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Total hip arthroplasty through the mini-incision (Micro-hip) approach versus the standard transgluteal (Bauer) approach: a prospective, randomised study

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ABSTRACT

Purpose. To compare outcome after total hip arthroplasty (THA) through the mini-incision approach versus the standard transgluteal approach.
Methods. 80 women and 63 men aged 33 to 89 (mean, 62) years with primary osteoarthritis of the hip were randomised to undergo unilateral THA through a mini-incision approach (Micro-hip, n=55) or standard, lateral, transgluteal approach (Bauer, n=88). Levels of haemoglobin, haematocrit, serum creatine kinase, and C-reactive protein, length of hospital stay, mobilisation, and any complication were recorded. Visual analogue scale (VAS) for pain was assessed. Hip function was assessed using the Harris Hip Score and the Oxford Hip Score, whereas general health was assessed using the EQ-5D general health questionnaire. The cup inclination and varus/valgus of the stem position were measured using a goniometer.
Results. The Micro-hip group achieved a significantly lower mean incision length (9.3 vs. 13.4 cm, p<0.001), mean surgical time (60 vs. 68 minutes, p=0.021), mean reduction in haemoglobin level (2.1 vs. 2.8 g/dl, p<0.001), and mean VAS for pain from hour 6 to day 6 (all p<0.05). One patient in the Micro-hip group developed early aseptic loosening of the cup and underwent revision surgery at month 4. Three patients in the Bauer group and one patient in the Micro-hip group sustained intra-operative non-displaced fractures of the proximal femur, which were fixed with cerclages. Two patients in the Micro-hip group developed deep vein thrombosis during week 1.
Conclusion. THA through the Micro-hip approach achieved faster pain relief.

Key words: *arthroplasty, replacement, hip; pain, postoperative*

INTRODUCTION

Mini-incision total hip arthroplasty (THA) reduces blood loss, recovery time, and duration of hospital stay, and achieves better in-hospital and early functional

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results,[1] patient satisfaction,[2] and postoperative pain.[3,4] Its long-term outcome is similar to that of conventional THA.[5,6] Nonetheless, mini-incision THA results in increased implant malpositioning and risk of neurovascular complications, owing to limited intra-operative visualisation.[7,8] In a meta-analysis of over 2800 THAs, only the risk of transient lateral femoral cutaneous nerve palsy increases significantly after mini-incision THA.[5] This is consistent with our findings for the Micro-hip approach.[9]

The definition of 'mini-incision' is imprecise when based only on the incision length.[9–12] The extent of muscle, tendon, and other soft tissue damage should also be taken into consideration. There are various mini-incision techniques; grouping them under a single term may be misleading. This study aimed to compare patients undergoing THA through the mini-incision (Micro-hip) approach versus the standard transgluteal (Bauer) approach. We hypothesised that the Micro-hip approach would result in lower intra-operative blood loss and postoperative pain, and earlier mobilisation without increasing complications.

MATERIALS AND METHODS

The ethics committee approved this study. Informed consent was obtained from each patient. An absolute difference of 15% in Harris Hip Score and Oxford Hip Score was considered clinically important. Thus, at least 54 patients per group were required to achieve 80% power to detect differences between groups, with the level of significance of 0.05 (2-sided).

Between January 2010 and October 2010, 80 women and 63 men aged 33 to 89 (mean, 62) years with primary osteoarthritis of the hip were randomised to undergo unilateral THA through a mini-incision approach (Micro-hip,[13] n=55) or a standard, lateral, transgluteal approach (Bauer,[14] n=88) by a dedicated team with extensive experience. More patients in the Micro-hip group deferred or refused surgery after randomisation. Patients with previous surgery on the affected hip or severe inflammatory polyarthritis that was likely to compromise postoperative mobility were excluded.

The Micro-hip approach adopted the modified Smith-Petersen approach.[15] Patients were positioned in a lateral decubitus position. The skin midway between the greater trochanter and the anterior superior iliac spine was incised. The subcutis and fascia were dissected, followed by the interval between the tensor fascia lata muscle and the rectus muscle. The joint capsule was split and left in place. The femoral neck was osteotomised and the femoral head removed. A special acetabular reamer with an altered angulation was used. Acetabular components were then implanted. After repositioning the leg in extension, adduction, and external rotation, the stem was prepared, with the femur rasped to the size of the medullary cavity. The fascia was closed and the skin was stapled.

For the Bauer approach, patients were positioned supine. A slightly dorsally arcuated incision was made over the greater trochanter region.[14] The subcutis and fascia lata were incised parallel to the skin incision, and the gluteal medius and minimus muscles were split along the line of their fibres. The joint capsule was split and left in place. The femoral neck was osteotomised *in situ*, and the femoral head removed. The acetabular components were implanted after reaming. After repositioning the leg in adduction and external rotation, the stem was prepared and implanted. The muscles were reattached to the trochanter bone stock, the fascia was closed, and the skin was stapled.

