

INTERLOCKING HUMERUS NAIL

Surgical Technique



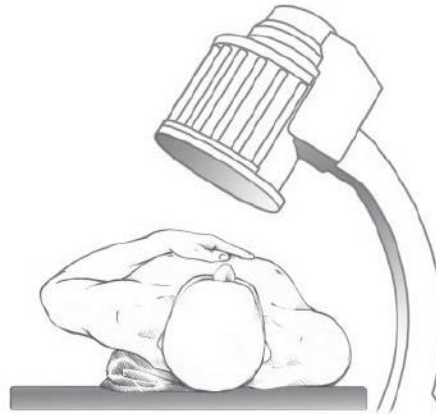
Antegrade Nail Insertion—Opening the Proximal Humerus

1

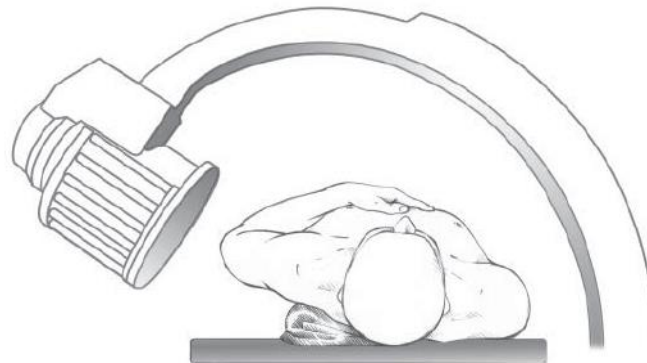
Position patient

- Position the patient in a modified lateral position on a completely radiolucent OR table. Position the C-arm to enable visualization of the entire humerus in the AP and lateral planes. Place the C-arm opposite the surgeon, perpendicular to the longitudinal axis of the humeral shaft in the AP view.

Obtain a scapular “Y” lateral view by bringing the C-arm through a 90° arc and projecting the beam directly at the glenoid.



C-arm in position for AP view.



C-arm in position for scapular “Y” lateral view.



Scapular “Y” lateral view.

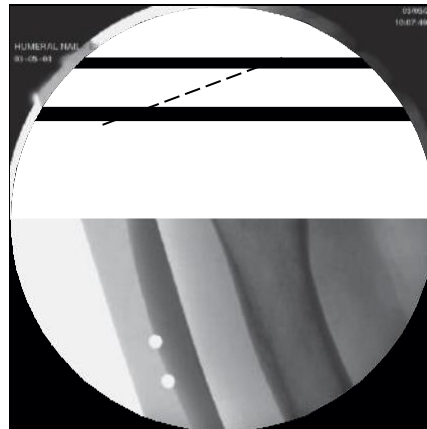
2 Confirm nail length

- If a Titanium Cannulated Humeral Nail–EX is indicated during preoperative planning, position the C-arm to view the proximal humerus. When measuring the fractured humerus, apply gentle traction to restore length.

With long forceps, hold the radiographic ruler along the humerus, with the top approximately 1 cm distal to the superior edge of the articular surface. Mark the skin at the top of the ruler.

- Move the C-arm to the distal humerus. Take an AP or lateral image of the distal humerus. Verify fracture reduction.

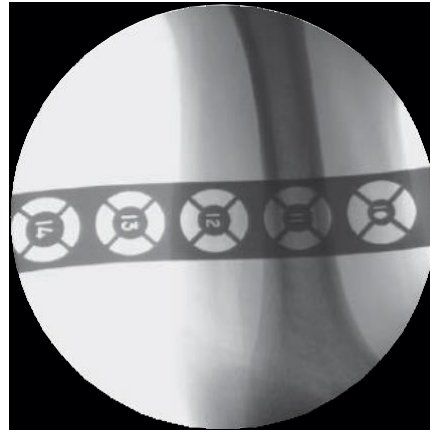
Place the proximal end of the ruler at the skin mark. Read the nail length directly from the ruler image, selecting the measurement that is at least 2.5 cm proximal to the superior edge of the olecranon fossa.



3

Confirm nail diameter

- 1 Position the C-arm and hold the radiographic canal width estimator over the humerus with the diameter gauge centered over the narrowest part of the medullary canal that will contain the nail. Read the diameter measurement on the circular indicator that fills the canal.



5 Insert guide wire

- The insertion point is in line with the medullary canal in the lateral view and at the margin of the articular surface in the AP view. Verify the entry site, incise the supraspinatus longitudinally, and tag the margins with sutures. These sutures will help retract the edges of the supraspinatus during the procedure and assist in reapproximating the supraspinatus during final closure.

