

TOTAL ELBOW ARTHROPLASTY PROCEDURE

ARTICLE BY LORI BANITT, CST

The total elbow arthroplasty procedure's primary goal is to attain pain relief in those patients afflicted with rheumatoid arthritis and degenerative arthritis involving the elbow. This procedure is particularly useful in circumstances of extensive bone loss or gross instability due to trauma or revision surgery.

In those patients with both shoulder and elbow pathology, the most severely involved joint should be done first. When involvement is comparable, it is recommended the shoulder replacement should be performed first.

Contraindications include any condition of prior joint infection or osteomyelitis. Total joint replacement should also not be considered in anyone anticipating heavy labor or competitive sports.

Development of Prosthesis

Experience with total elbow arthroplasty in the early 1970s consisted of coupled articulations with rigid hinges and metal on metal articulations. The Coonrad-Morrey total elbow device has developed in three stages over the last 20 years. When the device was first released in 1973, it was a constrained hinged elbow joint. The prosthesis was changed to a semiconstrained device in 1978 with a 7-degree hinge laxity in varus and valgus. The device underwent further modification in 1981 by Bernard F. Morrey, MD, with the addition of an anterior flange on the humeral component and a porous coating on the distal humerus and proximal ulnar components.

The prosthesis is manufactured from titanium alloy by Zimmer (Warsaw, Indiana). The hinge assembly consists of a metallic pin and high-density polyethylene bushings to prevent metal debris. The implant is available in 4-, 6-, and 8-inch humeral lengths with standard and small sizes matching the ulnar components 4-inch length. When both shoulder and elbow replacement is to be performed, the 4-inch implant should be used.

Patient Preparation

The patient is brought to the operating room and placed supine on the operating room table. The patient is then anesthetized and a nonsterile tourniquet is placed as high as possible on the operative extremity. The operative extremity is then hung, with a stockinette tied around the hand, to allow the extremity to be prepped for 10 minutes from the

wrist to the tourniquet cuff. Draping begins by wrapping the hand in an impervious towel and rolling a stockinette over the hand to the tourniquet cuff. Two split sheets are placed around the extremity, one facing inferior and the other facing superior as close to the tourniquet as possible. Sterile sheets are used to cover the remaining surface area of the individual. The stockinette is cut near the incision site and the arm is placed across the individual's chest.

Surgical Technique

A straight incision is made centered just lateral to the medial epicondyle and just medial to the tip of olecranon (Figure 1). The medial aspect of the triceps muscle is identified and the ulnar nerve is isolated using a bipolar cautery and protected by nerve tape.

An incision is made over the medial aspect of the proximal ulna and the ulnar periosteum is elevated along with the forearm fascia. The medial aspect of the triceps is then retracted along with the posterior capsule. The triceps is removed from the proximal ulna by releasing Sharpey's fibers from their insertion. The extensor mechanism is further reflected laterally including the anconeus, allowing complete exposure of the distal humerus, proximal ulna, and the radial head. The entire extensor mechanism is subluxed laterally.

Humeral Preparation

The tip of the olecranon is removed. After the ulna and radius have been rotated out of the way, the midportion of the trochlea is removed to allow the medullary canal of the humerus to be identified (Figure 2). The medullary canal of the humerus is identified with a twist reamer (Figure 3). The humeral alignment stem is placed down the canal (Figure

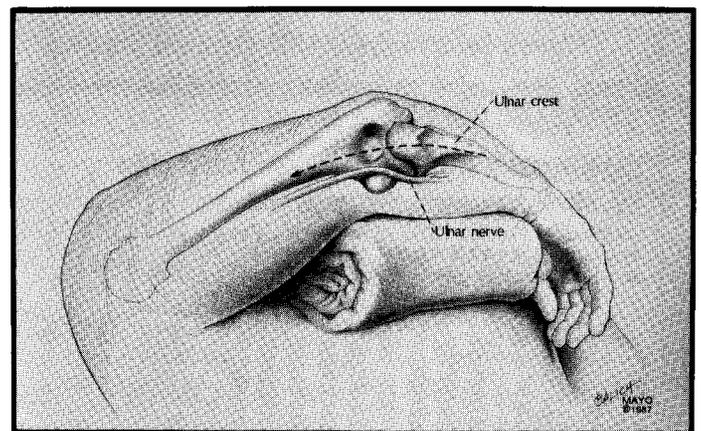


Figure 1. A straight incision is made.

