Introduction

It is widely reported that the growth in minimally invasive surgery (MIS) of the hip has been driven by patient demand. Whilst there is certainly now truth in this assertion, a fundamental question is: how did the public become aware that this type of surgery is possible and how have they been convinced that MIS surgery is desirable? MIS surgery has been marketed by implant companies directly to patients for commercial advantage before there is yet scientific evidence that it confers any clinical advantage. MIS surgery has not yet been conclusively shown by randomized prospective studies to confer any of the clinical benefits reported in the marketing brochures and on commercial Web sites. Multi-center randomized, prospective studies are ongoing and initial results are expected soon. It will then become clearer which of the surgical approaches confer any type of short-term benefit; conversely it may be shown that some of the MIS techniques adopted are associated with unacceptably high complication rates. Only in the longer term will it become clear if any short-term benefit to the patient (if proven) is to become overshadowed by compromised function of the joint in later years.

Orthopedic surgeons should not lose sight of the fact that the indication for re-operation in over 70% of patients requiring further surgery after their index arthroplasty is mechanical loosening of the prosthesis [1]. It will therefore take much longer to show that the long-term result for patients is not compromised by the use of some of the new techniques. RSA studies [2] could be used to prove or disprove the thesis that some MIS approaches may compromise initial mechanical stability of implants, but studies of this type were not carried out before these techniques were popularized by their advocates and no information of this sort is available.

We should, therefore, conclusively and scientifically prove the benefits of each approach to MIS surgery before employing them on a large numbers of patients. This proof should ideally be sought through randomized prospective studies. A step-wise approach to the introduction of techniques of this sort, akin to that advocated for new implants, would have been desirable [3].

An advantage of carrying out small-incision surgery through a reduced posterolateral approach in contradiction to, for instance, the two-incision approach, is that the surgical modifications necessary may be practiced to the surgeon’s satisfaction without threatening the end result of surgery for the patient. The size of the incision can then be sequentially reduced as expertise is gained. At any point in a procedure the exposure may be enlarged should circumstances dictate to ensure the best surgical result.

Advantages of the Mini-Posterolateral Approach

Advantages inherent in the minimal posterolateral approach over other mini approaches therefore include:

- It is easily extendable if, at any point, it is felt that the operative procedure is being compromised by lack of exposure.
- The incision length can be progressively reduced as the surgeon gains experience with the technique.
- It is based on an approach with which many surgeons are already familiar, and fluoroscopy is not required.
It requires disruption of only the small external rotators of the hip and preserves the hip abductors. There is no fear of damage to the superior gluteal nerve.

- The acetabulum and femur are exposed through a single incision.
- It is suitable for the insertion of both cemented and uncemented components in the acetabulum and the femur.

Pre-Operative Planning

Pre-operative planning is an essential part of performing total hip replacement through a mini-incision. Particular attention should be paid to the following areas:

- **Patient selection:** We would advise that surgeons should gain initial experience with patients whose build, diagnosis and bony anatomy are conducive to total hip replacement through a less extensive approach. As confidence is gained with the technique more patients will be deemed suitable for the use of a smaller incision.

- **Patient examination:** The patient should be carefully assessed for leg-length discrepancy, pelvic obliquity and fixed deformities to guide patient positioning on the operating table (vid. inf.) and the subsequent surgery.

- **Templating of radiographs:** Pre-operative radiographs should be analyzed using the manufacturers templates or digital templates to determine the correct leg length, center of rotation of the hip joint, femoral offset and the size of prostheses.

Equipment

Although the operation can be performed with difficulty using non-customized instruments, there are definite advantages to using equipment that has been specifically developed to allow exposure of the hip through a smaller incision (Fig. 7.54). These instruments include a range of narrower, longer re retractors and a longer gluteus medius retractor that can retract both muscle and skin edge (Fig. 7.55). Most importantly a range of femoral elevators are desirable that not only allow direct access to the cut section of the femoral neck but also create sufficient space on the anterior aspect of the femur in order that the implant may be inserted in the correct amount of anteversion (Fig. 7.56).

Modified cement accessories are deemed to be essential in order to prevent compromise of the cementing technique. For acetabular cementing, an aspirator-retractor, used in the proximal end of the wound, enhances exposure and helps to promote adequate intru-
sion of cement into trabecular bone whilst minimizing accumulation of blood at the interface (Fig. 7.57). For femoral cementing, smaller sorbothane accessories are required with an extended metal backing plate over the gun nozzle and proximal femoral seal and a handled femoral seal-pusher for use around the femoral neck once the implant has been seated to the correct depth.

**Patient Positioning**

Place the patient on the operating table in the lateral decubitus position. It is helpful to position the patient towards the far side of the operating table since this reduces the chance of impingement of the operated leg on the table, facilitating maximal adduction for subsequent femoral exposure. Ensure also that the opposite leg can be extended so that it does not oppose later adduction of the operated leg.