Insert another 2.5 mm K-wire through the insertion site and into the medullary canal to the level of the lesser tuberosity.



6 Open canal

Instruments

Threaded Bolt With Sleeve

Cannulated Awl

Drill Bit 3.2 mm X 8

Pass the 10.0 mm cannulated drill bit over the guide wire and through the 10.0 mm protection sleeve to the bone. Drill to the depth of the medullary canal.

Precaution: Take care not to plunge the drill bit into the fracture site since this may displace the fracture.

Remove the drill bit and guide wire.

Dispose of the guide wire. Do not reuse.

Optionally, the 10.0 mm cannulated awl may be used to open the canal or expand the opening created by the drill bit. Place the awl over the guide wire and to the bone. Use a twisting motion to advance the awl.

Precaution: As with the drill bit, take care not to plunge the awl into the fracture site since this may displace the fracture.



Antegrade Nail Insertion—Inserting the Nail

1

Assemble insertion instruments

Orient the insertion handle laterally and match the geometry of the handle to the nail. Pass the cannulated connecting screw through the insertion handle and into the nail. Secure using the 11 mm combination wrench.

Tighten the cannulated connecting screw using the 11 mm combination wrench.

Align the nail to the insertion handle and the cannulated connecting screw.



2 Insert nail

- Under image intensification, verify fracture reduction and insert the nail as far as possible by hand. Use the nail as a reduction tool while keeping the patient's elbow steady to counter any distraction forces.

Insert the nail until the proximal end is slightly below the superior surface of the proximal humerus. The nail may be overinserted up to 15 mm, and nail length can be extended with an end cap.

Do not leave the nail proud as this may cause impingement of the rotator cuff.

- View nail insertion under image intensification.

Precaution: The nail should not be hammered in since this increases the risk of iatrogenic fissures or fractures at the insertion site.



Proximal Locking—Spiral Blade Locking

1

Confirm fracture reduction

- 1 Confirm fracture reduction with AP and lateral images, keeping the insertion handle oriented laterally.

2

Assemble spiral blade insertion instruments

Instruments

Guide Wire 1.8 mm X 30" Long

Attach the spiral blade aiming arm to the insertion handle. Assemble the 14.0 mm/8.0 mm drill sleeve, 8.0 mm/2.0 mm wire guide and 2.0 mm trocar. Pass the assembly through the hole marked "SPIRAL BLADE" in the spiral blade aiming arm. Create a lateral incision adjacent to the tip of the trocar and bluntly spread the fibers of the deltoid. Bring the sleeves into contact with the bone.

Precaution: Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.



Proximal Locking—Standard Locking

1

Confirm fracture reduction

- Confirm fracture reduction with AP and lateral images, keeping the insertion handle and aiming arm oriented laterally. Standard proximal locking can be accomplished by locking through the proximal locking hole, and optionally, the superior end of the proximal slot.

Place the arm in neutral rotation to minimize tension on the axillary nerve.

2

Drill

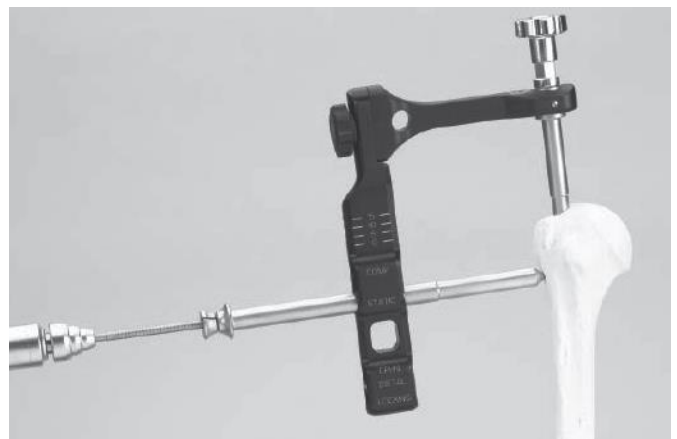
Instruments

Drill Sleeve 2.7 mm / 3.2 mm



Attach the standard aiming arm to the insertion handle.

To lock through the transverse locking hole, insert the 12.0 mm/8.0 mm protection sleeve, 8.0 mm/3.2 mm drill sleeve and 3.2 mm trocar through the hole in the standard aiming arm marked "STATIC." Dimple the skin with the trocar tip. Slightly retract the trocar assembly to permit skin incision. Dissect carefully to the bone, to avoid injury to the surrounding neurovascular structures and soft tissue. Advance the trocar assembly to the bone. Remove the trocar



Precaution: Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.

