INTRODUCTION

Minimal incision surgery (MIS) total hip replacement is gaining popularity due to theoretical and demonstrated advantages over more conventional and extensile surgical approaches. Advantages of MIS techniques include less postoperative pain, less blood loss, quicker and easier rehabilitation with shorter hospital stays, and smaller more cosmetic surgical incisions. Several competing approaches and surgical strategies have evolved, each with advantages and disadvantages. This paper will discuss these issues and describe the author’s preferred single incision posterior surgical approach in detail.

At least some mention of possible disadvantages inherent to all MIS techniques should be made. First and foremost, all advantages to MIS are realized in the early rehabilitation period, and no long-term benefits have been described. Thus, the physician needs to take care that any MIS technique employed does nothing to compromise the excellent long-term result of what has been a spectacularly successful procedure. Possible MIS disadvantages relate to complications associated with compromised surgical exposure. Compromised acetabular exposure can lead to component malposition and a higher dislocation rate. Compromised femoral exposure can lead to an undersized and thus loose component, to an oversized component risking fracture, and to inaccurate neck length assessment leading to leg length inequality. Damage to the skin and soft tissue envelope during overzealous retracting through small incisions can lead to an increased risk of infection. Compromised surgical exposure in general can lead the inexperienced surgeon into any number of other technical misadventures.

That having been said, many surgeons feel minimizing the surgical dissection can be safely and reliably accomplished in a reproducible fashion providing for the patient a quicker and easier recovery, thus improving on what has become one of the most successful operative procedures developed over the last several decades.

SURGICAL APPROACHES

Three minimal incision surgical approaches have been commonly described. These include the “two-incision technique”, the anterior approach, and the single-incision posterior approach.

MIS “TWO-INCISION” & ANTERIOR APPROACHES

THE TWO-INCISION TECHNIQUE

The “two-incision” technique has received quite a bit of press, both in the orthopaedic literature and unfortunately in the lay press. Advantages include its truly minimal nature, reported quick recovery time and short hospital visits. However there are several serious disadvantages limiting its applicability. First, this is a difficult technique with a demonstrated steep learning curve. X-ray exposure for the patient and staff is required. Accurate femoral component sizing due to the percutaneous nature of the exposure is difficult. Subtle component under sizing can lead to microscopic motion and loosening. Over sizing or incorrect anteversion can lead to femoral fracture and leg length inequality due to incomplete component seating. There is no easy intra-operative bailout to a more extensile approach if problems are encountered. Patient selection and applicability is very limited. There is great
concern that this technique, while offering some short-term advantages to a few selected patients, will result overall in an increase in the complication rate of total hip replacement surgery. Any MIS technique considered needs to reliably and reproducibly match the excellent safety record and long-term successfulness of more conventional approaches. It is here that the two-incision technique falls short.

ANTERIOR APPROACH

The anterior approach has the single theoretical advantage of more complete acetabular exposure. Its disadvantages relative to the posterior approach include lack of surgeon familiarity. Many feel the anterior approach is inherently a more difficult surgical exposure. Blood loss is often greater. Access to the femur is difficult, and there is an increased risk of ectopic bone formation. Prolonged postoperative limp has also been reported. For these reasons the anterior approach has not been popular in recent years in either MIS or more extensile exposures.

MIS SINGLE INCISION POSTERIOR APPROACH

ADVANTAGES / DISADVANTAGES

The posterior single-incision MIS approach has several advantages over other surgical techniques. First, it is the most familiar and commonly performed surgical approach to the hip. Many feel it is also the easiest and simplest approach as well. The posterior approach is extensile, so that if “bailout” of MIS is required, it can be easily accomplished. In addition, it is not an “all or none” approach. The surgeon can sneak up on the approach by gradually shortening the skin incision while progressively minimizing the deeper dissection. These features shorten the learning curve and help avoid operative complications. It assists in fulfilling the “do no harm” surgical creed.

In addition, the surgical approach principles are applicable to all patients. In large patients it is necessary to extend the skin incision, but once the dissection is carried down to the external rotators, the dissection remains the same in all patients, large or small.

Theoretical disadvantages include somewhat more difficult acetabular exposure, which can lead to asymmetrical acetabular reaming, component malpositioning, and the potential for dislocation. With experience, though, advocates of this approach believe these problems can reliably be overcome.

