MIS meets CAOS
Less and Minimally Invasive Surgery
for Joint Arthroplasty: Fact & Fiction
Scottsdale, Arizona
October 26-28, 2006

Tissue-Preserving Total Hip Arthroplasty Using a Superior Capsulotomy: Preparing the Femur First

Stephen B. Murphy, Timo M. Ecker
and Moritz Tannast

Center for Computer Assisted and Reconstructive Surgery
New England Baptist Hospital
Tufts University School of Medicine,
Boston, MA

Introduction

Various methods of performing total hip arthroplasty have been proposed recently which typically have the principal aim of accelerating recovery. In particular, attempting to prepare and implant a femoral component with inadequate exposure and with insufficient protection of the abductor musculature can lead to increased incidences of both intraoperative femur fracture and abductor injury[1-5]. To address these issues, a method of performing total hip arthroplasty through an incision in the superior capsule of the hip joint was developed[7,8]. The capsular incision in placed just posterior to the gluteus medius and minimus, in the course of the piriformis tendon, anterior to the short rotators and posterior capsule. The femur is prepared before the femoral head is removed. The femur is prepared before the femoral head is removed for a number of reasons:

1. Leverage retractors can be used around the femoral neck and in the head.

2. The femur remains steady during preparation.

3. The femur is probably much more resistant to fracture if the head and neck are attached, as opposed to a femur with a freshly transected femoral neck, where resistance to fracture propogation is poor.

4. The broach can be used as an internal neck resection guide.

5. The femoral neck is transected from the inside-out and the blade is within the femur itself, far away from the skin, reducing the risk of injury to surrounding soft tissues.

The following described the technique of surgery and the clinical results of recovery and complications.

2. Superior Capsulotomy – Indications, Planning and Technique

Introduction

Tissue-Preserving Total Hip Arthroplasty using a Superior Capsulotomy is a technique that allows for implantation of the total hip components under direction vision through a single incision. The technique allows for recovery that is as rapid as a mini-posterior exposure while conferring stability of the hip joint that is equal to other exposures that preserve the posterior hip joint capsule and short external rotators. Our experience (reported below) demonstrates that the technique is actually safer than total hip arthroplasty performed using a direct lateral exposure and results in a significantly more rapid recovery.

The technique is best learned by observing the surgery 1st hand and then performing the surgery on cadaveric specimens. Surgeons who perform the miniposterior exposure can transition to the superior capsulotomy technique gradually over a number of total hip procedures. Assisting in surgery is also possible and encouraged, but requires obtaining a temporary medical license and temporary hospital privileges, which is a process that can take 3 or more months.

Indications

This technique is indicated for any standard total hip arthroplasty where there is no preexisting hardware, where there is typical amount of space between the acetabular rim and the greater trochanter, and where there is an absence of significant malformation of the hip. Heavy patients can be efficiently treated with the technique. In fact, the difference in difficulty between thin and obese patients is actually less than it is with the miniposterior or direct lateral exposures although initially experience should focus on simpler total hip arthroplasties before the technique is applied to obese patients or patients with prior surgery or more significant deformities.

Preoperative Planning.

Preoperative planning should be performed as usual, with the exception that the placement of the femoral component should be measured in relation to the tip of the greater trochanter rather than in relation to the lesser trochanter.

Patient Positioning

The patient is positioned in the lateral position with the body positioned a little bit toward the anterior side of the table, so that the hip can be maximally adducted (Figure 1).

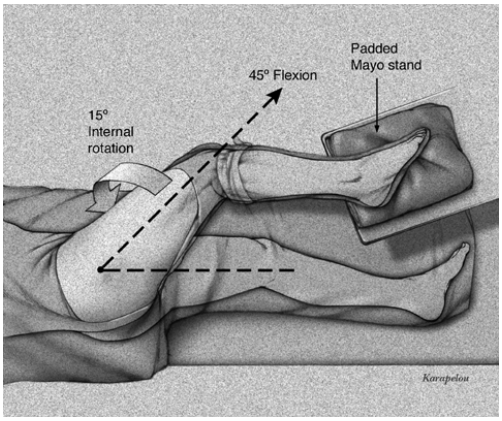


Figure 1

Incision placement

With the hip flexed 45 degrees, the incision is placed starting at the tip of the greater trochanter and extending 8cm proximally, exactly in line with the femoral shaft axis (Figure 2).