Drill through the lateral cortex with the calibrated 3.2 mm three-fluted drill bit. Monitor drill bit insertion radiographically, since the position of the drill bit tip directly represents locking screw tip position in the bone. This locking screw may be

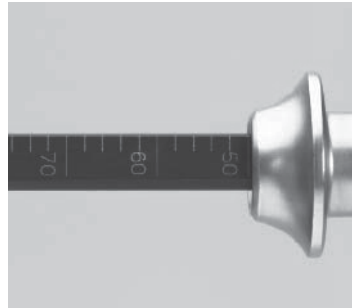
bicortical or unicortical depending upon its placement relative to the articular surface. Careful attention is important to prevent neurovascular injury.

Read the locking screw length directly from the drill bit at the back of the drill sleeve. Press the drill sleeve firmly to the cortex to avoid measurement errors.

Alternatively, for bicortical screws, use the depth gauge for locking screws. Remove the scaled probe portion from its outer housing and remove the drill sleeve from the protection sleeve. Insert the scaled probe through the protection sleeve so that the hook of the depth gauge grasps the far cortex of the bone. Read the scale against the edge of the protection sleeve to determine the appropriate locking screw length.

In order to pass the hook through the protection sleeve, the sleeve of the depth gauge must be removed.

Precaution: Avoid deep perforation as this might cause radial nerve injury.



3

Insert locking screw

Instruments

323.35 Screw Driver 3.5 X 200 mm

Insert the appropriate length 4.0 mm titanium locking screw through the protection sleeve using the T25 StarDrive Screwdriver. A second transverse locking screw may be inserted through the superior end of the slot by repeating this procedure through the hole in the standard aiming arm marked "COMP."



1

Open humerus and insert nail using standard technique

Precaution: Ensure that the nail is not left proud after compression because this may cause impingement.



2

Insert distal locking screws

Determine locking screw length and insert one or two 4.0 mm titanium locking screws through the nail tip using technique of choice.



Distal Locking—Freehand Locking

1

Confirm fracture reduction

- 1 Confirm fracture reduction with AP and lateral images.

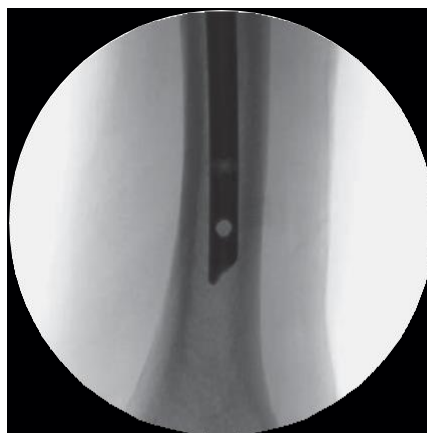
2

Align image

- 2 Align the C-arm with the hole in the nail until a perfect circle is visible in the center of the screen.



Oblique hole — incorrect



Round hole — correct

3

Determine incision point

Identify the center of the hole to mark the incision point and make a stab incision. Dissect the soft tissues to create a clear view of the bone. Use spreaders or retractors to avoid injury to neurovascular structures.

Precaution: Only incise the skin and then perform blunt dissection down to the bone to avoid injuring the brachial artery or median nerve.

4

Center drill bit in locking hole

Instruments

Drill Bit 3.2 mm X 8"



- Under image intensification, insert the tip of the 3.2 mm three-fluted drill bit or 3.2 mm three-fluted drill bit for radiolucent drive through the incision and onto the bone. Keep the drill bit oblique to the x-ray beam until the tip is centered in the locking hole. Be sure to use a sharp drill bit to prevent slippage and ensure accuracy.

5
Drill

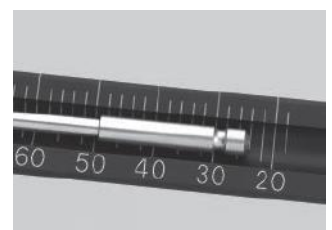
- Tilt the drill until the drill bit is in line with the beam and centered in the outer ring. The drill bit will nearly fill the locking hole image. Hold the drill firmly in this position and drill through both cortices. Monitor drill bit insertion radiographically, as the position of the drill bit tip directly represents locking screw position in the bone.

Note: For greater drill bit control, discontinue power after perforating the near cortex. Manually guide the drill bit through the nail before resuming power to drill the far cortex.



6
Measure

Leaving the drill bit in place, detach the drill. Place the direct measuring device against the drill bit, with the tip of the direct measuring device against the bone. Read the graduation against the end of the drill bit to determine locking screw length.



