Through the keyhole: An examination of minimally invasive hip surgery

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Summary
Minimally invasive hip (MIH) surgery involves the insertion of total hip replacement (THR) prostheses via 1 or 2-incisions each less than 10 cm, compared with a traditional incision of 20–30 cm. The orthopaedic community, lay press and many patients are currently excited by such an approach as it is seen as a way of promoting faster recovery from surgery. However, when compared with traditional incision THR surgery there are as yet a lack of large-scale long-term robust clinical trials on MIH surgery. The impact on orthopaedic nursing of this new surgical approach may be felt along the whole patient pathway including patient education, post-operative recovery and long term follow-up after surgery. The article examines some of the publicity surrounding this new procedure, the different types of MIH surgery, and the possible implications for orthopaedic nursing.

KEYWORDS
Minimally invasive hip surgery; Orthopaedic nursing

Editor’s Comment
One of the key issues in this article relates to previous assumptions that minimally invasive surgery was the prime reason for early discharge, see also O’Brien et al’s article (2005 Vol.9 No. 3 140-145). It would appear that interventions other than reducing the size of the wound play a more important part in improving patient outcomes that lead to early discharge. Many of these positive interventions are dependent on nursing care.

Introduction
Minimally invasive hip (MIH) surgery has become a talking point amongst both the orthopaedic community and patients over the last 5 years. For the former it seems to offer a way of reducing the complications of more traditional, longer, surgical incisions, and for the latter the possibility of a faster recovery and smaller scar. It is still, however, a relatively new procedure and must therefore be viewed with caution. Ranawat and Ranawat (2003) counsel that in other fields of surgery minimally invasive techniques have also been enthusiastically embraced only for problems to emerge later; for example minimally invasive direct coronary artery
bypass surgery (MIDCAB) was pioneered in the early 1990s but was later found to lead to problems with wound infection, myocardial infarction and mortality and now only 25% of cardiac surgeons use this technique. The use of new surgical techniques can also impact on nursing practice, and the possibility of much reduced lengths of stay after MIH surgery, one of the major selling points of the approach, would undoubtedly affect the nature of orthopaedic nursing in the acute and primary care settings.

Publicity

In the United Kingdom the publicity about MIH surgery began in October 2003 with newspaper headlines such as 'Woman given a new hip is walking in 3 h (Daily Mail, October 2nd 2003), 'Pioneering operation for hip replacement lets patient walk out of hospital within 24 h (The Independent, October 3rd 2003). Similar reports were broadcast on national and local television. Hungerford (2004) found that using the Internet search engine Google in May 2004 brought up 8330 hits for the phrase 'minimally invasive total hip replacement’. Many of these sites are those of orthopaedic companies suggesting to prospective patients that the MIH surgical approach will benefit them or sites of individual surgeons and hospitals advertising that they undertake MIH surgery.

It is not surprising therefore that patients come to orthopaedic outpatient or pre-admission assessment clinics and ask surgeons or nurses whether they can have this marvellous new surgery. In the author’s own clinical practice patients attending as new referrals from their General Practitioner (GP) and those attending the information class for patients waiting for a THR often ask whether their operation will be done using a mini-incision or ‘keyhole’ approach, as they are aware one of the surgeons in the hospital uses this method. Indeed some patients are referred by GPs from up to 50 miles away at their insistence because of the desire to have ‘keyhole’ THR, even if they are not exactly sure what this means.

The incision

Traditional incisions for THR surgery are 20–30 cm long (Figure 1) so that the surgeon can directly visualise the acetabulum and proximal femur to ensure that the prosthetic components are inserted in the correct position; that the femoral component sits squarely in the femoral canal and that the acetabular cup is not tilted. They afford complete and continuous observation of the entire hip and surrounding structures at the cost of moderate muscle and tendon trauma, potentially more pain, and a slower patient recovery time (Berger, 2003).

