in place (Figure 4).

ENTRY POINT

Finding the bone entry point
The correct entry point can be identified by touch; it is located at the junction of the anterior third and posterior two-thirds of the tip of the greater trochanter and on the tip itself.

Breaching the cortex
The medullary canal is opened, under image intensification if necessary; use of the two-part curved awl (11) from the special instrument tray is recommended, as its conical sleeve is designed to be left in place to facilitate passage of the reamer guide wire. Care must be taken to ensure that the awl is not misplaced; this is more likely in the anterior-posterior plane i.e. as seen on the lateral view.

The insertion point should be just on the tip of the greater trochanter. If it is very medial (e.g. in the piriform fossa) the nail will not go down the shaft properly, with the danger of fracturing the femur.

When the entry point has been made, the reamer guide wire is placed in position so that the proximal femur may be prepared using flexible intramedullary reamers (Figure 5).
PREPARATION OF THE MEDULLARY CAVITY

In order to accommodate the proximal end of the Trochanteric Gamma® Locking Nail, the trochanteric region MUST be reamed up to 17 mm (Figure 6).

The sub-trochanteric cavity must be 2 mm greater than the distal diameter of the nail i.e. at least 13 mm; reaming may be necessary in some patients to achieve this. When reaming is performed, the whole femoral canal should be over-reamed to 13 mm.

REAMING TECHNIQUE

Pass the reamer guide wire from the tip of the greater trochanter into the shaft of the femur as shown in Figure 7, using the Jacob’s chuck (2). Rotating the guide wire during insertion will help it to take up the desired position and avoid it coming out of a posterior fracture line.

Flexible reamers are used to ream the shaft of the femur in stages starting from 9 mm diameter and increasing in 0.5 mm increments (Figure 8), in all cases to a minimum of 13 mm.

Care must be taken with flexible reamers to ensure that the guide wire is not displaced laterally during reaming. This could lead to resection of more bone on the lateral side of the wire, which in turn would lead to an offset position for the nail and a risk of fracturing the shaft.
Assembly of targeting device
The selected nail is now assembled onto the carbon fibre targeting device (3) as shown in Figure 9, ensuring that the locating peg slots into the corresponding notch; it is held by the nail holding bolt (4), and tightened using the socket wrench (5) and driver extension (6).

Nail/Lag Screw Positioning
Nail insertion is monitored with the image intensifier C-arm; the projected axis of the lag screw should be measured with a ruler on the monitor screen to ensure that the lag screw will be positioned in the ideal position. Visual estimation has proved to be unreliable. To ensure correct positioning of the lag screw, close attention must be given to the anteversion angle and to the depth of insertion of the nail into the femoral canal.

Using anterior-posterior screening, the Trochanteric Gamma® Locking Nail is inserted by hand (TAKE CARE TO AVOID UNDUE FORCE – DO NOT USE A HAMMER*) until the axis of the lag screw holes (visible as crescent shapes on the screen) is lined up with the inferior half of the femoral neck. The desired result of this is to ultimately position the lag screw tip just below the centre of the femoral head in the frontal plane (see Figure 15).

Check: When the Trochanteric Gamma® Locking Nail is inserted to its final depth the plane of the targeting device will be parallel to the percutaneous guide wire positioned earlier [see page 11]. This ensures the correct degree of rotation to align the lag screw holes with the angle of anteversion of the femoral neck.

* NOTE: It is sometimes difficult to fully insert the nail into the femur; one reason could be that the medullary canal is too narrow. As the Trochanteric Gamma® Locking Nail is a very strong, rigid implant, it MUST NOT be forced into the femur e.g. by hammering, as there is a danger of fracturing the femur.

If the nail will not go into the femoral cavity far enough to allow correct positioning of the lag screw, further reaming should be carried out in 0.5 mm increments until the nail will go in fully.
Remove the reaming guide wire using the Jacob's chuck (2), ensuring that the targeting device is supported to prevent rotational movement of the Trochanteric Gamma® Nail.