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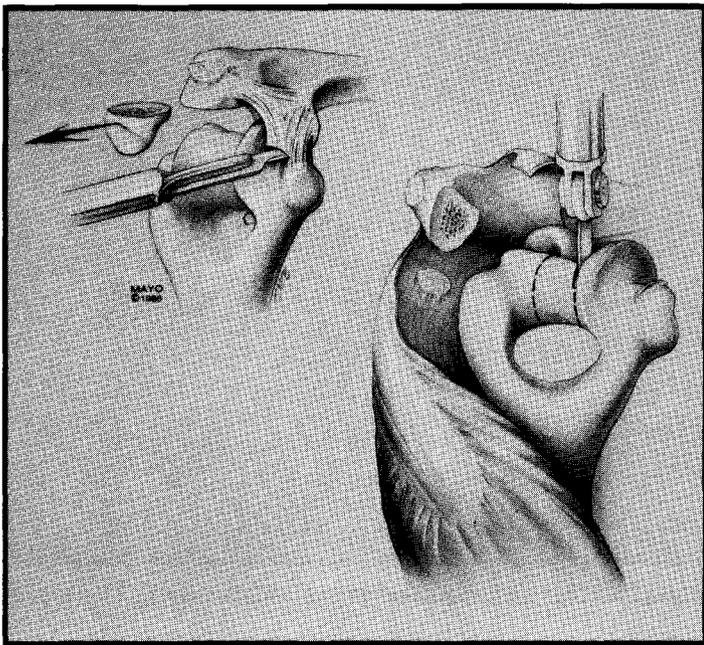


Figure 2. The midportion of the trochlea is removed.

4). The handle is removed and a cutting block is attached, which allows accurate removal of the articular surface of the distal humerus.

The side arm of the cutting block is attached to the radial side and rests on the capitellum in order to provide the appropriate depth of cut (Figure 5). With an oscillating saw, the trochlea is removed according to the dimensions of the humeral component. The humerus is further prepared by serially rasping the humerus in such as to receive the appropriate size humeral component (Figure 6).

Ulnar Preparation

The medullary canal of the ulna is identified by using a high speed burr. The tip of the olecranon is removed or notched to allow a shortened Rush rod reamer to be introduced

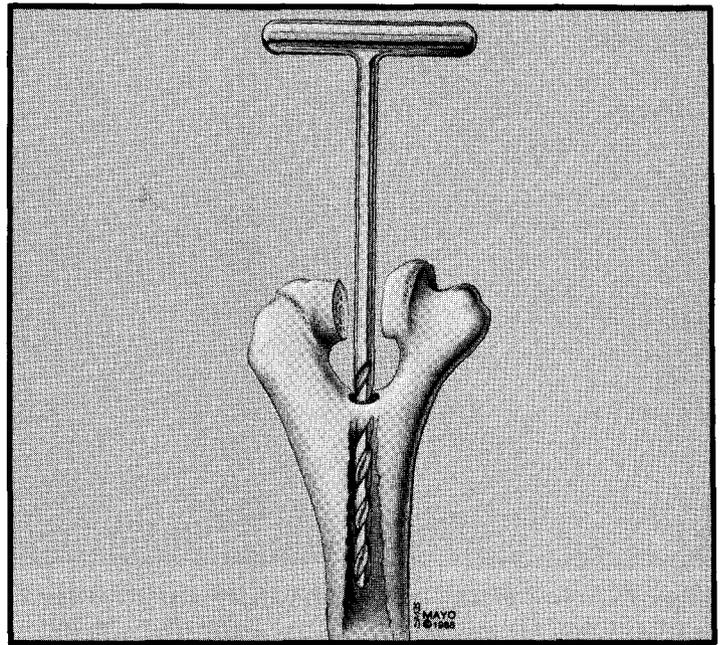


Figure 3. The medullary canal of the humerus is identified.

down the medullary canal (Figure 7). The appropriate size ulnar rasp is then used. A mallet is sometimes required to seat the rasp in the ulnar canal (Figure 8).

Cementing Prosthetic Components

The medullary canals of both bones are cleansed with a pulsating antibiotic lavage irrigation system and dried. A piece of flexible tubing 7/32 inch (I.D.) is cut to the appropriate humeral length and inserted through the orifice of the injection cartridge to provide a flexible cement delivery system (Figure 9).