Figure 2

Technique of the Exposure

The incision is made to the level of the fascia. The fascia is incised, starting at the tip of the greater trochanter, and extending again in line with the incision. Two wing-tipped elevators are then used to spread the gluteus maximus fibers to expose the bursa tissue overlying the gluteus medius muscle. The very thin later of bursa tissue is then carefully incised just along the posterior border of the gluteus medius.

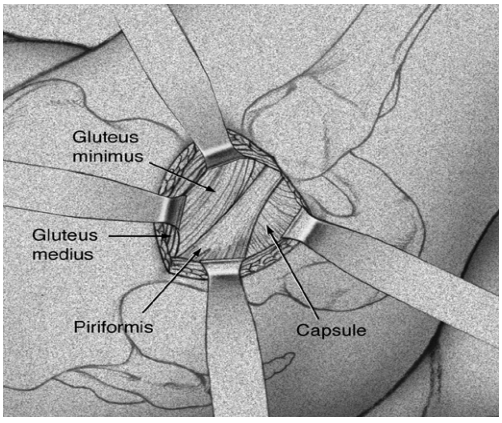


Figure 3

A blunt pull retractor is then placed on the posterior border of the gluteus medius to expose the piriformis tendon and gluteus minimus muscle.

A Cobb elevator is placed underneath the anterior aspect of the piriformis tendon at its insertion on the piriformis fossa. A blunt pull retractor is the placed on the piriformis tendon and pulled inferiorly to move the posterior border of the gluteus medius out of the way, to maximally expose the piriformis tendon as distally as possible. A long-handled knife is then used to transect the piriformis tendon as distal as possible. Take care not to extend the cut into the superior gemellis or obturator internus tendon.

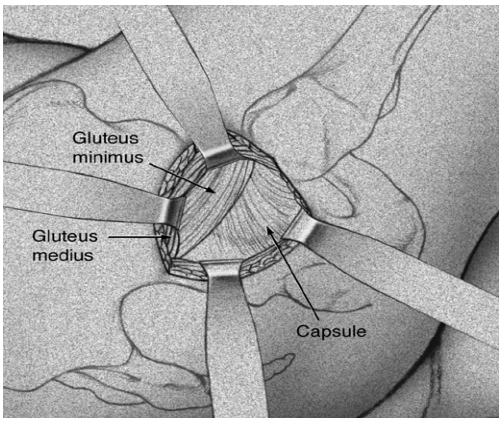


Figure 4

Identify the posterior border of the gluteus minimus and mobilize the muscle from the hip joint capsule from posterior to anterior using a cob elevator for a very small distance, just enough to allow for an incision in the superior capsule (Figure 4).

Sharp dissection with a knife may be necessary at the start. Place a spiked Homan retractor through the anterior capsule into the femoral head to allow anterior retraction of the gluteus medius and minimus. Place another spiked homan retractor through the posterior capsule into the femoral head to retract the transected tendon of the piriformis and the posterior portion of the gluteus maximus.

Make an incision in the superior hip joint capsule from 6 O'clock in the trochanteric fossa to a little posterior of 12 O'clock at the superior acetabular rim. Use a long electrocautery to incise in the trochanteric fossa to prevent bleeding of the anastamosis around the base of the femoral neck. Make a second incision in the capsule along the acetabular rim for a short distance of about 15mm.

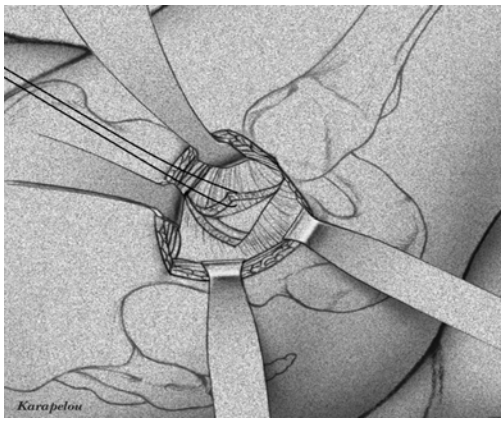


Figure 5

Place a tagging suture at the corner of the capsule (figure 5).

With the capsule now open, place two blunt Homan retractors inside the hip joint capsule around the anterior and posterior femoral neck. Also place two spiked Homan retractors inside the hip joint capsule in the posterosuperior portion of the femoral head and the anterosuperior portion of the femoral head or in the anterior ilium to complete the exposure (figure 6).