With the nail now inserted to the correct depth, slide the Trochanteric Gamma® targeting sleeve (colour-coded green) (7) corresponding to the nail angle of the selected Trochanteric Gamma® Locking Nail onto the end of the carbon fibre targeting device (3) (Figure 11). **ENSURE YOU ARE USING THE TROCHANTERIC SLEEVE (GREEN CODED), NOT THE STANDARD OR LONG GAMMA® TARGETING SLEEVES.**

Please ensure before proceeding that the nail holding bolt (4) is fully tightened.

The targeting device (3) may require support by an assistant, to prevent its weight from externally rotating the nail, until the next stage is completed.

Next, assemble the soft tissue protector (8) and the guide sleeve for the lag screw (9), and pass them through the targeting sleeve (7) to the level of the skin. This now indicates the position for the small incision to be made, which is developed down to the bone.

The guide sleeve and tissue protector assembly is now passed through the incision to press firmly against the lateral cortex (Figure 12). If the guide catches the fascia lata, twisting it will usually allow it to pass through to the bone. **If not already inserted, the percutaneous anteversion guide should now be placed (see page 11).**

The soft tissue protector (8) is removed and the lag screw guide sleeve (9) is firmly abutted to the lateral cortex of the femur to stabilize the targeting device (Figure 13). The thumbwheel on the targeting sleeve (7) should be tightened to lock the guide sleeve (9) in place and further stabilize the targeting assembly (Figure 13 inset).
With the guide sleeve (9) firmly engaged in the cortex, the awl (10) should be inserted and turned in order to pierce the lateral cortex (Figure 14). Check for correct positioning on both anterior-posterior and lateral intensifier views.

**NOTE:** Before proceeding, check that the guide wire for the flexible reamer used earlier has been removed.

The soft tissue protector (8) is now re-inserted to act as a guide sleeve for the lag screw guide wire (11), which is inserted using the Jacob’s chuck (2).

The guide wire should be screwed into the subchondral bone, checking for position on both the anterior-posterior and lateral intensifier views.

Checking is essential if you are to ensure good lag screw positioning. The tip of the guide wire (11) must be placed in the inferior half of the femoral head in the frontal plane, and on the midline in the lateral plane. The objective is to place the lag screw below the centre of the femoral head on the anterior-posterior view and centrally on the lateral view, to decrease the risk of it cutting superiorly out of the femoral head. (see Figure 15).

If the guide wire (11) is too anterior or posterior it must be repositioned; this should seldom be necessary if the anteverision-guiding percutaneous wire has been inserted correctly (see page 11).

If the guide wire (11) is mispositioned, the first step is to withdraw the guide wire itself, and then to withdraw the nail. Rotate the nail in the appropriate direction and re-insert as before. The guide wire is then re-drilled and control screening is carried out as before.
After achieving a satisfactory position for the guide wire (11), the lag screw length required is measured using the lag screw length measuring gauge (12). Before starting to measure, ensure that the guide sleeve (9) is pressed firmly against the lateral cortex of the femur.

Take the measuring gauge (12) and place it directly under the guide wire (11) as shown in Figures 16a & b. The measurement on the gauge is now transferred to the adjustable stop on the lag screw step drill (13). It should be noted that the adjustable stop is positioned with the chosen length next to the stop on the side towards the drill tip (Figure 17a). The collar is used to lock the stop in position (Figure 17b).
The soft tissue protector (8) is now removed and the lag screw step drill (13) is passed over the guide wire (11), through the guide sleeve (9) (see Figure 18a). The path for the lag screw is drilled using the Jacob’s chuck (2). If exceptional resistance is encountered, a power drill may be used with great care. Drilling should continue until the stop impacts against the guide sleeve (see Figure 18b), ensuring that the targeting device is well supported to prevent backing out and rotation.

If you check on the image intensifier at this stage you should see the tip of the guide wire protruding slightly from the step drill (Figure 18c). This is because the threaded portion of the guide wire is deliberately excluded from the drill measurement to prevent joint penetration by the drill.

