Introduction

Minimally invasive surgery has the potential for minimizing surgical trauma, pain and recovery. These minimally invasive techniques in total hip replacement include single-incision and two-incision techniques. This chapter describes a minimally invasive hip-replacement procedure performed with two incisions: one incision for acetabular preparation and placement, the other for the femoral preparation and placement. This new minimally invasive technique avoids transecting any muscle or tendon, thereby minimizing morbidity and recovery. Unique instruments have been developed to facilitate this technique. Fluoroscopy aids in many steps in this process to ensure the proper starting points for the incisions and accurate component position and alignment. Standard implants are used to maintain the present expectation for implant durability.

Surgical Technique

A radiolucent operating-room table is used. The patient is placed in the supine position with a small bolster under the ischium on the effected side. The leg and hip are prepped and draped. The fluoroscope is used to define the femoral neck. A metal marker is used to mark the midline of the femoral neck from the junction of the head distally 1.5 inches (Fig. 7.82). An incision is made directly over the femoral neck from the base of the femoral head distally 1.5 inches. The fascia of sartorius is present in the proximal-medial incision whereas the tensor fascia lata lies at the distal-lateral portion of the incision. The sartorius muscle and tensor fascia lata can be seen beneath the fascia. Just medial to the tensor fascia lata, the fascia is incised longitudinally, parallel to the sartorius muscle and tensor fascia lata. This lateral fascial incision avoids the lateral femoral cutaneous nerve, which is located superficial to the sartorius muscle. Sartorius is retracted medially, and tensor fascia lata is retracted laterally, exposing the lateral border of rectus femoris. The medial retractor is repositioned to retract the rectus muscle medially (Fig. 7.83). This exposes the lateral circumflex vessels, which are coagulated with an electrocautery. The fat pad then is retracted medially and laterally exposing the capsule over the femoral neck.

Two curved lit Hohmann retractors (part of the minimally invasive two-incision instruments [Zimmer, Warsaw, IN]) are placed extra-capsularly around the femoral neck, illuminating the capsule. The capsule is incised in line with the femoral neck. This incision is made from...
Chapter 7.8: Minimally Invasive Total Hip Arthroplasty Using the Two-Incision Approach

Fig. 7.83

Fig. 7.84

Fig. 7.85

the edge of the acetabulum distally to the intertrochanteric line. The capsule can be elevated approximately 1 cm medially and laterally along the intertrochanteric line if additional exposure of the femoral neck and head is needed. The two-curved lit Hohmann retractors are repositioned intra-capsularly to expose the femoral head and neck from the acetabulum to the inter-trochanteric line (Fig. 7.84).

The head is removed in two pieces. The first neck cut is made at the equator of the femoral head with an oscillating saw and a second cut is made 1 cm distal to this (Fig. 7.85). The small 1 cm wafer of bone is removed using a threaded Steinmann pin. Next, a threaded Steinmann pin is placed into the femoral head and the head is removed. If the ligamentum teres is intact, a curved osteotome is used to transect the ligamentum teres. Based upon pre-operative templating, the final femoral neck osteotomy is completed. Appropriate femoral neck resection is confirmed with fluoroscopy or by flexing and externally rotating the hip in a figure-of-four, which exposes the lesser trochanter.

Three curved lit Hohmann retractors are placed around the acetabulum, one anteriorly around acetabulum, a second posteriorly around the acetabulum, and the third directly superiorly over the brim of the acetabulum. This retracts the capsule and allows excellent visualization of the acetabulum (Fig. 7.86). The labrum is excised, exposing the entire peripheral bony rim of the acetabulum.

The superior retractor is removed while the anterior and posterior retractors are left in place. Specially designed, low-profile reamers (part of the minimally invasive two-incision instruments), which are cutout on the sides, are used to ream the acetabulum. These reamers are aggressive with square cutting teeth; therefore, it is possible to start with a reamer that is close in size to the intended final reamer to avoid inserting and extracting many reamers. Furthermore, the open design of these reamers...
allows visualization of the acetabulum during reaming. With gentle traction on the leg, the reamer is inserted in line with the femoral neck, with the cutouts of the reamer aligned with the two retractors. The acetabulum is reamed at 45° of abduction and 20° of anteversion. The fluoroscope is used for visualization as the acetabulum is reamed (Fig. 7.87). The acetabulum is sequentially reamed until a healthy bleeding bed of cancellous bone is present throughout.