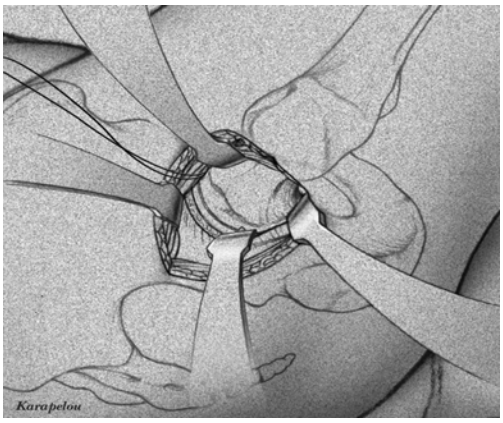
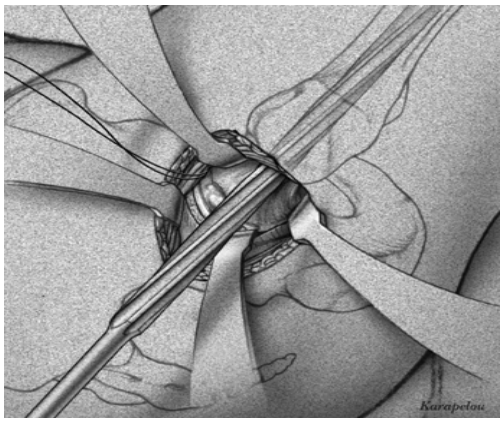


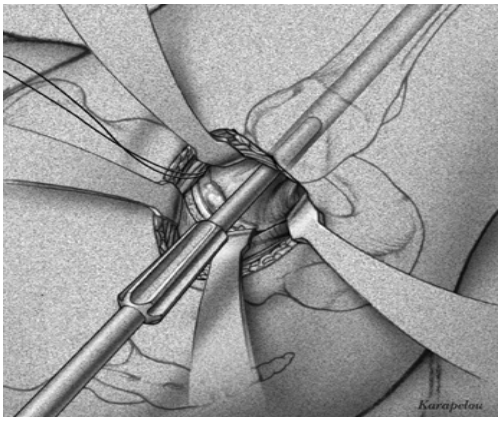
Figure 6

Preparing the femur

Using an end-cutting cylindrical starting reamer, enter the femoral canal through the trochanteric fossa (Figure 7).

Figure 7





Use a conical metaphyseal reamer to expand the proximal opening, ensuring that the subsequent instruments are in proper alignment and not in varus (Figure 8).

Figure 8

Use cylindrical reamers up to proper size if the femoral component requires them. Use an osteotome to open superior neck and lateral portion of the femoral head to allow insertion of femoral broaches (Figure 9).

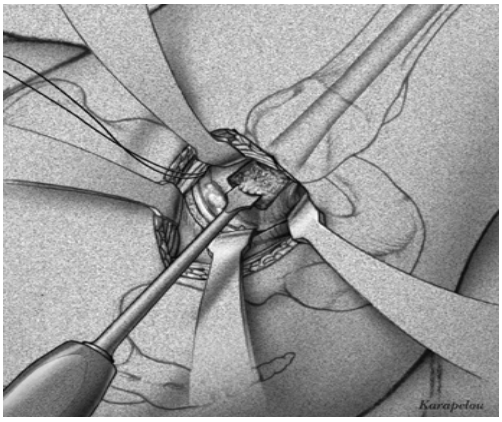
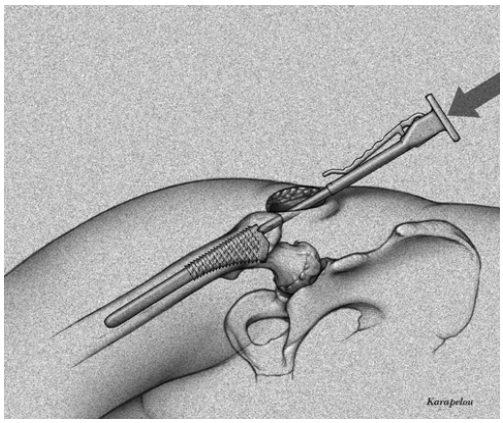


Figure 9



Use broaches up to size and gauge the depth that the shoulder of the broaches are inset below the tip of the greater trochanter. The broach insertion handle may have a ruler etched on it to facilitate this estimation (Figure 10).