SURGICAL TECHNIQUE:

The patient is turned in the lateral position with the affected hip up. The importance of proper positioning cannot be over emphasized as it will affect accuracy of later acetabular component positioning and ability to properly expose the femur. The use of the pegboard as opposed to the beanbag greatly facilitates this positioning. The pegboard can more reliably hold even large patients rigidly in position, and its lower profile nature allows for greater adduction of the thigh during femoral canal exposure so as to avoid the need for extending the skin incision posteriorly.

SKIN INCISION: Planning and placing the skin incision is critical to posterior approach MIS surgery. It first involves mapping the greater trochanter position. A line is drawn through the greater trochanter along the longitudinal axis of the femur. Next, the most posterior superior point of the greater trochanter is located and marked. The skin incision will pass through this point at a 30 degree angle to the longitudinal axis line. The incision is 7 centimeters long, with
4 centimeters extending proximally from the posterior superior greater trochanteric point and 3 centimeters distally along the above-mentioned 30 degree angle to the longitudinal axis. Improper placement of the skin incision will not adversely impact the ultimate result of the hip replacement. However, if not strategically located, a more extensile approach (longer incision) will be necessary for proper exposure.

**DEEP DISSECTION:** Once the skin incision has been carried out, the deep gluteus and iliotibial band fascia is divided in line with the skin incision. The leg is then internally rotated 30 degrees and the foot propped on a padded, sterile OR table. Fat covering the external rotators is swept away. The sciatic nerve is not exposed, but is gently retracted. Using the cautery devise, the external rotators and the underlying posterior capsule are divided from the piriformis tendon proximally to the quadratus distally, sparing the quadratus muscle along the femoral neck. Make sure the proximal extent of the capsular cut extends to the rim of the acetabular bone and cuts through the labrum. With a Hohman type retractor passing over the anterior femoral neck, make a second capsular cut at a 30 degree angle to the first posterior cut by angling it proximally and anteriorly towards the one o’clock acetabular position. Again, make sure this cut extends through the labrum. It is these two capsular and labral cuts that allows for easy hip dislocation through this limited incision.

**HIP DISLOCATION:** The hip can now be easily posteriorly dislocated with little force by rotating the leg internally 90 degrees. A young patient with a hypertrophied ligamentum flavum may require its division for complete dislocation to occur. A sharp pointed Hohman retractor should now be driven into the most superior part of the femoral head. This will prevent the head from subluxing back into the acetabulum after the femoral neck has been osteotomized (a somewhat frustrating event when working through a small incision). The lesser trochanter is palpated, and the femoral neck is cut. There is a tendency to make the femoral neck cut too proximal due to diminished neck exposure. If this occurs, acetabular exposure will be more difficult due to the excessively long remaining femoral neck, and if not later corrected, can lead to leg length inequality problems. Once the neck is osteotomized, the head can be removed from the wound with use of the Hohman proximally and a bone hook into the neck cut distally.

**ACETABULAR PREPARATION:** Retractors are placed around the acetabulum. Usually three or four are sufficient placed inferiorly at six o’clock, posteriorly into or at the level of the ischium, and anterior/superior at one o’clock. Specially designed acetabular retractors that are bent so that the hands of the assistants are out of the immediate operative field can be useful. Once placed, the leg can be rested on the sterile, padded OR table in about 30 degrees of internal rotation. Capsulectomy is performed as necessary for exposure of the acetabulum. The inferior transverse acetabular ligament usually makes the acetabular opening phimotic, and its removal facilitates exposure. Removal of soft-tissue remnants from the bottom of the fovea allows for best judgment of acetabular depth preparation. To minimize postoperative pain, anterior capsular dissection should be minimized. It is observed that complete anterior capsulectomy is associated with greater immediate postoperative groin pain, and its removal should only be performed as necessary for proper exposure. If possible, leave the anterior capsule intact. Operative findings that necessitate anterior capsular division or excision include a contracted hip making mobilization of the femur difficult, the presence of large anterior osteophytes that might result in impingement and thus require removal, larger patients in whom the exposure is inherently more difficult, or any other anatomical conditions that compromise acetabular exposure.
Once exposed, the acetabulum is ready for reaming. With the limited exposure of MIS, the soft tissues and femur can lever the reamer and produce asymmetric posterior over reaming. To keep the acetabulum concentric, care must be taken to prevent this. Special curved reamers can help, but often cause chatter during reaming creating a slightly oversized hemisphere, which can affect implant stability. The depth of reaming should be measured via the visualized fovea floor. Positioning of the component during acetabular implantation is crucial. Watch anatomic landmarks to make sure the implant matches the acetabular rim. Posterior over hanging bone may simply mean that the implant is deeply seated into the acetabular depths or that posterior osteophytes are present. But significant bony overhang posteriorly can also be an anatomic indicator of insufficient acetabular anteversion. Again, rigid patient positioning in the lateral position can help avoid mistakes during acetabular implantation.

