MIS in Total Hip Arthroplasty: Present Status and Future Direction

C.S. Ranawat, A.S. Ranawat

Introduction

From the time of Sir John Charnley, the pioneer of modern total hip-replacement (THR) surgery, the principles of hip reconstruction have emphasized the reproduction of anatomic geometry to both improve biomechanics and to create the proper myofascial balance. Appropriately performed, THR can reliably and predictably relieve pain, restore function, and improve motion for a period approaching 20 years.

To achieve such a long-term outcome in total hip replacement, proper visualization of the acetabulum and proximal femur was thought to be of paramount importance in order to ensure proper component positioning and to achieve durable fixation. The length of incision was never a consideration. Avoidance of complications was and average hospital stays lasted 1–2 weeks or more.

However, during an era of capitated reimbursements, there was continuing pressure to reduce the length of stay (LOS) in the hospital which demanded earlier recovery of function. The continual strive to speed recovery fostered an "envelope-pushing" mentality using more bone-sparing and abductor-preserving approaches, improved component fixation, aggressive rehabilitation, patient education, improved anesthetic and pain-management techniques and the introduction of clinical pathways. The net result in recent years has been a gradual reduction in average LOS for primary THR to approximately 4 days with the added benefit of improved patient outcomes and lower complication rates than in previous years. Because of this, these improvements have been almost universally accepted by hospitals and surgeons alike.

The trend to push the envelope in THR is a good one encouraging thought-provoking, scientific discussions and new insights. But one must never forget our primary responsibility in medicine: primum non nocere (first, do no harm).

The most recent development that calls this into question has been the introduction of minimally invasive surgery (MIS) to THR. While some patients have demanded speedier recovery, earlier return to work and improved cosmesis, most of the impetus has come from manufacturing companies, hospitals, and some select surgeons eager to capitalize on the market share of a very competitive business, while possibly ignoring the interest and welfare of their patients. Some surgeons have expressed their concern and opinion in opposing this trend, stating that direct marketing of pharmaceutical products, and now, poorly studied orthopedic surgical procedures, like MIS THR, may be unethical. Orthopedic manufacturing companies may have misled the public in the interest of gaining market share and promoting the value of their companies, without scientific evidence to demonstrate the safety, reproducibility, quality of function, and durability of MIS THR.

The purpose of this presentation is to outline how a properly designed study can be carried out to answer the question whether the MIS procedure for total hip replacement, using one or two incisions, is safe, reproducible, functional, and durable. This paper specifically addresses one incision of 10 cm or less, which is used for either posterior or anterolateral exposures, in comparison to a posterior incision of 10–15 cm.

Methods

An appropriately designed scientific study, aimed at investigating MIS in total hip replacement, should be multi-centered, involving 5 to 10 surgeons doing 100 to 300 procedures a year, with a study period of 0 to 5 years. MIS
patients should be recruited with proper IRB approval. Informed consent must explicitly delineate the benefits and risks. If possible, patients should be recruited in a randomized manner or at least in two consecutive series of 300 or more patients per surgeon in order to be able to show significant differences between the groups where the incidence of complications may be less than 5%. There should be some uniformity with regards to prosthesis design and fixation. Data collection should be done independently and prospectively using standardized clinical (Harris Hip, HSS, WOMAC) and radiographic evaluations as well as self-administered patient questionnaires at 2 weeks, 4 weeks, 6 weeks, 3 months, and yearly thereafter. The study should address these questions:

- What percentage of patients are concerned about cosmesis and/or the length of incision?
- Is MIS as good as standard total hip replacement in terms of safety, quality, reproducibility and durability?