All but 8 patients received spinal anaesthesia with intravenous midazolam or propofol. Press-fit acetabular components and cement-free hydroxyapatite-coated stems with metal heads were used. Five patients in the Bauer group and one patient in the Micro-hip group received a cemented stem because of poor bone stock. The stem and acetabular positions were checked intra-operatively using mobile C-arm fluoroscopy. Blood loss was estimated through a cell saver system. Only one patient needed re-transfusion of the collected blood. Prophylaxis against deep vein thrombosis included administration of enoxaparin and early mobilisation. Mobilisation (partial weight bearing of a maximum of 30 kg for 6 weeks and then full weight bearing) was supervised by physiotherapists.

Patient demographics, body mass index, the American Society of Anesthesiologists status, levels of haemoglobin, haematocrit, serum creatine kinase, and C-reactive protein, length of hospital stay, mobilisation, and any complication were recorded. Visual analogue scale for pain was assessed at hours 6 and 12 by the responsible physician, and then from day 1 to day of discharge at 7 am and 4 pm by the patients themselves. Hip function was assessed using the Harris Hip Score and the Oxford Hip Score,[16] whereas general health was assessed using the EQ-5D general health questionnaire.[17] The cup inclination and varus/valgus of the stem position were measured using a goniometer.[18]

A Kolmogorov-Smirnov test for normal distribution was used. Continuous variables were analysed using the Student's *t* test. Non-parametric

Table
Patient demographics and outcomes*

Parameter	Micro-hip (n=55)	Bauer (n=88)	p Value
No. of females:males	33:22	47:41	0.443
No. of left:right hips	27:28	47:41	0.618
Patient age (years)	61.9±12.1 (33–85)	61.3±11.6 (35–89)	0.761
Weight (kg)	79.4±22.2 (38–141)	86.1±19.6 (53–160)	0.070
Height (cm)	170±10 (140–189)	170±10 (148–187)	0.899
Body mass index (kg/m^2)	27.6±6.0 (15.7–42.0)	30.1±5.6 (17.6–48.8)	0.013
American Society of Anesthesiologists grade			0.169
1	5	9	
2	23	49	
3	23	27	
4	0	0	
Incision length (cm)	9.3±1.4	13.4±2.7	<0.001
Surgical time (mins)	60±13.9	68±26.8	0.021
Blood loss in cell saver (ml)	313.7±172.2	390.7±598.9	0.355
Length of hospital stay (days)	8.8±1.5	9.0±1.7	0.324
Haemoglobin level (g/dl)			
Preop	13.9±1.4	14.3±1.5	0.104
Postop day 1	11.7±1.6	11.5±1.6	0.401
Postop day 2	11.2±1.6	10.9±1.6	0.186
Postop day 7	11.3±1.4	11.1±1.6	0.407
Reduction from preop to postop day 1	2.1±1.2	2.8±1.3	<0.001
Haematocrit level (%)			
Preop	40.3±4.3	41.3±6.7	0.447
Postop day 1	35.8±4.8	35.4±4.9	0.612
Postop day 2	31.6±6.2	31.1±4.8	0.613
Postop day 7	32.8±4.3	31.9±4.7	0.260
C-reactive protein level (mg/l)			
Preop	3±4.6	4±6.7	0.435
Postop day 2	134±78.7	147±61.0	0.298
Postop day 7	46±25.3	57±35.2	0.046
Serum creatine kinase level (U/l)			
Postop day 2	268±192	427±969	0.131
Postop day 7	133±75	204±203	0.238
Postop visual analogue scale for pain			
Hour 6	1.7±1.7	2.5±2.7	0.035
Hour 12	1.8±1.9	2.8±2.7	0.020
Day 1	2.0±1.5	3.4±2.4	<0.001
Day 2	2.0±1.9	3.0±2.1	0.007
Day 3	1.8±1.6	2.7±2.0	0.010
Day 4	1.7±1.7	2.6±2.0	0.017
Day 5	1.7±1.7	2.6±2.0	0.011
Day 6	1.5±1.5	2.2±1.8	0.030
Day 7	1.5±1.5	2.0±1.7	0.060
Day 8	1.4±1.4	1.9±1.6	0.056
Mobilisation (days)			
Out of bed	1.4±0.6	1.4±0.8	0.525
Walking	2.6±1.0	2.7±1.1	0.486
Climbing stairs	5.8±1.7	6.3±1.7	0.453
Cup inclincation	48.1°±6.0° (33°–65°)	49.7°±6.0° (31°–63°)	0.545
Stem alignment	2.6°±2.1° varus (0°–8°)	2.8°±2.2° varus (-2°–10°)	0.425
Harris Hip Score			
Preop	45.6±15.9	45.6±15.1	0.991
Postop week 6	78.0±12.7	74.1±13.6	0.142
Postop month 3	87.1±14.9	85.2±16.5	0.562
Oxford Hip Score			
Preop	20.0±8.3	19.1±8.0	0.508
Postop week 6	39.4±7.0	37.0±6.7	0.083
Postop month 3	41.9±5.4	39.9±8.7	0.196
EQ-5D general health questionnaire			
Preop	0.473±0.235	0.466±0.253	0.859
Postop week 6	0.847±0.167	0.810±0.169	0.274
Postop month 3	0.850±0.216	0.845±0.230	0.909