It is recommended that the ulnar and humeral components be cemented separately. One gram of antibiotic powder is combined with one full package of cement; vacuum mixing is not recommended. Because of high resistance, the cement should be injected early in the polymeri-

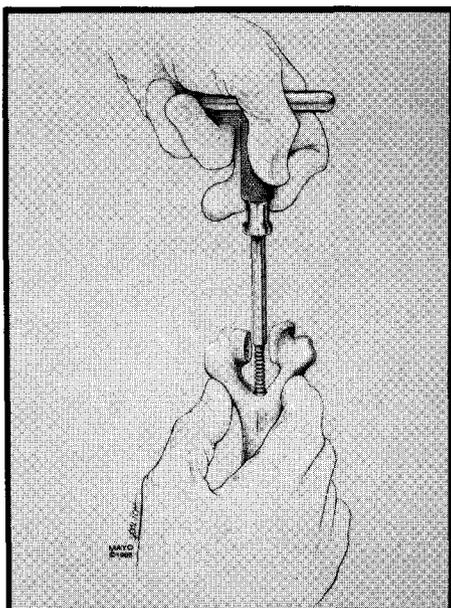


Figure 4. The humeral alignment stem is placed down the canal.

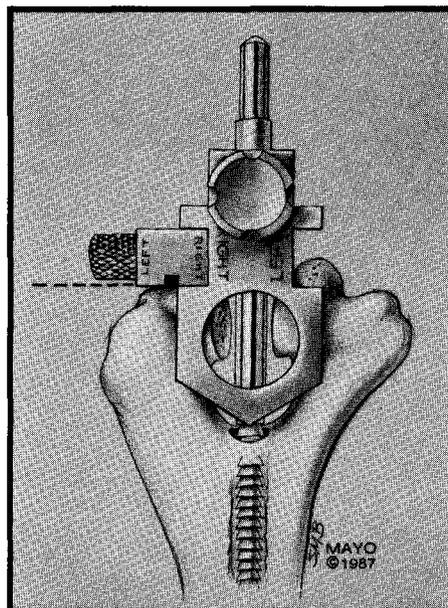


Figure 5. The side arm of the cutting block is attached to the radial side.

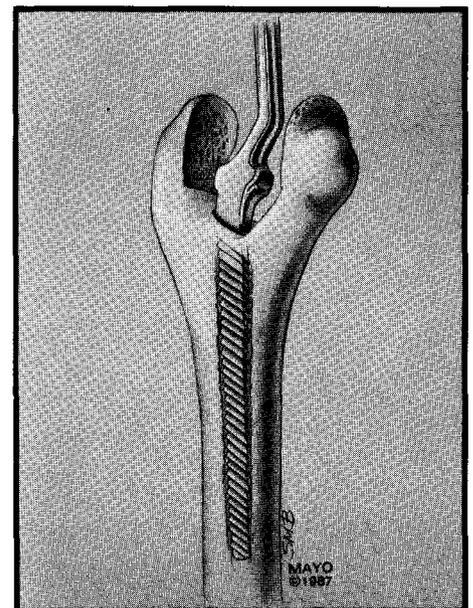


Figure 6. The humerus is serially rasped.

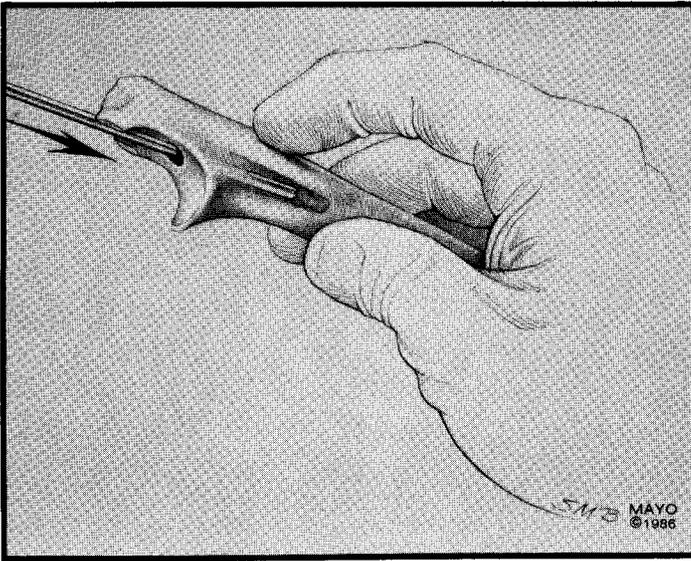


Figure 7. The tip of the olecranon is partially removed and a Rush rod ream is inserted.