The correct length lag screw is chosen by selecting a size at least 5 mm longer than the measurement previously made on the lag screw gauge (12) for drilling (see Figure 16). It is important that the lag screw protrudes at least 5 mm from the lateral femoral cortex to retain rotational stability and to permit sliding.

The correct size lag screw is now assembled with the lag screwdriver (14). The end thumbwheel must be pulled back, and the screw and driver connected as shown (Figure 19).

After pulling back and connecting, the end thumbwheel is tightened to secure the connection.

The lag screw is now passed over the guide wire (11), through the guide sleeve (9), and threaded up to the subchondral part of the head (Figure 20). If the guide wire is inadvertently removed, then the screw may still be passed without it provided that the guide sleeve is still in contact with the cortex.

After tightening the screw ensure that the handle of the lag screwdriver (14) is either parallel or perpendicular to the targeting device (3) so that the set screw will engage in one of the four lag screw grooves (see Figure 21c).

NOTE: It is important to observe the K-wire during drilling with the step drill on the intensifier to make sure that under no circumstances the k-wire will be pushed into the pelvis. This may damage large bloodvessels.
The set screw is inserted through the opening in the carbon fibre targeting device (3) and the nail holding bolt (4) at the proximal end of the nail (Figure 21b). It is then tightened fully using the set screwdriver (15) and socket wrench (5). You may find this a little stiff because the screw has a nylon insert in the threads to prevent spontaneous loosening.

The screw should then be unscrewed one quarter of a turn to ensure free sliding of the lag screw. Ensure that the set screw is still engaged in the groove by checking that the lag screw cannot now be rotated with the lag screwdriver (14).

A proximal plug (see Fig 21c) is available to prevent ingrowth from becoming trapped in the proximal threads of the nail; where used, this is tightened using the set screwdriver (15).

If distal locking is not indicated, disconnect the lag screwdriver (14) using the end thumbwheel, remove the lag screwdriver (14), guide sleeve (9), guide wire (11), targeting device (3) and sleeve (7), then complete the operation as described on page 22.

If distal locking is indicated then leave the targeting device (3) and sleeve (7) in position and continue.
The decision to use the distal locking screw must be made according to the pattern of the fracture.

It should be used:

- When the fracture is unstable
- To control the length of a comminuted fracture of the proximal femoral shaft
- When there is a great disparity between the diameter of the nail and the femoral cavity

**Distal Screw targeting**

Insert the distal soft tissue protector (16) into the distal guide sleeve (17). Slacken the thumbwheel on the targeting sleeve (7), then pass the guide sleeve and protector through the hole in the targeting device (3). This indicates where the incision is to be made. **ENSURE YOU ARE USING THE TROCHANTERIC SLEEVE (GREEN CODED), NOT THE STANDARD OR LONG GAMMA® TARGETING SLEEVES.**

The incision is developed down to the lateral cortex, and the tissue protector sleeve assembly passed through as shown in Figure 22.

The soft tissue protector (16) is now removed and the guide sleeve (17) is pushed into contact with the cortex. The guide sleeve should be locked into position using the thumbwheel provided (Figure 23).
If required, the distal awl (18) may be passed through the distal guide sleeve (17) and turned gently to make a small impression in the lateral cortex of the femur (Figure 24). Care should be taken to avoid causing fissures through excessive force e.g. through use of a hammer.

The awl (18), if used, is now removed and the 5.5 mm drill guide sleeve (colour-coded blue) (19) is inserted. The 5.5 mm distal drill (colour-coded blue) (20) is used, making sure the distal guide sleeve (17) is held firmly engaged in the cortex at all times during the drilling (Figure 25).

**Distal Screw length measurement**

After drilling, measurement of the distal screw length is made by using the distal screw depth gauge (21), first removing the distal drill guide (19).

The gauge passes through the distal guide sleeve (17) with its tip passing into the medial cortex (Figure 26). A measure of the distal screw length is therefore taken from a direct reading of the depth gauge (21). 25 and 30 mm screws are the most commonly used lengths.