6. Measure continued

Instrument

Depth Gauge T & F

Alternatively, use the depth gauge for locking screws by removing the drill bit and inserting the scaled probe to grasp the far cortex of the bone with the hook. Read the scale against the edge of the outer housing to determine locking screw length.



7

Insert locking screw

Instruments

323.45 Screw Driver 4.5 X 200 mm

323.35 Screw Driver 3.5 X 200 mm

Insert the appropriate length 4.0 mm titanium locking screw using the T25 StarDrive Screwdriver and holding sleeve with locking device.

Verify locking screw length under image intensification. If needed, a second distal locking screw may be inserted using the same technique.



End Cap Insertion

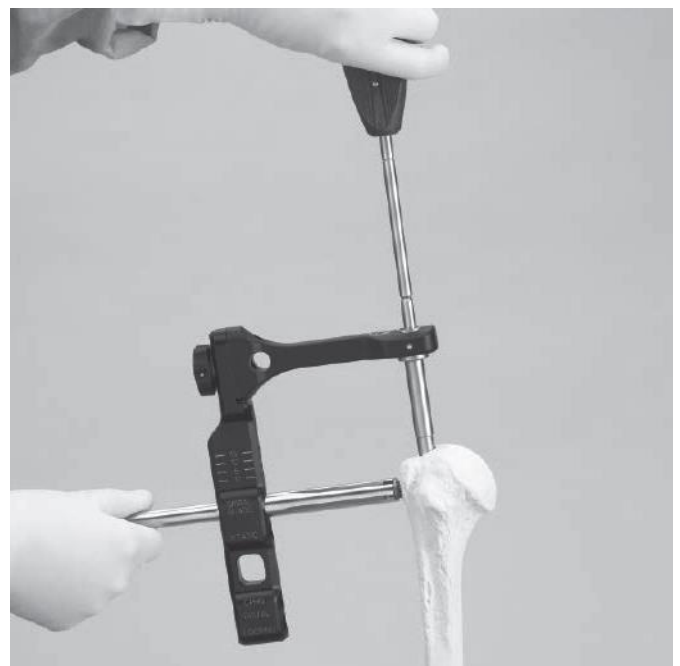
Use of an end cap is recommended if bony ingrowth into the proximal end of the nail is of concern, or if the nail has been overinserted.

Precaution: When locking with a spiral blade, an end cap must always be inserted into the nail; otherwise the spiral blade will not be properly secured.

End caps are available with 0 mm, 5 mm, 10 mm and 15 mm extensions and have detented threads that will provide some resistance upon insertion

For 0 mm end cap

If the nail has not been overinserted, use an end cap with 0 mm extension. Align the end cap with the nail axis to prevent cross-threading. Fully seat the end cap using the T25 StarDrive Screwdriver. The 0 mm extension end cap can be inserted through the insertion handle for additional control. If a spiral blade has been used, keep the spiral blade insertion assembly attached to the spiral blade, to help maintain alignment. Carefully remove the connecting screw from the nail.



Implant Removal

1

Remove end cap

Use the T25 StarDrive Screwdriver to remove the end cap.



2

Remove spiral blade

Instruments

Round Hammer

Small Hammer Unit

Connect the spiral blade inserter and spiral blade connecting screw to the spiral blade. Manually turn the spiral blade inserter counterclockwise, removing the spiral blade.

If resistance is encountered, the spiral blade connecting screw may be used alone. Use light, controlled blows of the slide/fixed hammer to remove the spiral blade.



3

Remove locking screws

Instruments

Cannulated Connecting Screw

323.45 Screw Driver 4.5 X 200 mm

Threaded Bolt With Sleeve

Precaution: Always mount the connecting screw prior to the removal of the screws. This will prevent the nail from rotating in the medullary canal.

Use the T25 StarDrive Screwdriver and the holding sleeve with locking device to remove the locking screws.

Note: Care should be taken to partially disassemble and distract the holding sleeve with locking device during cleaning before placing it in the graphic case for sterilization.



4

Remove nail

Instruments

Round Hammer

Small Hammer Unit

Remove the nail.

If resistance is encountered, thread the hammer guide onto the end of the connecting screw and use light, controlled blows of the slide/fixed hammer to remove the nail.





Address: G/551, Metoda, Lodhika G. I. D. C.,
Kalawad Road, Gate No. 3, Rajkot – 360021,
Gujarat, India.

Tele/fax No.: +91-2827-287538 / +91-2827-287541

Fax No.: +91-2827-287541

E – Mail: bombayortho@gmail.com