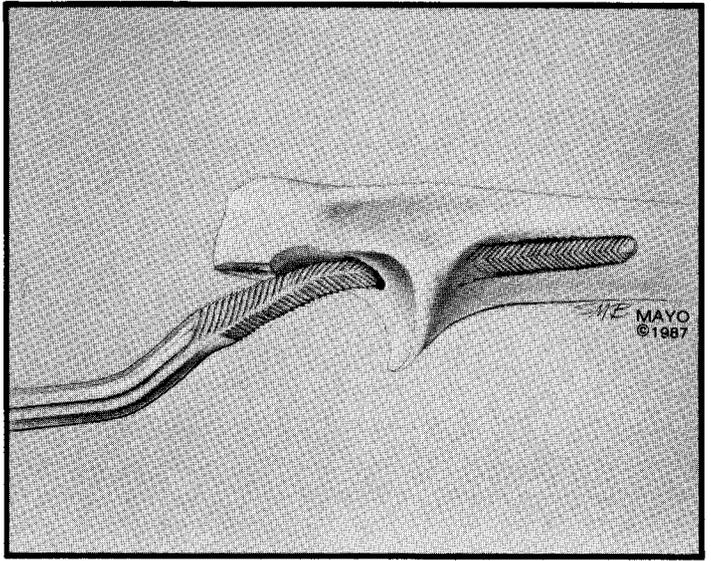


Figure 8. The rasp is seated in the ulnar canal.

zation process. The ulnar component is inserted first as far distally as the coronoid process.

After the cement has hardened and excess has been removed from around the ulnar component, cement is introduced down the medullary canal of the humerus (Figure 10).

Bone Graft Preparation

A bone graft has been previously prepared from the excised trochlea or from the iliac crest for revision surgery. The graft should measure 2 to 3 mm in thickness and be about 1.5 cm in length and 1 cm in width. The bone graft is placed anterior to the anterior cortex of the distal humerus. The humeral component is then inserted down the canal to a point that allows both articulation of the device and where the bone graft is partially covered by the flange (Figure 11).

Assembly and Impaction

The ulnar component is articulated with the humeral component by placing the pin articulation through the humerus and ulna and securing it with a split-locking ring (Figure 12). After the prosthesis has been coupled, the humeral component is impacted down the medullary canal (Figure 13).

Closure

The tourniquet is deflated and hemostasis is obtained. One drain is left deep to the fascial layers. The wound is closed with the triceps being returned to its anatomic position. Nonabsorbable sutures are placed through drill holes in the proximal ulna (Figure 14). An absorbable subcuticular running suture and staples to the skin complete the closure. A compressive dressing is applied with the elbow in full

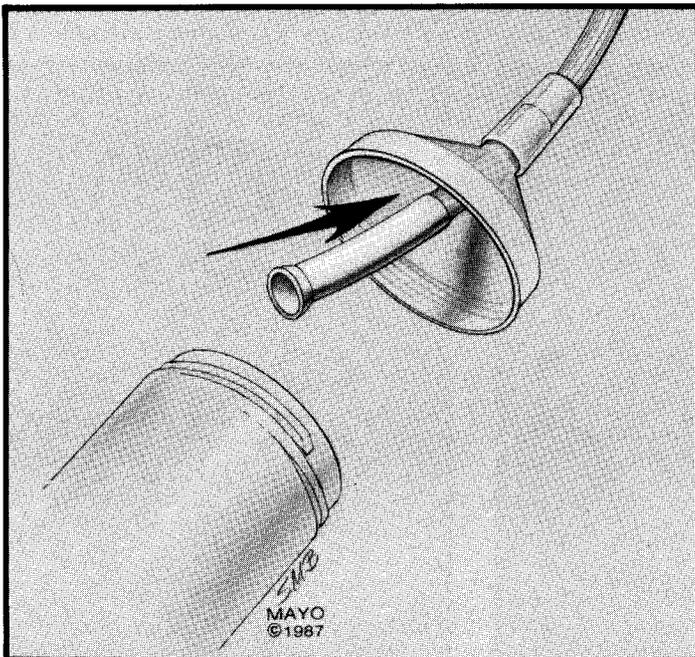


Figure 9. A piece of flexible tubing is inserted through the orifice of the injection cartridge.