The correct size of distal self-tapping screw is introduced through the distal guide sleeve (17) and tightened using the distal screwdriver (22) (Figure 27).
FINAL CHECKING

Remove the guide sleeve (17) and targeting device (3). Check the final position of the implant using the image intensifier in the anterior-posterior and lateral planes (Figures 28a & b). Close the wounds (don’t forget the small stab wound) with one drain proximally.

POSTOPERATIVE CARE AND REHABILITATION

After the wound is closed, elastic bandage is applied from the toes to the hip. Active and passive mobilization of the lower limbs should be started immediately. The injured limb is kept elevated. The drain is removed when the drainage stops and usually within the first 48 hours. Walking can be started on the third day.

For stable fractures with dynamic locking, full weight-bearing walking can be started immediately.

For unstable fractures with static locking, immediate full weight-bearing walking is allowed in fractures with good bone contact. For fractures with poor bone contact due to comminution and large medial third fragment, partial weight-bearing walking is allowed for the first 6 to 8 weeks. Full weight-bearing walking can be commenced when there is a bridging callus formed on the medial side as evident on the follow up X-ray.

Dynamization of the fracture may be performed if delayed union is noted between four and six months after operation.

If the implants are going to be removed after the fracture is healed, removal of the distal locking screw (dynamization) six months prior to implant removal is recommended in order to further improve the quality of the medial cortical bone.
EXTRACTION OF TROCHANTERIC GAMMA® LOCKING NAIL

Where extraction is indicated, please proceed as follows:-

Step I
Remove the distal screw if fitted.

Step II
Make a small incision through the old scar below the greater trochanter to expose the outer end of the lag screw. Remove any bony ingrowth which may be obstructing the outer end or internal thread of the lag screw as necessary to ensure correct connection for the lag screwdriver (14).

The lag screw guide wire (11) is then passed up to the lag screw into the head of the femur. The lag screwdriver (14) is passed over the guide wire, using the guide sleeve (9) as a tissue protector, and engaged with the distal end of the lag screw (Figure 29).

Check that ingrowth does not obstruct secure engagement of the lag screwdriver (14), otherwise the lag screw or driver may be damaged and extraction made much more difficult.

Step III
An incision is made over the proximal tip of the nail, the proximal plug is removed, and the set screwdriver (15) is engaged with the set screw. The screw is rotated anticlockwise with the socket wrench (5) far enough to disengage it from the lag screw groove (Figure 30). The set screw does not need to be completely extracted.

Step IV
The lag screw is extracted by rotating the lag screwdriver (14) in an anticlockwise direction. The lag screw guide wire (11) must then be removed.

Step V
The nail extraction rod (23) is then threaded into the proximal end of the nail (Figure 31). A sliding hammer assembly (from the G & K system) is attached and the nail extracted. Finally the wounds are closed.
PROBLEM SOLVING

Resistance to nail insertion
Sometimes it is difficult to introduce the nail far enough into the femur. In the case below (Figure 32), the lower end of the nail is impinging on the anterior cortex of the femur.

**DO NOT** hammer the targeting device (3). Some femurs are highly curved anteriorly and hammering will break the anterior cortex or the base of the greater trochanter.

The cortex should be reamed again using a 13 mm reamer and the nail re-introduced (Figure 33).
Bent guide wire

If insertion of the guide wire (11) is repeated in order to get a satisfactory position, the wire may be bent due to its passing through a previous track. This makes it difficult to pass the step drill (13) over the bent wire (Fig 34).

If the guide wire (11) is only slightly bent then the step drill (13) can be passed over it using a to and fro movement (Fig 35).

If the guide wire (11) is markedly bent then it should be removed and a new guide wire inserted; alternatively, the step drill (13) can be passed smoothly up to the sub-chondral bone without wire (Fig 36).
**Posterior displacement**

In the case of a comminuted fracture, there is a tendency for the fracture to become displaced downwards, i.e. posteriorly, making it difficult to pass the guide wire (11) into the centre of the neck or head. This should be solved by lifting the nail insertion targeting device (3).