The term minimal incision is usually taken to mean 10 cm or less (de Beer et al., 2004; Woolson et al., 2004; Sculco, 2004) and there are 2 types of MIH surgery; 1 or 2-incision. 2-incision MIH surgery involves an anterior and a posterior incision, each 4–5 cm. in length (Figure 2). The anterior incision over the femoral neck allows retraction of tensor fascia lata laterally and sartorius medially, capsulectomy and osteotomy of the femoral neck. With the removal of the femoral head the acetabulum...
can be visualised and prepared for the acetabular component to be inserted. The posterior incision is then used to allow access to the femoral canal between the abductor and piriformis tendons and the femoral component is introduced (Berger, 2003). Only uncemented prostheses are used with 2-incision MIH, as there is insufficient room to introduce a cement gun.

1-incision MIH surgery can be carried out via an anterior or posterior approach although the majority of research published is on the posterior approach (Figure 3). Both uncemented and cemented prostheses can be used, although for the latter a longer incision is required to accommodate the cement gun. For a posterior approach the incision starts just behind the greater trochanter and involves some excision of gluteus maximus (not more than 8 cm), and then the capsule with the external rotator muscles are elevated as a single tissue flap and reattached at the end of the operation (Dorr, 2003). The femoral head is removed, which allows access to the acetabulum and insertion of the acetabular cup. The femur is then brought into the wound for femoral preparation and insertion of the femoral component.

The 2 key differences between MIH surgery and the conventional surgical approach to THR are that there is less tissue trauma with MIH surgery and that the surgeon has restricted vision and therefore the use of adapted instrumentation is necessary, often with image guided navigation.

Outcomes

Outcomes for THR surgery can be measured in many different ways. Traditionally mechanical effectiveness was the primary outcome measure used; that is how long the prosthesis survived before revision was necessary. However, recently there has been increasing emphasis on clinical effectiveness and cost-effectiveness. Clinical effectiveness relates both to patient self assessment of quality of life and health status improvement and to the impact of specific patient characteristics such as demographic factors, health related factors and surgical factors on the success of surgery (Parsons and Sonnabend, 2004). Cost-effectiveness relates to comparing the operative to non-operative cost of treatment over the long-term (Parsons and Sonnabend, 2004).

Traditional incision

THR surgery using a traditional incision has been practiced for over 40 years and excellent results have been shown with anterolateral, lateral, posterolateral and transtrochanteric approaches (Wright et al., 2004). Research studies commonly report 90–95% survival rate of the prosthesis at 10 years (see for example Berry et al., 2002). In terms of clinical effectiveness it appears that patients are happy with the results of surgery, with one study showing 90% satisfied at 15 years (Roder et al., 2003), and that health related quality of life improves after THR (McMurray et al., 2002). However, such benefits depend to some extent on patient factors such as psychological profile before surgery (Huo and Muller, 2004). Cost-effectiveness has also been demonstrated in THR surgery (Parsons and Sonnabend, 2004).

However these results should be viewed with caution for a number of reasons. Reported studies often come from centres of excellence where a large number of such procedures are carried out, and may therefore not be typical of all orthopaedic surgeons. Many research trials are led by surgeons who perform the surgery, which may bias the results and what is needed are studies carried out by independent researchers (Jordan et al., 2003). It has been reported that 50% of all scientific papers presented in 2 major orthopaedic journals and at 2 major American orthopaedic meetings were funded by commercial companies, and that commercially funded hip research reported positive outcomes in 93% of studies, whereas independently funded researchers reported good results in only 37% (Ezzet, 2003). There are no randomised
controlled trials that have compared THR with non-surgical intervention, although this would be difficult from both a research design and an ethical perspective (Jordan et al., 2003).

THR surgery is not without its risks and the commonest complications following a traditional incision are dislocation, aseptic loosening and infection (Lucas, 2004). Figures for these vary between studies but it appears that for traditional incision THR surgery the average dislocation rate is 2–10% (Siguiere et al., 2004), aseptic loosening requiring revision surgery occurs in approximately 3% of patients at 10 years (Berry et al., 2002), and there is a 0.2–1.1% infection rate in the first 26 weeks following surgery (Phillips et al., 2003).