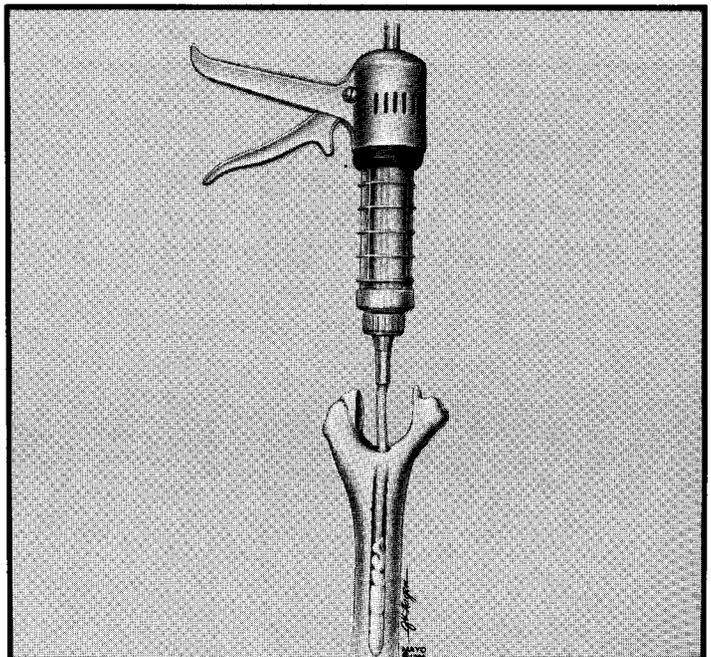


Figure 10. Cement is introduced down the medullary canal of the humerus.

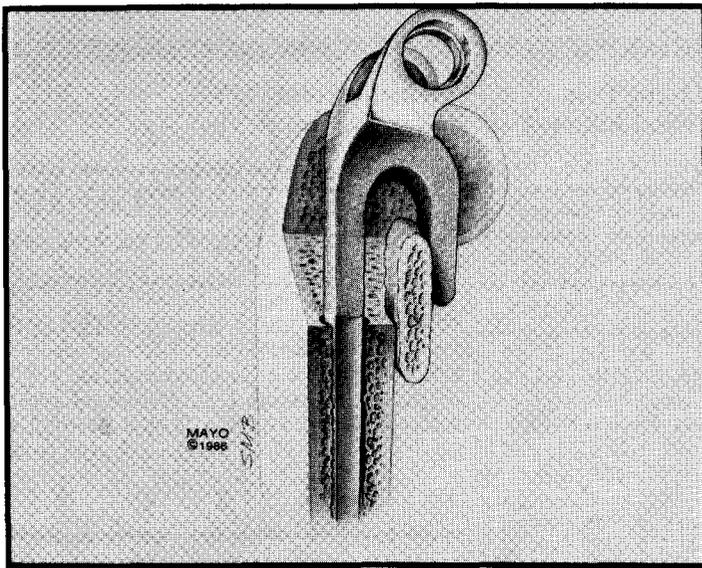


Figure 11. The humeral component is inserted down the canal.

extension or flexion at 90 degrees based on the surgeon's preference.

Postoperative Care

The arm is elevated and iced postoperatively for 2 to 3 days with the elbow above shoulder level. The drain is removed at 24 hours and the compressive dressing removed at 48 hours postoperatively. A light dressing is applied and elbow flexion and extension is allowed, as tolerated. The patient is instructed to begin activities of daily living (ADLs). No formal physical therapy is generally required or indicated. Strength exercises are avoided. The patient is advised never to lift more than 10 pounds with the operated arm. □