Alternatively, the assistant could lift the greater trochanter up with his hand, and support it with a sandbag. This will maintain the neck and the femur in nearly the same axis, so that it will be easy to pass the guide wire (11) through the centre of the neck and head (Figures 37a, b, c). The position should then be checked on both anterior-posterior and lateral views using the image intensifier. Care is required to avoid radiation risk to the assistant.
Distal repositioning

Malposition of the distal locking screw hole can only happen due to loose fitting of the targeting device (3). It is unwise to try and make a further hole having tightened the targeting device, as the drill (20) will tend to follow its old track. A free-hand technique to drill the distal screw hole is recommended using the following procedure:

Steps to be taken are:

1. Remove the targeting device (3).

2. Place the image intensifier in a true lateral position (Figure 38) and obtain an image of the distal holes in the nail.

3. Rotate the image intensifier C-arm until you see the nail hole as a perfect circle on the image intensifier.

4. A very sharp pointed 3.5 mm guide wire is fitted to the power drill, and its pointed end is placed on the outer cortex of the femur in the centre of the shadow of the round hole of the nail, as viewed on the image intensifier.

5. The 3.5 mm guide wire is then positioned parallel to the X-ray beam (as judged by the position of the image intensifier) and tapped gently in order to engage the sharp end into the cortex. Its position is then checked again on the image intensifier.

6. The 3.5 mm guide wire is then drilled through the lateral cortex, the power driver removed, leaving the guide wire in situ, and its position rechecked using the image intensifier to see that it lies in the centre of the circular hole.

7. The 3.5 mm guide wire is drilled through the medial cortex and its position checked with the image intensifier. It is then removed.

8. The 5.5 mm distal drill (19) from the case is then placed in the hole in the lateral cortex made by the 3.5 mm guide wire and its position checked with the image intensifier in both planes. The drill is held horizontal and passed through both cortices. It is then left in situ and its position checked with the image intensifier. It should be in the centre of the circular shadow as viewed on the image intensifier.

9. The screw is then selected and placed in position in the usual manner.
The Trochanteric Gamma® Nail has been available in a new sterile packaging, since the autumn of 2001. The nail is packed together with the set screw in one box, because the use of the set screw is required in every case.

<table>
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<th>Cat No</th>
<th>Description</th>
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### Trochanteric Gamma® Locking Nail – Implant Case

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<td>Distal screw 25 mm</td>
</tr>
<tr>
<td>1107 - 4030S</td>
<td>Distal screw 30 mm</td>
</tr>
<tr>
<td>1107 - 4035S</td>
<td>Distal screw 35 mm</td>
</tr>
<tr>
<td>1107 - 4040S</td>
<td>Distal screw 40 mm</td>
</tr>
<tr>
<td>1107 - 4045S</td>
<td>Distal screw 45 mm</td>
</tr>
<tr>
<td>1107 - 4050S</td>
<td>Distal screw 50 mm</td>
</tr>
<tr>
<td>1208 - 1212S</td>
<td>Proximal plug</td>
</tr>
<tr>
<td>1215 - 2125</td>
<td>Targeting sleeve / metal green 125°</td>
</tr>
<tr>
<td>1215 - 2130</td>
<td>Targeting sleeve / metal green 130°</td>
</tr>
<tr>
<td>1215 - 2135</td>
<td>Targeting sleeve / metal green 135°</td>
</tr>
<tr>
<td>1220 - 1040</td>
<td>Implant case (empty)</td>
</tr>
</tbody>
</table>

S= sterile  
Note: For ‘non sterile’ products remove “S”