We advocate the use of supports on both anterior superior iliac spines in combination with a sacral prop for secure and accurate stabilization of the patient on the table (Fig. 7.58). The props should be applied so that the anterior iliac spines are over each other in both vertical and horizontal planes and the degree of pelvic flexion is assessed by palpating the position of the pubis. It should be borne in mind that flexion of the contralateral hip may flex the pelvis, as will obliteration of the normal lumbar lordosis [4]. Additionally, the anterior spine may adduct by 10–15 degrees in the coronal plane.

With strong retraction, sometimes necessary when a mini-incision is used, movement of the pelvis within the soft tissue envelope may lead to malpositioning of the acetabular component unless this movement is identified and corrected for by the orientation of the acetabular introducer. Navigation will reduce the incidence of malpositioning from this cause.

**Operative Technique**

**Skin Incision**

The routine skin incision for a mini-posterolateral approach is sited more posteriorly and obliquely than a standard incision (Fig. 7.59) although it is possible to carry out the procedure through a variety of different orientations of skin incision. The routine incision starts distally over the femur and runs obliquely, passing 2 cm posterior to the tip of the greater trochanter, and continuing proximally a further 5 cm. By convention, the incision should be less then 10 cm in length to be called a “mini-approach” [5].

**Deep Dissection**

The fascia lata is divided in line with the skin incision, extending the fascial incision 1–2 cm proximally and distally to the skin incision splitting the gluteus max-
imus muscle in the line of its fibers. This reveals the pos­
terior aspect of the greater trochanter and the
trochanteric bursa. The latter is incised posterior to the
trochanter and swept back by digital pressure to expose
the short external rotators. The sciatic nerve, which lies
posterior to these tendons can be easily palpated and
need not be exposed. It must be protected at all times
during the procedure. Internal rotation of the hip at this
point will lengthen the short external rotators and the
view is further enhanced by retracting the posterior bor­
der of the gluteus medius in an anterior direction. This
exposes the underlying gluteus minimus tendon and
piriformis, which lies immediately posterior to it. These
two tendons may be separated and a retractor passed
over the femoral neck in the interval between the rota­
tors and gluteus minimus ( Fig. 7.60). Then, keeping
the hip internally rotated, piriformis and obturator
internus with associated gemelli are tagged with stay
sutures and then divided along the posterior aspect of
the greater trochanter thus leaving as long a length of
tendon as possible for later repair. The piriformis ten­
don may be preserved in many cases; it is then retracted
with the medius and minimus tendon. The external
rotators may be raised with the posterior capsule as a
composite flap or the two layers may be raised separate­
ly, but in either case these layers should be firmly
repaired at the end of the procedure. The capsule is fur­
ther split proximally in line with the original direction
of the piriformis tendon and then distally as near to the
trochanteric attachment as possible, and then along the
posterior border of the femoral neck and inferiorly
towards the transverse ligament.

Dislocation and Neck Resection

In most cases the femoral head is now easily dislocated
and the neck sectioned after placement of retractor
around it ( Fig. 7.61). If the head is very large or the hip
is ankylosed then the neck may be sectioned at the cor­
rect level prior to dislocation, a further section of proxi­
mal neck removed, to enhance exposure and then the
head removed piecemeal.
Acetabular Exposure

Exposure of the acetabulum may be achieved by placing the anterior retractor (Fig. 7.62) over the anterior column and retracting the femoral metaphysis anteriorly. This retractor can either be stabilised by an assistant, or secured with a weight and chain. Release of the iliofemoral ligament and the reflected head of rectus femoris by running a knife from anterior to posterior on the ilium just above the superior acetabular rim can dramatically improve access (Fig. 7.63). Incising the inferior capsule further down to the transverse acetabular ligament improves anterior mobilisation of the femur and assists in acetabular exposure. The inferior retractor is placed immediately distal to the transverse acetabular ligament, underneath the cotyloid notch with its tip in the obturator foramen and a weight may be used to hold this retractor in position. At the proximal end of the wound the aspirator-retractor may be hammered in to the wing of the ilium. After defining the plane between the posterior capsule and acetabular labrum, one blade of a self retaining retractor (such as a Norfolk and Norwich retractor) is placed in this interval and the other jaw under the gluteus minimus muscle anteriorly (Fig. 7.64). The acetabulum can now be prepared for either a cemented or uncemented component in a standard fashion. Access to the acetabulum is not usually a problem. However, if it proves difficult to correctly orientate the acetabular reamer then positioning of the aspirator-retractor may be left until the stage of lavaging and cementing the acetabular component. For a cemented implant a trabecular bone bed is prepared wherever possible and multiple drill holes made in the dome and around the rim. The surface is thoroughly lavaged using a powered system and the aspirator-retractor attached to a vacuum. Care is taken with this device not to remove an excessive amount of host blood. Bone graft is routinely placed on the cortical surface of the true medial wall prior to introduction of the cement and prolonged pressurization with a proprietary pressurizer (Fig. 7.65). Using simplex cement at 21°C the pressurizer is usually applied at 3 min after the beginning of
mixing and used until 6–7 min have elapsed after mixing until the viscosity of the cement is rising. A flanged polyethylene socket with its flange accurately trimmed to fit concentrically within the acetabulum is then firmly pushed into place. The lateral “Charnley style” acetabular introducer is ideal to position the acetabular implant since it does not impinge on the femoral neck (Fig. 7.66).