Acknowledgments

The author wishes to extend her appreciation to B.F. Mor-

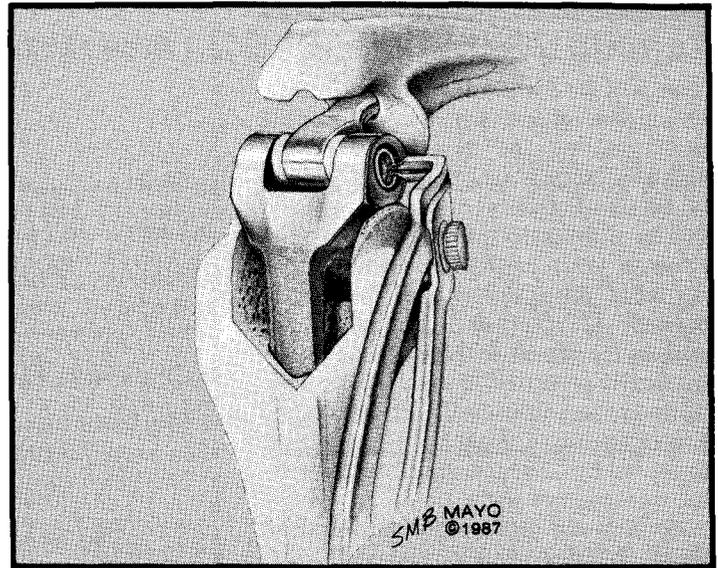


Figure 12. The ulnar component is articulated with the humeral component.

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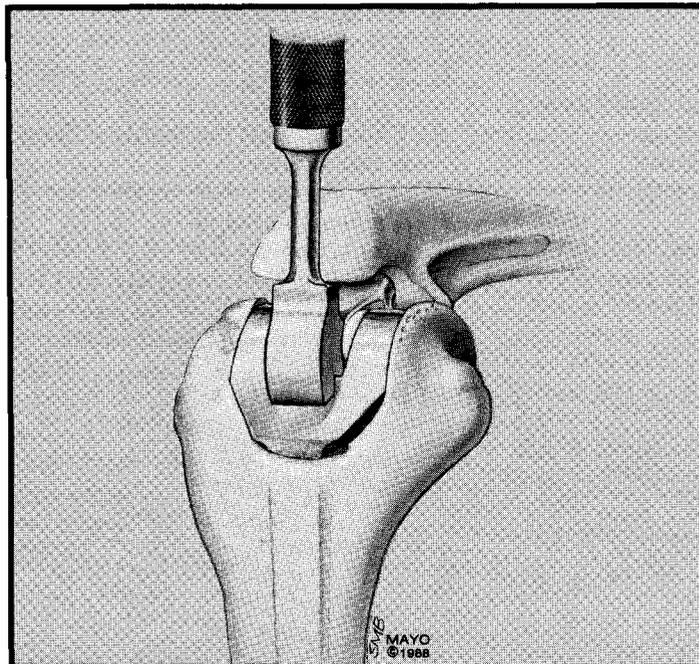


Figure 13. The humeral component is impacted down the medullary canal.

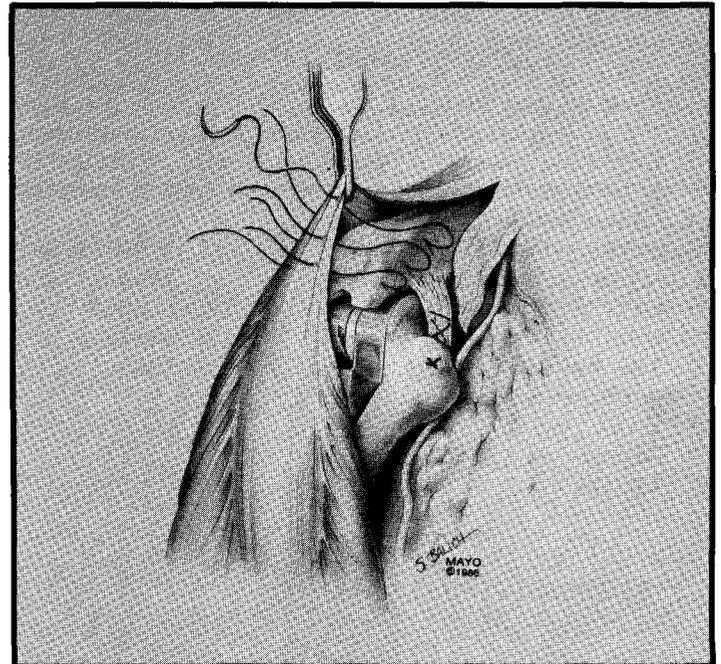


Figure 14. Nonabsorbable sutures are placed through the drill holes.