### Gamma® Locking Nail – Instrument Case 2A

<table>
<thead>
<tr>
<th>CAT. No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1212 - 1000</td>
<td>Small extraction rod</td>
</tr>
<tr>
<td>1214 - 3265</td>
<td>Distal awl</td>
</tr>
<tr>
<td>1214 - 6000</td>
<td>Distal screw depth gauge</td>
</tr>
<tr>
<td>1214 - 2180</td>
<td>Distal obturator</td>
</tr>
<tr>
<td>1213 - 7000</td>
<td>Jacob’s chuck &amp; key</td>
</tr>
<tr>
<td>1214 - 5300(S)</td>
<td>Drill – 5.5 mm dia. x 300 mm, blue</td>
</tr>
<tr>
<td>1220 - 1020</td>
<td>Instrument case 2A &amp; B (empty)</td>
</tr>
<tr>
<td>CAT. No.</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>1213 - 1300</td>
<td>Socket wrench</td>
</tr>
<tr>
<td>1213 - 1304</td>
<td>Set screwdriver bit SW4</td>
</tr>
<tr>
<td>1210 - 3220</td>
<td>Lag screw guide sleeve</td>
</tr>
<tr>
<td>1213 - 4300</td>
<td>Lag screw awl</td>
</tr>
<tr>
<td>1210 - 5250</td>
<td>Kirschner wire guide sleeve</td>
</tr>
<tr>
<td>1210 - 6450(S)</td>
<td>Kirschner wire 3.2 x 450 mm</td>
</tr>
<tr>
<td>1210 - 7190</td>
<td>Lag screw length gauge</td>
</tr>
<tr>
<td>1210 - 8100</td>
<td>Lag screw step drill</td>
</tr>
<tr>
<td>1213 - 9000</td>
<td>Lag screwdriver</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAT. No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1213 - 1000</td>
<td>Carbon-fibre targeting device</td>
</tr>
<tr>
<td>1213 - 1100</td>
<td>Nail holding bolt</td>
</tr>
<tr>
<td>1213 - 1220</td>
<td>Screwdriver for nail holding bolt</td>
</tr>
<tr>
<td>1214 - 1160</td>
<td>Distal tissue protector</td>
</tr>
<tr>
<td>1213 - 2125</td>
<td>Targeting sleeve 125°</td>
</tr>
<tr>
<td>1213 - 2130</td>
<td>Targeting sleeve 130°</td>
</tr>
<tr>
<td>1213 - 2135</td>
<td>Targeting sleeve 135°</td>
</tr>
<tr>
<td>1214 - 4172</td>
<td>Drill guide sleeve 5.5 mm</td>
</tr>
<tr>
<td>1214 - 5300(S)</td>
<td>Drill bit – 5.5 mm x 300 mm, blue</td>
</tr>
<tr>
<td>1214 - 7025</td>
<td>Distal screwdriver</td>
</tr>
<tr>
<td>1214 - 9000</td>
<td>Final Impactor</td>
</tr>
<tr>
<td>1220 - 1030</td>
<td>Instrument case 3 – empty</td>
</tr>
</tbody>
</table>

Not stored on tray

0121 - 0002 2-part curved awl

Note: The Standard Gamma Targeting Sleeves (metal colour) are NOT for use with the Trochanteric Gamma® Nail.
### Optional Instruments

#### Optional Instruments not stored on tray

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1213-3010</td>
<td>One Shot Device</td>
</tr>
<tr>
<td>1213-9090</td>
<td>Cannulated cutter</td>
</tr>
<tr>
<td>1213-9091</td>
<td>Guide pin for cannulated cutter, 4 mm x 400 mm</td>
</tr>
<tr>
<td>1214-4090</td>
<td>Prox. drill guide sleeve f. lag screw, 5.5 mm x 250 mm, blue</td>
</tr>
<tr>
<td>1215-2225</td>
<td>Trochanteric targeting sleeve 125° (plastic)</td>
</tr>
<tr>
<td>1215-2230</td>
<td>Trochanteric targeting sleeve 130° (plastic)</td>
</tr>
<tr>
<td>1215-2235</td>
<td>Trochanteric targeting sleeve 135° (plastic)</td>
</tr>
<tr>
<td>1800-0150</td>
<td>Screwdriver, 5 mm x 250 mm, self-retaining</td>
</tr>
<tr>
<td>1803-0030</td>
<td>Proximal femur drill, 17 mm x 300 mm</td>
</tr>
<tr>
<td>1803-0070</td>
<td>Proximal femur guide sleeve, 300 mm</td>
</tr>
<tr>
<td>1806-0040</td>
<td>Awl, curved</td>
</tr>
<tr>
<td>1806-0085S</td>
<td>Guide wire 3.0 mm x 1000 mm, ball tip</td>
</tr>
<tr>
<td>1806-0095</td>
<td>Guide wire handle</td>
</tr>
<tr>
<td>1806-0096</td>
<td>Guide wire handle chuck</td>
</tr>
<tr>
<td>3371-1085</td>
<td>Tap for lag screw</td>
</tr>
</tbody>
</table>