* Data are presented as no. of patients or mean±SD (range)

variables were analysed using the Mann-Whitney *U* test. The Chi-squared test was used for dichotomous variables. A p value of <0.05 was considered statistically significant.

RESULTS

All patients were followed up for at least 3 months. No patient was lost to follow-up. The Micro-hip and Bauer groups did not significantly differ in terms of demographics, American Society of Anesthesiologists grade, hip scores, and general health status, except for the body mass index (p=0.013, Table). The Micro-hip group achieved a significantly lower mean incision length (9.3 vs. 13.4 cm, p<0.001), mean surgical time (60 vs. 68 minutes, p=0.021), mean reduction in haemoglobin level (2.1 vs. 2.8 g/dl, p<0.001), mean C-reactive protein level at day 7 (46 vs. 57 mg/l, p=0.046), and mean VAS for pain from hour 6 to day 6 (all p<0.05).

One patient in the Micro-hip group developed early aseptic loosening of the cup and underwent revision surgery at month 4. Three patients in the Bauer group and one patient in the Micro-hip group sustained intra-operative non-displaced fractures of the proximal femur, which were fixed with cerclages. Two patients in the Micro-hip group developed deep vein thrombosis during week 1.

DISCUSSION

THA through the Micro-hip approach achieved lower reduction in haemoglobin levels. This is consistent with the findings in previous mini-incision studies.[2,5,19,20] However, its clinical impact is low, as it does not affect the blood transfusion rate.[5] Other studies reported similar blood loss in the 2 approaches.[3,21]

THA through the Micro-hip approach achieved shorter surgical time. This may have been due to extensive experience of the surgical team, and the reduced time for wound closure in the modified Smith-Peterson approach. Other studies using the modified Watson-Jones approach[22] or the single-incision posterolateral approach[23] also reported similar surgical times.

Serum creatine kinase levels of the 2 groups were similar, indicating similar levels of muscle trauma. This is consistent with a study using the modified Watson-Jones approach.[22] Nonetheless, detaching muscles may result in temporarily decreased function without rise in serum creatine kinase levels. Other studies of mini-incision techniques reported reduced muscle damage.[24,25]

Pain scores were lower in the Micro-hip group during the first week. This may have been due to reduced muscle damage.[19] In contrast, no reduction in postoperative (day 3) pain was reported after the anterior mini-incision approach.[22] In a study using patient-controlled analgesia, no difference was noted in postoperative pain scores or morphine use.[20]

Hip function was similar in both groups. This is consistent with results from other studies.[19–21] Cup and stem positioning was similar in both groups. In particular, the rate of implant malpositioning did not increase in the Mirco-hip group. This is consistent with findings of other studies.[3,5,19,20,22,23,26] However, a wider range in anteversion[24] and increased malpositioning of the acetabular component have been reported after a posterior[21] or an anterolateral[27] approach with a mini-incision technique.

The complication rates were similar to those in other studies.[2,3,5,19,20,26] An increase in wound complications was reported after a mini-incision posterior approach.[21] An increase in revision surgery was also reported after a 2-incision technique.[28] Severe complications have been described.[27] Temporary lateral femoral cutaneous nerve neuropraxia is a common complication after anterior mini-incision techniques,[5,23,28,29] but was not seen in our patients.

One limitation of this study was the lack of long-term results. Most of the positive effects of mini-incision hip surgery occur in the short- and mid-term.[19,26] Pain relief and early mobilisation are the main benefits in the early in-hospital period. There were no significant differences in the functional scores or the general health status after 3 months. Nonetheless, results may vary if experience with the Micro-hip approach is not extensive enough. Long-term studies are needed to investigate implant loosening and late infections.

CONCLUSION

THA through the Micro-hip group achieved faster postoperative pain relief.

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DISCLOSURE

No conflicts of interest were declared by the authors.

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