Despite these notes of caution it cannot be denied that millions of patients worldwide have benefited from a dramatic improvement in their lives following THR surgery. Overall it appears therefore that THR surgery using a traditional incision is technically and clinically successful and cost effective.

2-incision MIH surgery

It is not surprising that there are fewer studies available which examine the results of either 1 or 2-incision MIH surgery, as these methods have been in use for less than 10 years. Table 1 outlines some of the studies on 2-incision surgery.

The outcomes appear very positive, with reduced operating times and reduced lengths of stay, often with discharge on the day of surgery. The improvement in Harris hip scores, a validated, disease specific, total hip rating outcome tool, in 2 of the studies (Duwelius et al., 2003; Berger et al., 2004) is encouraging in terms of clinical effectiveness of the 2-incision technique. None of the studies consider the cost-effectiveness of the 2-incision technique.

The majority of these studies are observational with short term follow-up, a small sample, and carried out by the surgeons themselves, which are all limiting factors. The surgeons also tend to be pioneers in the field and the findings cannot therefore, be generalised to all orthopaedic surgeons; indeed Berger (2003) stresses that the technique requires meticulous surgical technique and that training beforehand is strongly recommended. Archibeck and White (2004) found that surgeons who had performed less than 50 traditional incision THRs per year before 2-incision training had a 26.5% complication rate with the 2-incision approach, compared with a 7.1% complication rate for those who had performed over 50 traditional THRs per year before training. It may be therefore that only the most experienced orthopaedic surgeons should be using this approach.

Patients selected were often not typical of the THR population, being thinner, less muscular and having less co-morbidity. 2-incision MIH surgery may therefore not be suitable for all patients, affecting its overall clinical effectiveness.

It is clear from some of the studies that it was not only the type of incision that was changed but also the anaesthetic protocol and/or the post-operative rehabilitation regime. It is difficult therefore to determine what affected the chosen outcomes, in particular length of stay which is a complex phenomenon susceptible to the effects of many variables. It may be that the reduction in the use of narcotic analgesia, use of regional anaesthesia, and accelerated physiotherapy are the true breakthroughs of MIH surgery and not the type of incision.

No surgery is without complications and it is argued by Archibeck and White (2004) that it is difficult to compare the complication rate of the 2-incision with a traditional incision approach as rates seem to differ according to the make of prosthesis. However, they conclude that the complication rates for the 2-incision MIH surgery are comparable to those with a traditional incision, with the exception of a slightly higher rate of nerve palsy and femoral fractures. However they also found that surgeons who performed more than 10 procedures did not experience a reduction in the number of complications, which suggests that it may not be experience with this approach but the actual procedure itself which leads to the reported complications.