#### Gamma Extraction Set, complete, consists of:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1220-1055</td>
<td>Gamma Extraction Set, complete, consists of:</td>
</tr>
<tr>
<td>1806-0110</td>
<td>Universal rod</td>
</tr>
<tr>
<td>1806-0130</td>
<td>Wrench 10/8 mm</td>
</tr>
<tr>
<td>1806-0175</td>
<td>Sliding hammer</td>
</tr>
<tr>
<td>1800-0150</td>
<td>Screwdriver, 5 mm x 250 mm, self-retaining</td>
</tr>
<tr>
<td>1407-1304</td>
<td>Inserter for set screw, self-retaining</td>
</tr>
<tr>
<td>1213-9000</td>
<td>Lag screwdriver</td>
</tr>
<tr>
<td>1213-1300</td>
<td>Socket wrench</td>
</tr>
<tr>
<td>1212-1010</td>
<td>Extraction rod conical</td>
</tr>
<tr>
<td>1220-1050</td>
<td>Gamma® extraction box</td>
</tr>
</tbody>
</table>

#### X-Ray Templates

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1204-1000</td>
<td>X-ray template Trochanteric Gamma® Nail (TGN)</td>
</tr>
<tr>
<td>1600-1000</td>
<td>X-ray template Long Gamma® Nail (LGN)</td>
</tr>
</tbody>
</table>
INSTRUMENT GUIDE

1. Two-part curved awl
2. Jacob’s chuck
3. Carbon fibre targeting device
4. Nail holding bolt
5. Socket wrench
6. Screwdriver for nail holding bolt
7. Targeting sleeve
8. Kirschner wire guide sleeve (for lag screw)
9. Lag screw guide sleeve
10. Lag screw awl
11. Kirschner wire
12. Lag screw length gauge
13. Lag screw step drill
14. Lag screwdriver
15. Set screwdriver bit
16. Distal opturator
17. Distal tissue protector
18. Distal awl
19. Drill guide sleeve (for 5.5 mm distal drill)
20. Drill bit 5.5 mm, blue, calibrated, with centre tip
21. Distal screw depth measuring gauge
22. Distal screwdriver
23. Nail extraction rod
Fold out this page to show instrument guide for operating technique.
The TGN is the latest development in Orthinox®, the continuing evolution of the Gamma Locking Nail family designed for rapid and secure fixation of intertrochanteric and pertrochanteric fractures. Combining strength and biomechanical advantages of the existing Gamma family it is the Golden standard for proximal femoral fractures.

The Long Gamma Nail is a specialised development of the original Gamma Locking Nail allowing surgeons to extend the benefits of the highly successful standard implant for trochanteric fractures. It has been designed to treat subtrochanteric, ipsilateral neck and shaft fractures as well as for prophylactic use.

The OMEGA PLUS Compression Hip Screw System integrates innovative features such as sideplate made of superstrong alloy material and improved instrumentation. OMEGA PLUS Plates and Lag Screws are available in Sterile or Non-Sterile packaging for customer preference and convenience.

This new generation of Cannulated Screws has been designed to optimise surgical outcomes while simplifying procedures. The ASNIS III System offers the surgeon a complete choice of implants, material and packaging combined with a new user-friendly instrumentation.

This innovative device has been developed for Femoral Neck Fracture and Slipped Capital Femoral Epiphysis treatments. The Hansson Pin System is a simple and precise instrumentation combined with a unique implant. This unthreaded pin with a spreading hook allows a strong and stable fixation through a simple and short procedure, thus preserving the blood supply and the bone integrity.