The following variables should be controlled for:
- Pre-operative patient education
- Patient motivation
- Post-operative pain control
- Rehabilitation protocol

The following parameters should be measured:
- Length of incision
- Time of operation
- Blood loss – based on drop in hemoglobin count
- Intra-operative complications such as mal-position, fracture, nerve palsy, vascular injury, infection, and dislocation
- Difficulty of procedure: learning curve
- Post-operative assessment of pain intensity
- Recovery of activities of daily living
- Return to work
- Normal ambulation (without pain, limp, and support)
- Stair climbing ability
- Return to sporting activities

Discussion

No published studies currently exist that specifically compare MIS total hip replacement to standard total hip replacement using the aforementioned criteria. DiGioia’s recently published study, the only properly conducted, prospective, comparative study of mini-incision technique currently available, concluded that patients in a mini-incision group had significantly faster improvement in their limps and in their ability to climb stairs at 3 months [1]. This accelerated improvement diminished with longer follow-up; by one year, both the standard-incision and mini-incision patients had experienced the same amount of improvement.

Despite the absence of properly conducted, prospective studies comparing MIS to standard total hip-replacement surgery, direct marketing by manufacturers, hospitals, and surgeons has continued unabated lending apparent validation to this technique as a “standard of care.”

MIS in total hip replacement does have its place. With the help of special retractors, lighting, reamers and other instruments, a total hip replacement can be done from a posterior or anterolateral exposure, using one or two incisions of 10 cm or less. Many surgeons have championed MIS THR. Those who have performed single-incision MIS total hip-replacement studies, using either posterior or anterolateral exposure, include Dorr, Hartzband, Mahoney, Sculco, Sherry, Waldman, and Wenz [2, 6–9]. Berger, Duwelius, Mears, and Keggi have studied the two-incision MIS technique [2, 4]. According to Berger, Dorr, and Sculco, the recovery of function in a select group of motivated, well-informed patients with properly-controlled pain management have shown early recovery of activities of daily living by 2–3 weeks, such as getting out of bed, walking, and climbing stairs, compared, in their experience, to patients who received standard total hip replacement in the recent past [2, 9].

Yet, the unanswered question remains: Is 2 to 3 weeks of early recovery of hip function with MIS THR worthy of such widespread publicity? Only when the safety, reproducibility, and quality of function of MIS have been documented by qualified investigators, can we say “yes.” When the majority of the most serious complications of THR are prevented by proper surgical technique, how can we advertise a less than adequately tested procedure?

RTTS in Total Joint Surgery

We hereby introduce the term RTTS, reduced tissue-trauma surgery, in total joint replacement. In RTTS, a total hip replacement can be performed from a posterior or exposure using a properly placed incision of 10–15 cm in the majority of cases. Improved retractors,
better lighting and angled reamers developed for MIS THR have made this possible.

After incising the skin, the total joint procedure, whether via MIS or a 10–15 cm incision, is similar in terms of interfering with the gluteus maximus and fascia lata, except the length of the split is lessened by about 30–50% with MIS. Exposure of the external rotators and posterior capsule is similar. The main difference, in MIS is that the quadratus femoris and the insertion of the gluteus maximus are not detached. However, the quadratus is often torn as the leg is internally rotated making it incompetent and more difficult to repair; and not detaching the gluteus-maximus insertion may be responsible for a higher incidence of sciatic nerve palsy as the nerve is compressed under the tense tendon during prolonged internal rotation. Final preparation of the acetabulum and femur is similar in both procedures.

In recent years, pain management in total hip replacement surgery has been greatly improved. With more effective pain control, pre-operative patient education, and improved post-operative rehabilitation programs, the majority of RTTS patients of all ages at our center have a recovery of function in 4–8 weeks, judged by ambulation without pain, limp, and support, with cemented, hybrid, and non-cemented fixation.

**Conclusions**

Total hip replacement is indicated to relieve pain, and to restore or improve function and range of motion; in addition, in certain cases, returning patients to sporting activities may be a goal. Safety, reproducibility, quality of function, and durability are the benchmarks for the success of total hip replacement. Compromising these criteria could have a negative impact on total joint surgery. Without appropriately performed studies comparing MIS to the standard incision, MIS total hip replacement cannot be recommended as a standard of care, and must certainly not be promoted or marketed as such. On the other hand, if we can demonstrate safety, quality of function, reproducibility and durability in MIS THR, it will prove to be a definite advance. It will take the next 5–10 years for MIS THR to find its proper place in the management of arthritis of the hip.

**References**