A specialized dog-leg acetabular inserter (part of the minimally invasive two-incision instruments) with the supine positioner is used to place the chosen acetabulum shell. The anterior and posterior retractors are left in place, as gentle traction is placed on the leg. The bolster beneath the ischium is removed so that the patient is completely supine. The acetabular component is inserted as the retractors keep the capsule from invaginating. The acetabulum is viewed with the fluoroscope as the cup is positioned in 45° of abduction and 20° of anteversion, following the native acetabulum. The cup is then impacted in place and the inserter is removed (Fig. 7.88). With the curved lit acetabular retractor in place around the acetabulum, the stability of the shell is assessed. Two supplemental screws are placed in the posterosuperior quadrant of the shell. Finally, a small-curved osteotome is used to remove any osteophytes around the rim of the acetabulum and the polyethylene liner is impacted into the shell. All retractors are removed from the acetabulum and attention is turned to the femur.

The leg is adducted fully and placed in neutral rotation. A 1- to 1.5-inch incision is made in the posterior lateral buttocks, co-linear with the piriformis fossa allowing access to the femoral canal. A Charnley awl is guided through the posterior incision, posterior to the abductors and anterior to the piriformis fossa down the femoral canal. Fluoroscopy can aid this starting point
and can be used to visualize the leg in a frog lateral position to ensure this is well centralized anteriorly and posteriorly. Specially designed lateralization side-cutting reamers (part of the minimally invasive two-incision instruments) are used to enlarge this starting hole and position the starting point laterally against the trochanteric bed. These lateralization reamers are used sequentially through the posterior incision within the same track as the Charnley awl (Fig. 7.89). Flexible reamers are used to ream the canal until cortical chatter is obtained. Straight reamers with a tissue-protecting sleeve then are used to ream the femoral diaphysis until good cortical chatter is obtained.

After reaming to the appropriate size, broaching is done. With visualization though the anterior wound, the rasp is rotationally aligned to the calcar. The rasp is fully seated. Rasps then are sequentially introduced and seated, finishing with appropriate size (Fig. 7.90). When the final rasp is seated, care must be taken to visualize the rotation of the rasp in the anterior wound to ensure alignment with the metaphysis.

A trial reduction may be performed. The trial neck and head are placed on the broach from the anterior wound. The hip is then put through a range of motion to assess stability. The hip should be stable in full extension with 90° of external rotation and 90° of flexion with 20° of adduction and at least 50° of internal rotation. The fluoroscope can be used to assess leg lengths by comparing the level of the lesser trochanters with the obturator foramen. In addition, with the patient in the supine position, the medial malleoli may be checked to assess leg length. When the trial reduction is complete, the head and neck are removed through the anterior incision and the broach is removed through the posterior incision.

Two Hohmann retractors are placed into the posterior wound, one anterior to the femoral neck and one posterior to the femoral neck. These retract the soft tissue as the stem is placed into the femoral canal. The stem then is introduced into the femoral canal from the posterior incision and impacted into place (Fig. 7.91). Visualization through the anterior incision ensures no soft-tissue entrapment between the calcar and the collar and assures correct stem version.

With the actual component in place, repeat trial reduction is performed, placing the head from the anterior incision. The hip should be stable and leg lengths equal. With the hip in external rotation and the bone hook around the neck, the real head is then placed on
the neck and gently impacted in place. The hip is located with gentle traction and internal rotation. The capsule is then closed. The fascia between the sartorius and the tensor fascia lata is closed, followed by closure of the anterior and posterior incisions. Two 2x2 inch bandages are used to cover the incisions (Fig. 7.92). Figure 7.93 demonstrates the pre-operative and post-operative radiographs of this case example.

**Conclusions**

Minimally invasive surgery has the potential to minimize surgical trauma and pain while improving functional recovery in patients having total hip replacement. The minimally invasive two-incision total hip technique described here, where no muscle or tendon is cut, shows substantial short-term pain and functional improvement over traditional hip replacement. In fact, in the last 100 patients done at Rush Hospital with this procedure, all surgeries have been performed as an outpatient. Furthermore, unique instruments and fluoroscopic assistance enabled accurate component position and alignment. While this minimally invasive two-incision technique shows great promise, this technique requires meticulous surgical technique, specialized instrumentation, and special instruction. As such, preclinical exercises, anatomy laboratories, cadaver training, and proctoring programs are strongly recommended for surgeons interested in this new technique to minimize complications and ensure the success of this new procedure.