Femoral Exposure

To expose the femur, the acetabular retractors are removed and then the non-operated leg is moved into full extension. This allows the operated leg to be placed in maximum adduction, thus helping deliver the proximal femur into the wound. A range of 3 elevators (straight, right- and left-angled) are available, and use of two elevators will often improve exposure (see Fig. 7.56). The leg is internally rotated and one or more femoral elevators placed under the femoral neck. The forks of the elevator can be placed on either side of the iliopsoas tendon as it inserts into the lesser trochanter, or more proximally. The gluteus medius retractor (Fig. 7.67) is then introduced with the spike rotated around minimus and through the fleshy anterior fibers of medius, to allow direct access to the femoral canal (Fig. 7.68).
The posterolateral corner of the cut femoral neck is opened with a box chisel to allow in-line access to the femoral canal. Taper pin reamers are then used to open the femoral canal. To prevent varus stem placement the canal should be opened posteriorly and laterally into the base of the trochanter if necessary so that the taper pin reamer points to the middle of the popliteal fossa when viewed down its axis (Fig. 7.69).

The femoral canal is then prepared with the rasps. Modular rasps are available and are easier to insert at this stage than the routine monobloc rasps with necks. However, it should be remembered that there must be sufficient space anteriorly for the stem to be inserted in the correct degree of anteverision without impingement of the device on the retractor or soft tissues. Further internal rotation of the leg may help to prevent such impingement. It is important to rehearse this step to make certain that the stem can be accurately inserted into the cement mantle without impingement and consequent movement of the stem inside the polymerizing cement.

After final seating of the definitive rasp a trial reduction is performed to confirm appropriate leg length, stability and choice of offset. When satisfied, the femur is marked with diathermy or methylene blue dye at a level opposite one of the leg-length markers on the rasp. These marks correspond to marks on the definitive implant.

Femoral Cementing

The canal diameter is measured and an appropriate cement plug inserted. The femoral canal is then thoroughly washed to remove bone fragments and fat from the endosteal surface. A suction catheter is inserted to aspirate any accumulating blood from the distal canal and a peroxide soaked ribbon gauze is packed into the femur. These are removed immediately prior to retrograde injection of cement, using a cement gun about 3 min after mixing. The new reduced-size femoral seal and extended backing plate (Fig. 7.70) are designed for optimum cement pressurization through a mini-incision and these are used until approximately 6 min after mixing. The stem is inserted down the axis of the femur to the pre-rehearsed position. Following stem insertion, cement pressurization is maintained until polymeriza-
Chapter 7.7 - Single, Posterolateral, Mini-Incision Approach to the Hip

Femoral cement pressurisation using gun, extended metal backing plate and sorbothane proximal femoral seal (Fig. 7.70a, b).

It is essential that the femoral component is not allowed to move inside the cement mantle once it is fully seated. The correct position of the stem is towards the posterior aspect of the cut surface of the femoral neck in order to ensure a complete mantle of cement just below the lesser trochanter (Fig. 7.72).

**Reduction and Closure**

A further trial reduction may now be performed and the appropriate neck length chosen to establish exact leg length as well as optimal soft-tissue balance and stability of the hip. After the selected head has been engaged on the Morse taper, the hip is reduced and the posterior structures repaired through drill holes in the greater trochanter (Fig. 7.73). Repair of these structures is

Fig. 7.71. Mini horse-collar and angled stem seal pusher to maintain pressure in femoral canal after stem insertion.

Fig. 7.72. Ideal position of stem towards posterior aspect of femoral neck.

Fig. 7.73. Posterior capsule and external rotators re-attached through drill holes in greater trochanter.
important in minimizing the risk of post-operative dislocation of the hip [6–8].

**Conclusions**

If practiced in the manner advocated above, we believe it is possible to carry out a cemented hip arthroplasty through a mini-posterior incision without compromising the end result for the patient. There is no doubt that patients like the cosmetic result of a smaller wound, and with increasing experience of the technique it has become evident that the traditional length of wound is rarely required, even in larger patients. Whether the smaller MIS incision, less than 10 cm, confers any other clinical advantage is yet to be conclusively demonstrated.

**References**