1-incision MIH surgery

Table 2 summarises some of the studies using the 1-incision approach. Length of stay appears to be longer than in the 2-incision studies but there are fewer details on the peri and post-operative regimes and it may be that these were not changed. Even so the reported lengths of stay compare favourably with, for example, the length of stay for THR patients in England 2002–2003 which was a mean of 11.1 days (DOH 2005). Dorr (2003) reports that patients were offered same day discharge but few chose this option. Two studies examined patient centred outcomes with de Beer et al. (2004) finding that patients having MIH surgery had similar improvements in Harris Hip Score and Oxford Hip Score to those who had a traditional incision. Wright et al. (2004) found that 73% of
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<th>Authors</th>
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| Archibeck and White     | Report presenting data from case study of surgeons who had completed company training programme on 2-incision approach | 159 surgeons, 851 mini-incision procedures. Patients similar to THR population although propensity to be slightly younger and thinner (mean Body Mass Index (BMI) = 26) | Not described                      | Mean operative time = 148 min  
Decrease in mean operative time from surgeon’s first to tenth case (from 168 to 130 min)  
Mean blood loss = 496 ml  
No decrease in complication rate of individual surgeon as performed more cases | 35 fractures of femoral neck/calcar region (4.1%)  
11 femoral shaft fractures (1.3%)  
9 greater trochanter fractures (1.1%)  
27 nerve deficits/injuries (3.2%)  
8 early dislocations (0.9%)  
8 early revisions (0.9%) |
| Berger (2003)           | Prospective, observational, 1 year follow-up | 100 patients, morbidly obese and patients over 75 years excluded                                | First 12 patients — ‘normal regime (not described)  
Remaining 88 ‘Sameday’ pathway rehabilitation protocol — independently walking and climbing stairs day of surgery | First 12 patients — average length of stay = 1.5 days  
85% of remaining 88 patients discharged day of surgery, remaining 15% following day | 1 proximal femoral neck fracture  
No other complications                                                                                     |
| Berger et al. (2004)    | Prospective, observational, 3 month follow-up | 100 patients Exclusion criteria:  
• Morbid obesity (BMI > 35)  
• Recent Myocardial infarction  
• 3 or more uncontrolled medical co-morbidities | Epidural anaesthesia, no narcotics  
Accelerated rehabilitation protocol — taught crutches use pre-admission, mobilisation commenced 5 h post-surgery | Mean operative time = 101 min  
Mean blood loss = 291 cc  
97% discharged to own home day of surgery. Remainder within 23 h of surgery  
Mean time to activities:  
○ Discontinuation of all walking aids — 9 days  
○ Driving — 6 days  
○ Return to work — 8 days  
Harris Hip Score improvement from 56 (pre-op) to 96 (12 weeks post-op)  
X-rays — no evidence of loosening/subsidence | No readmissions, reoperations, dislocations                                                                 |
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<tr>
<td>Duwelius et al. (2003)</td>
<td>Report on results from 2 centres – prospective, observational, 1 year follow-up</td>
<td>100 patients at each centre: less obese and less muscually developed than patients having traditional incision, less than 75 years old, no major co-morbidities</td>
<td>Not described</td>
<td>Mean surgery time = 90 min</td>
<td>2 posterior hip dislocations</td>
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<td>167 patients discharged home within 24 h of surgery</td>
<td>1 loosening of femoral component (required revision)</td>
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<td></td>
<td>Harris Hip Score = 52 pre-operatively, 90 at 1 year post surgery</td>
<td>3 femoral fractures</td>
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<td></td>
<td></td>
<td>2 posterior hip dislocations</td>
<td>No readmissions</td>
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<tr>
<td>Mears (2003)</td>
<td>Multicentre prospective observational</td>
<td>No details, except minimal co-morbidities</td>
<td>Regional anaesthesia, Non-narcotic pain medication, Portable local anaesthetic infusion pumps, Accelerated physical therapy programme</td>
<td>90% of patients discharged within 24 h of surgery</td>
<td>Proximal femoral neck fractures – 2.8% of patients (all in surgeons’ first ten cases)</td>
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| de Beer et al. (2004)    | Comparative cohort, 6 week follow-up | lateral vs traditional lateral | 30 MIH surgery patients vs 30 traditional lateral incision patients, matched for gender, age, BMI | Spinal anaesthesia          | • Less blood loss mini-incision group  
• Surgery time similar  
• Length of stay 5.1 days for both groups  
• Harris Hip Score and Oxford Hip Score improvements similar in both groups  
• X-ray position satisfactory in both groups at 6 weeks | No surgical complications |
| Dorr (2003)              | Prospective single cohort, 2 year follow-up | Posterior       | 105 arthroplastys, Mean BMI = 26.2                                    | Epidural and intravenous narcotics avoided | Surgery time — mean of 64 min  
• Length of stay 4.1 days on average  
• Radiographically stable at 2 years | 1 infection  
1 transient sciatic nerve palsy |
| Siguier et al. (2004)    | Retrospective observational, 7 year follow-up (specifically examining dislocation rates) | Anterior        | 1037 arthroplastys, excluded obese and muscular patients | Standing day after surgery  
Walking day 2 post-operatively | Discontinued use of walking aids 8 days–3 weeks post-surgery | 10 dislocations (0.96%) — 2 required revision  
2 post-operative femoral paresis (resolved within 1 year)  
5 infections (3 required revision)  
2 aseptic loosening requiring revision |
| Woolson et al. (2004)    | Retrospective, controlled study, 6 month follow-up | Posterior       | 50 MIH vs 85 traditional posterior approach. Not randomised. MIH surgery patients taller, lower body mass and less medical comorbidity | Not described               | • No significant difference in average surgery time, blood loss or length of stay  
• No significant difference in average blood loss (603 ml MIH, 507 ml traditional)  
• No significant difference in average length of stay — 4.3 days MIH, 4.0 days traditional incision | Wound complications higher — 3 in MIH surgery group, 0 in traditional incision group  
Suboptimal radiographic results more common (alignment and fixation issues) |
patients who had the MIH surgery would have been less pleased if they had had a longer scar, and that 67% of those with a traditional incision would have been more pleased with their surgery if they had had a smaller incision. This suggests that for patients the smaller scar, and presumably therefore the cosmetic effect, is important. There was no examination of cost effectiveness in the studies.

