Uniflex Humeral Nail Surgical Technique
The Uniflex® Humeral Nail System was developed in conjunction with Ralph B. Blasier, M.D., Chief of Orthopaedics, Grace Hospital, Detroit, Michigan. This brochure is presented to demonstrate the surgical technique utilized by Ralph B. Blasier, M.D. Biomet, as the manufacturer of this device, does not practice medicine and does not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs only implant procedure is responsible for determining and utilizing the appropriate techniques for implanting the prosthesis in each individual patient. Biomet is not responsible for selection of the appropriate surgical technique to be utilized for an individual patient.
Pre-Operative Planning

PATIENT POSITIONING

To predict the correct diameter and length of nail required, take A/P and lateral X-rays of the fractured humerus. When possible, take comparison films of the uninjured arm. Nail size can be approximated by measuring the medullary canal diameter and length on preoperative radiographs.

The correctly sized nail will extend from the level of the top of the greater tuberosity of the humerus to the level where the medullary canal tapers to a point above the flare of the humerus (this level is typically 2.5cm proximal to the olecranon fossa on the A/P radiograph).

The canal must be reamed .5mm over the diameter of the nail to be inserted. The upper 7cm must be reamed to 11mm to accommodate the larger diameter proximal end of the nail. The Uniflex Humeral Nail System can be used to manage fractures from the surgical neck of the humerus to a point approximately 6cm above the end of the medullary canal.

The distal end of the nail accepts two cross-locking screws, and both should be used whenever possible. The proximal end of the nail has two holes M/L and two holes A/P to accept up to four locking screws and it is recommended to use at least two screws, proximally.

It is possible, in cases of comminuted fracture of the upper humerus, that the four alternative screw placement sites could be used to capture and fix fragments, but this depends on the skill and experience of the surgeon and the nature of the fracture.
Surgical Exposure

The skin incision starts at the AC joint and proceeds distally and anterolaterally, to the deltoid fibers [Figure 1]. The deltoid fibers are split in-line, exposing the underlying supraspinous muscle [Figure 2]. A small longitudinal split is created in the insertion of the supraspinous muscle [Figure 3].
Step 1

Canal Reaming

A 1/4" step drill is used to perforate the upper humerus [Figure 4].

With fluoroscopic guidance, the ball tip guide wire is passed across the fracture to the end of the medullary canal. Use of the Guide Pin Hand Grip attached to the Ball Tip Guide Wire may prevent unnecessary bending of the wire [Figure 5].

The canal must be reamed to at least 9.5mm for a 9mm nail. In comminuted fractures, extra care must be taken not to ream the soft tissues. If there is any suspicion that the radial nerve is involved in the fracture, consideration must be given to exposing the fracture and exploring the nerve. Ream the upper 7cm to 11 mm to accommodate the larger diameter proximal end of the nail. Exchange the ball tip guide for a 3.2mm nail driving guide, using the 6.3mm medullary alignment tube [Figure 6].

A second nail driving guide wire of the same length is used to measure the length of the medullary canal [Figure 7].
Step 2

Outrigger Assembly

The driver bolt is passed through the driver bushing and is attached to the nail. The tang must engage in the nail end [Figure 8]. The driver bolt locks the driver bushing to the nail. The target arm engages the driver handle [Figure 9]. The driver handle locks the target arm to the driver bushing. NOTE: For placing the proximal screws, the target arm can be placed laterally or anteriorly [Figure 10].
Step 3

Nail Insertion

After fracture reduction and reaming, the nail may be inserted over the nail driving guide wire or may be inserted without the nail driving guide wire [Figure 11].

In almost all cases, distal locking screws should be placed before the proximal screws. With the target arm in the lateral position, the distal target engages the target arm. The thumb screw end in the target guide must engage the hole on the target arm. Place the distal target with the lateral side lateral. Tighten the thumb screw with the hex T-wrench [Figure 12].

On the distal target, the holes for the drill guides are numbered corresponding to the nail length in centimeters. Please note that the drill guides straddle the appropriate number (the illustration shown here is for a 26cm nail) [Figure 13].

Multiple small stab incisions are not recommended for placement of the distal locking screws. Use an incision of at least 4cm (more in case of obesity). The radial nerve transits from the posterior to the anterior compartment above the recommended level for the distal screws, so the distal drills and screws fall behind the nerve. To be sure, (1) keep the distal screws exactly in the medial/lateral plane, and (2) gently sweep all soft tissue off the bone with an elevator, moving from back toward the front [Figure 14].
Step 4

Distal Screw Insertion

With fluoroscopic control, the 3.6mm drill is used to perforate the lateral humeral cortex, pass through the nail and perforate the medial humeral cortex. Having drilled one hole successfully, leave that drill in place and drill the second [Figure 15].

IMPORTANT NOTE ON DISTAL TARGETING:

Due to normal bending forces while inserting the nail into the humerus, the distal holes in the nail may not always align with the guide tubes. This may be especially true with the longer length nails. To correct any bending of the nail or spring in the distal target, the following technique may be used. The surgeon should insert his finger along side the guide tube, anterior and posterior, to determine that the guide tube is centered over the humerus.

NOTE: To verify that the drill has entered the distal hole in the nail, a guide pin can be inserted down the center of the nail. If the drill has passed through the nail, the guide pin will stop against the drill. This can be confirmed by measuring the amount of the guide pin inside the nail at the drill bit junction.

After removing the drill bushing, the depth gauge is used to measure the length of screw needed [Figure 16]. After the distal screws are inserted, remove the distal target [Figure 17].
Distal Screw Insertion

When the proximal lateral-to-medial screws are used, the target arm is set in the lateral position. The bushings are placed in the "L" positions on the proximal target. When the anterior-to-posterior screws are used, the target arm is set in the anterior (Right or Left) position. The bushings are placed in the "A" positions on the proximal target. For most fractures, only the two M/L screws are needed. For high fractures, it may be desirable to use the two highest screws, one M/L and one A/P. For some fractures, the A/P screws may be situated as to capture and fix a fracture fragment, such as a lesser-tuberosity fragment [Figure 18]. For soft bone, 3 or 4 screws can be used. The normal drill diameter for the locking screws is 3.6mm. If the bone of the upper humerus is believed to be particularly soft, a 3.2mm drill may be used for the upper screw to provide a tighter "bite."

After removing the drill bushing, the depth gauge is used to measure the length of screw needed. The upper M/L screw should be unicortical to avoid the joint, staying 6mm or more from the joint surface. For most typically-sized patients, a 38mm screw will be about right. The lower M/L screw is bicortical [Figure 19].

After the proximal screws are inserted, remove the instrument [Figure 20].

Note: A 3.2mm diameter drill bit (Part No. 472368) may be used for drilling the most proximal screw hole for a better screw purchase in the bone.
**Step 6**

**End Cap Placement**
The end cap may be threaded into the upper end of the nail to prevent fibrous ingrowth. This will facilitate subsequent removal [Figure 21].

**Nail Removal**
If nail removal is desired, locking screws are removed with a screwdriver and the nail extractor adaptor is threaded through the top of the nail and attached to the slap hammer for removal [Figure 22].

**Postoperative Care**
Postoperatively, the patient may be placed in a simple arm sling for comfort. Active range of motion exercises may begin at four to seven days.