Figure 10

This distance is typically 15 to 30mm but varies depending on the anatomy and preoperative leg length discrepancy. Once the final broach is fully seated, remove the broach handle. (Note, it is easiest to remove the final broach and use one size smaller as a neck-cutting guide for the femoral neck osteotomy to place the osteotomy at the optimal level).

<u>Femoral Neck Osteotomy</u>

Estimate the pre-reconstruction leg-length prior to removal of the femoral head. A pin in the pelvis measured to a point on the greater trochanter can be helpful. Use an oscillating saw with a narrow blade to transect the femoral neck, using the top of the broach as a template (Figure 11).

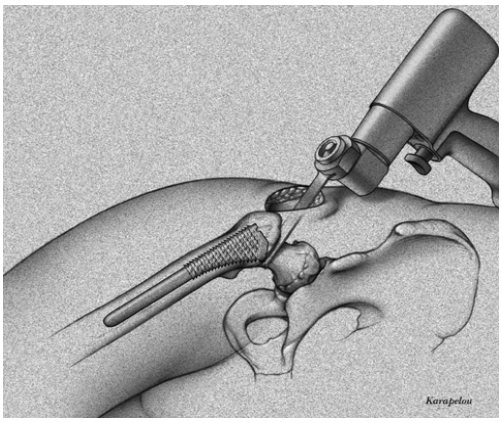


Figure 11

The blunt Homan retractors serve to protect the surrounding tissues. The saw blade can be felt to penetrate the bone much the same way that a cast saw is used when removing a cast. To ensure that the neck has been transected, place a Cobb elevator in the path of the saw blade and lever to ensure that the femoral neck cut has been completed.

Femoral Head Removal

Place a Cobb elevator at the head/socket junction and rotate the head into a little valgus. Place a long shanz screw into a solid part of the head (Figure 12).

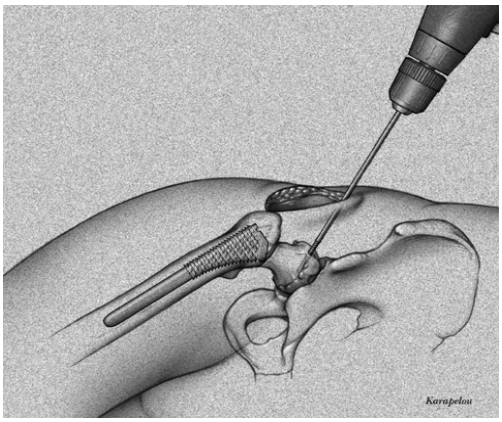


Figure 12

Affix a T-handle chuck to the shanz screw and a slap-hammer to the T-handle chuck. Remove the spiked Homan that is in the posterior/superior portion of the head. Use the shanz screw to rotate the head into valgus which will facilitate subluxation (Figure 13) and the slap-hammer to extract the head.

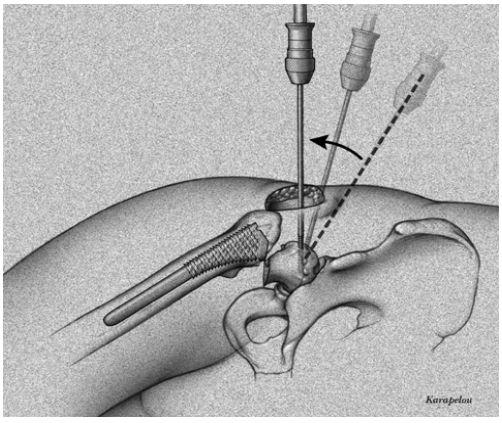
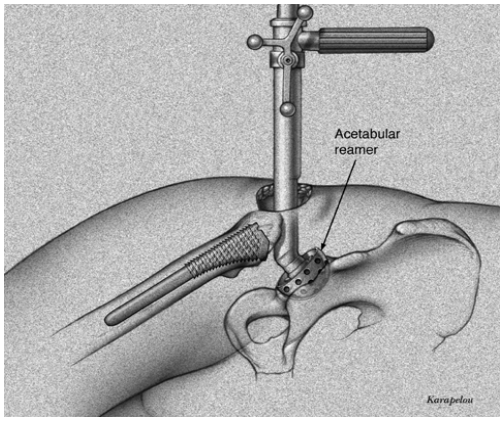


Figure 13

The acetabular exposure is completed by placing two sharp homan retractor into the bone, one anteriorly and one posteriorly, inside of the capsule but peripheral to the labrum. If necessary, a blunt homan retractor can be placed through the capsule anteroinferiorly to assist in mobilizing the femur into an anterior/inferior direction. Remove the non-ossified portions of the labrum.