The results must be viewed with caution. There are no randomised controlled trials but there are three which compare the 1 mini-incision with the traditional incision technique (de Beer et al., 2004; Woolson et al., 2004; Wright et al., 2004). One (de Beer et al., 2004) use matched groups but the other two have groups which are not similar, in particular the patients having the mini-incision were less obese. The surgeons reporting results are pioneers of the method, with the exception of Woolson et al. (2004), and another pioneer cautions surgeons who perform fewer than 50 THRs a year from using this approach (Sculco, 2004). As with the 2-incision method therefore this approach may not be suitable for all patients or for all orthopaedic surgeons.

Complications appear to be less than with the 2-incision approach. Woolson et al. (2004) concluded that there was no difference in average surgery time, blood loss or length of stay but that wound complications and suboptimal radiographic results were higher in the MIH group. They postulated that because there was more traction on the skin during surgery with a smaller incision it could predispose to skin damage and therefore wound complications. They found that complications did not decrease after performing 5—15 mini-incisions and concluded that the complication rate may therefore be a function of factors not under the surgeon’s control, such as poor visualisation of the anatomy, a similar finding to Archibeck and White (2004) with regard to the 2-incision technique.

The results for MIH surgery are encouraging but are, on the whole, from small scale studies often carried out by enthusiasts and pioneers in the technique. It has been pointed out (Callaghan, 2003) that MIH surgery does not address the problems that commonly result in total hip replacement complications, namely failure of fixation, instability and infection, and that potentially they may increase these problems. It is also difficult to untangle the effects of patient selection, altered patient expectations and the variables of peri/post-operative management from that of the type of incision (Lieberman, 2003). In summary, more studies need to be performed that examine clinical and cost-effectiveness of MIH surgery.
Implications for nursing practice

MIH surgery may influence orthopaedic nursing practice at all stages of the patient journey but there are 3 areas where the effects may be greatest, namely provision of patient education before surgery, immediate post-operative recovery, and long-term follow-up of patients after surgery.