Special mention must be made of protecting the skin during acetabular preparation. Inserting sharp reamers, leaning reamers into the skin during use, and actual component insertion itself can abrade the skin if not protected. It is preferable to extend the incision than to injure the skin. It is the major barrier and defense against later infection and wound problems. MIS reamers have been developed that have less than hemispherical teeth or are less than hemispherical in construct to help protect the skin, but their use can sometimes make reaming “feel” different and affect acetabular preparation.

**FEMORAL PREPARATION:** To expose the femur, the leg is flexed so that the femur is in line with the skin incision direction (30 degree angle to the longitudinal patient axis). The femur is internally rotated 90 degrees. The leg is adducted maximally popping the femur up into the wound (aided by the low-profile pegboard and proper preoperative positioning). A specially made retractor placed posteriorly behind and under the femoral neck can aid in exposing the femoral canal while protecting the quadratus. If unavailable a Hohman retractor will suffice. A scoop-type retractor should be placed under the femoral canal (under the anterior surface of the 90 degree internally rotated hip). This will also help deliver the femur up into the wound and simultaneously help protect the skin. A Hohman retractor can then be punched through the abductors at the tip of the greater trochanter, thus holding the abductors out of harms way. Evaluation of the available exposure should be carried out. If inadequate for protection of the skin during femoral preparation from sharp reamers and rasps, the skin incision should be extended in a proximal direction as necessary. The femur can now be prepared in the standard fashion. Care must be taken to lateralize the canal. With the diminished exposure of MIS techniques, it is relatively easy to rasp and ream in varus. Box cutters, trochanteric reamer, and careful observation of rasp placement can help avoid this problem. The MIS single-incision posterior approach does not limit the surgeon’s choice of implant type or fixation method. It is amenable to either cementless or cemented techniques. If cementless surgery is chosen, a taper-fit design is the simplest to implant (Biomet’s Taperloc and BiMetric stems are examples of this type of stem). This style stem can be placed deep into the femoral canal before becoming engaged, making rotational control and full seating easier and more predictable. A canal-fill design with extensive porous coating or supplementary distal fixation features (such as flutes) where the implant is engaged into the femoral canal bone stock early in its seating can be more difficult to insert. With these implants, anteversion is set early during insertion and full seating may not be achieved. During insertion of a taper-fit stem, one must take care not to impact the implant too vigorously so as to prevent femoral fracture (these implants act as a wedge and require light tapping for complete seating only).
TRIAL REDUCTION: During trial reduction, leg length equality and hip stability should be carefully assessed. As previously mentioned, potential pitfalls of the diminished exposure of MIS posterior approach surgery are inadequate acetabular anteversion creating posterior instability and an excessively long residual femoral neck creating an over lengthening of the leg. If aware, however, the surgeon can reliably avoid these troubles.

CONCLUSION

In conclusion, MIS total hip replacement surgery offers advantages to the patient of less postoperative pain, less blood loss, quicker and easier recovery, and the improved cosmesis of a shorter incision. The single-incision posterior approach offers advantages over the two-incision technique and anterior approach. Arguably its single biggest advantage is the ability of the surgeon to gradually incorporate this approach into his/her surgical strategy by progressively shortening the incision, minimizing the deep dissection, and extending the incision intra-operatively as necessary to avoid the complications of a learning curve. If aware, potential pitfalls can be avoided and this approach can be reliably performed and its principals applied to all to the benefit of patients undergoing THR surgery.