Acetabular preparation and component insertion

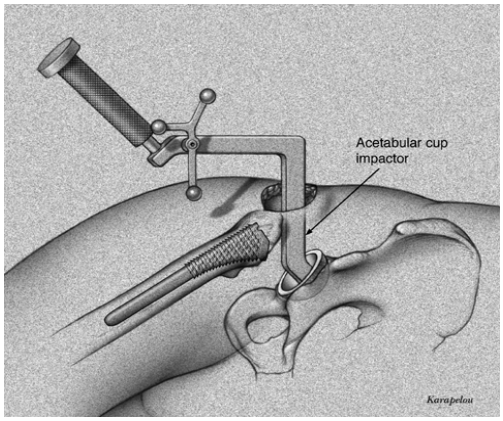


Use the 45 degree angled acetabular reamer handle to ream the socket appropriately (figure 14).

Figure 14

Use the double-angled cup impactor to insert the cup (figure 15).

Figure 15



Trial Reduction

Place a trial liner into the cup. If the femoral neck osteotomy was made with a broach that is one size smaller than planned for, replace it with the final broach. Place the trial head into the socket. Switch to the anterior side of the table and place a large bone hook into the top of the broach trial. The bone hook should be controlled with your hand that is closest to the hip. Cradle the knee and lower leg in your arm that is furthest from the hip. Deliver the femur into position for your assistant to place the trial femoral neck into the broach. Reduce the neck into the trial head by applying traction using the bone hook and controlling position of the leg with your other arm. The hip should be fully stable and undislocatable in any position.

Trial Disassembly and Final Component Insertion

Have your assistant hold the trial head within the socket using a long schnidt and, applying traction using the bone hook, disassemble the trial neck from the trial head. Remove the trial

neck and broach. Insert the real prosthesis. Repeat the trial reduction as necessary. Remove the trial liner and impact the real liner using the double-angled cup impactor. Place the real head within the liner. Insert the real neck into the femoral prosthesis. Reduce the neck into the head.

Closure

Using the tagging suture in the anterior capsule, close the capsule using a running suture from proximal, at the acetabular rim, to distal, toward the trochanteric fossa followed by fascial and superficial layer closure.

Rehabilitation

The patient should be able to progress without restriction of motion. Progress weight bearing according to your confidence in the implant-bone fixation.

THA Performed using Conventional and Navigated Tissue-Preserving Techniques[6]

Stephen B. Murphy, MD; Timo M. Ecker, MD; and Moritz Tannast, MD

Abstract

Less invasive methods of performing total hip arthroplasty have been considered controversial after reports of increased complication rates and component malpositioning. A new method of performing total hip arthroplasty through an incision in the superior capsule, posterior to the abductors and anterior to the posterior capsule, was developed with the aim of producing a technique that had the hip joint stability of the transgluteal exposure and the rapid abductor recovery of the posterior exposure. This study assessed the recovery and complications of this technique, performed with surgical navigation. The study group was compared to a control group of hips of similar complexity performed by conventional total hip arthroplasty, without surgical navigation, using the transgluteal exposure. There were 185 consecutive total hip arthroplasties in the study group and 189 total hip arthroplasties in the control group. The two groups were controlled for complexity and had no differences in body mass index, gender, diagnosis, operative side, bilateral operations, and previous surgeries. Patients were evaluated for clinical recovery and perioperative complications at 9 and 24 weeks. The study

group recovered faster at both followup examinations. The study group had significantly fewer peri- and postoperative complications compared to the control group. Especially the incidence of femoral complications including fracture was very low in the study group (1.1 % versus 3.7 % in the control group) Finally, accuracy of component positioning was not compromised compared to the control group. Less invasive surgery with the philosophy of maximally preserving the abductors, posterior capsule, and short rotators may result in a safer operation with faster recovery than traditional techniques.

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