Patient education

The English NHS Plan (DOH 1997) emphasised that the patient must be at the centre of care and that health care professionals must adapt practice to meet the patients’ needs. As Hewitt-Taylor (2004) points out this sits comfortably with societal changes where increasingly the focus is on individual choice. A key nursing role is thus ensuring that patients know all about the treatment and care they are receiving so that they can make an informed choice. For MIH surgery this provision of information by nurses can take place when the patient is first listed for surgery, in preparation classes whilst waiting for surgery, in pre-admission assessment clinics, or on the ward before surgery. The question is how much nurses, and medical staff, should tell patients about the effectiveness and risks of MIH surgery so that they can give informed consent? In UK law there is what is known as the Bolam principle — that practitioners are not negligent if they act in a way which is accepted as proper action by a ‘responsible body of practitioners skilled in the art’ (Cable et al., 2003). The principle applies to consent as well, so if a practitioner does not mention a risk of surgery and the court finds that a reasonably competent practitioner in a similar position would not have mentioned the risk, and that such a decision was supported by a responsible body of relevant professional opinion, then the practitioner was not negligent (Cable et al., 2003). In other words there is no duty to explain all the risks or benefits. Some of the surgeons’ websites that advertise the MIH approach are very positive about it, not surprisingly, and do not dwell on the lack of long-term results. The UK nursing regulatory body, the Nursing and Midwifery Council (NMC) also stresses that patients have a right to receive information about their condition or treatment (NMC 2002). As it points out it is usually the individual performing a procedure who should obtain the patient’s consent, and therefore it may seem that the main burden is on the surgeon and not the nurse. However it would be difficult ethically and professionally for a nurse to allow a patient to undergo a procedure if he/she was aware the patient had not given true informed consent. Equally nurses work as part of a healthcare team and therefore sensitivity is required in situations where nurses feel the surgeons have not given sufficient information, as working relationships may be affected. One solution would be the development of printed patient information, which sets out in a neutral fashion the advantages and disadvantages of MIH surgery. All orthopaedic nurses who care for these patients need to have some knowledge and understanding of the technique and the evidence for its success.

Post-operative recovery

The emphasis today is on speedy discharge and therefore in-patient areas tend to have a high proportion of acutely ill patients. If MIH surgery does reduce length of stay even further then the proportion of acutely ill patients will increase. The skills of nursing staff may therefore need to change, with more emphasis on recovery from anaesthesia and surgery than longer term rehabilitation. It may be that MIH surgery patients are nursed on general, short stay wards catering for different surgical specialities and if so there is a need to ensure that the staff have fundamental orthopaedic nursing skills such as correct moving and handling techniques.

With earlier discharge there is also the question of where patients will be discharged to. Ganz et al. (2003) reported the results of a survey of 11,000 discharges of patients from one American hospital after traditional incision THR surgery between 1990 and 2000. They found that post-operative length of stay fell from an average of 9.7 days in 1990 to 5.3 days in 2000. Discharges to rehabilitation centres increased from 13% in 1995 to 23% in 2000, whilst discharges to home decreased from 44% in 1995 to 23% in 2000. In the UK there is a tendency to use supported discharge schemes so that patients can be discharged earlier to their own homes (Jester, 2003). Rehabilitation facilities and supported discharge schemes need nursing staff with sufficient knowledge of MIH surgery and the recovery from it so that patients needs are being met; a rethink of the orthopaedic nursing role along the patient journey may be necessary (Lucas, 2002a).

Long-term follow-up

THRs can fail due to aseptic loosening, infection or late dislocation and as more are performed more revisions will be necessary. However by the time
the patient has pain or loss of function the destruction of periprosthetic bone may be extensive, making revision surgery more difficult (Teeny et al., 2003). It is advocated therefore that patients are monitored long-term after THR surgery and the need for this will be even greater with MIH surgery, as it is a new technique which needs long-term evaluation. A survey of American orthopaedic surgeons found that 95% believed that an orthopaedic surgeon rather than another health professional such as a nurse should carry out long-term follow-up of patients (Teeny et al., 2003). In reality however, nursing input into the long term follow-up of THR patients is increasing. Many of the patients having MIH surgery may be part of a research study, and such studies often employ a research nurse for the collection and interpretation of data (Legge, 2004). If MIH surgery is carried out by more surgeons in the future other patients will be managed within the existing follow-up system where nurse practitioners may be carrying out the care (Lucas, 2002b).

Conclusion

It appears that MIH surgery is here to stay with more and more surgeons beginning to use either a 1 or 2-incision approach. It is well recognised that these approaches are in their infancy, and that large scale multi-centre studies are needed to provide more robust evidence of outcomes. Early results appear encouraging and patients are certainly excited by the possibilities, but it may be that the early promise fades as it has with other types of mini incision surgery. In the meantime orthopaedic nurses will be asked about MIH surgery and should ensure that they know of the evidence available and are honest with patients about the current knowledge base. The impact of this type of surgery extends to many areas of nursing practice and may provide both opportunities and threats to the speciality of orthopaedic nursing.

References


