Early Pain Relief and Function After Posterior Minimally Invasive and Conventional Total Hip Arthroplasty. A Prospective, Randomized, Blinded Study

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Early Pain Relief and Function After Posterior Minimally Invasive and Conventional Total Hip Arthroplasty

A Prospective, Randomized, Blinded Study

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Background: Few prospective randomized studies have demonstrated benefits of minimally invasive total hip arthroplasty when compared with conventional total hip arthroplasty. We hypothesized that patients treated with a posterior mini-incision would have better results than those treated with a posterior long incision with regard to the achievement of established goals for pain relief and functional recovery permitting hospital discharge by the second postoperative day.

Methods: Sixty of 231 eligible patients were randomized (with thirty in each group) to have a total hip arthroplasty performed through either a posterior mini-incision (10 ± 2 cm) or a traditional long incision (20 ± 2 cm). After completion of the total hip arthroplasty, the mini-incision group underwent extension of the skin incision to 20 cm. Patients were evaluated on the basis of self-determined pain scores, requirements for pain medicine, need for assistive gait devices, and time until discharge. Gait analysis provided objective functional assessment.

Results: The average hospital stay was 63.2 ± 13.3 hours in the mini-incision group and 73.6 ± 23.5 hours in the long-incision group ($p = 0.04$). More patients with a mini-incision were discharged by the second postoperative day ($p = 0.003$) and more were using just a single assistive device at the time of discharge ($p = 0.005$). As scored on a verbal analog scale of 0 to 10 points, patients with a mini-incision had less pain on each postoperative day and the pain score remained significantly lower at the time of discharge (mean, 2.2 ± 1.0 points compared with 3.1 ± 0.9 points in the long-incision group; $p = 0.002$). After hospital discharge, there were no clinical differences in pain or function between the two groups of patients.

Conclusions: Compared with conventional total hip arthroplasty performed through a posterior incision, posterior minimally invasive total hip arthroplasty resulted in better early pain control, earlier discharge to home, and less use of assistive devices. Subsequent evaluations at six weeks and three months showed equivalency between the clinical results in the two groups.

Level of Evidence: Therapeutic Level I. See Instructions to Authors for a complete description of levels of evidence.

Advances in operative technique and instrumentation have enabled surgeons to perform total hip arthroplasty through smaller incisions[1]. Minimally invasive total hip arthroplasty has been defined by an incision length of 10 to 12 cm or less[2-8]. Proponents of this technique believe the potential benefits to be a reduction in soft-tissue trauma, shorter intraoperative time, less perioperative blood loss, less postoperative pain, more rapid rehabilitation, earlier hospital discharge, and improved

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cosmetic appearance[1-6,8,18]. Critics believe that the disadvantages include reduced operative visualization, a steep learning curve, an increased risk of neurovascular complications, a higher prevalence of dislocation, excessive skin trauma, and compromised implant fixation and positioning[1,7,19-24].

Most reports on the results of small-incision total hip arthroplasty have been based on retrospective cohort studies or prospective case series with or without comparison with a historical or matched cohort[2,3,5-8,10-18]. We are aware of only two prospective, randomized clinical studies comparing total hip arthroplasty involving use of a posterior small incision with that involving a traditional long incision[4,9].

In the present prospective, randomized, blinded study, the hypothesis was that patients treated with a total hip arthroplasty with a small posterior incision would have better results than those treated with a long posterior incision with regard to the achievement of the goals of early pain relief and functional recovery and that more patients in the mini-incision group would be candidates for hospital discharge by the second postoperative day. The difference in our study, compared with others, was that patients in both groups were actively encouraged to achieve these goals rather than allowing a passive recovery. These goals were selected because the foremost theoretic advantages of minimally invasive surgery are to reduce postoperative pain and to provide more rapid recovery.

Materials and Methods

Patient Selection

Institutional review board approval was obtained, and all patients gave their informed consent before participating in this study. All patients scheduled to undergo unilateral primary total hip arthroplasty between January 2004 and October 2005 were considered to be candidates. The exclusion criteria included previous surgery on the affected hip, a pathological condition of the hip that required an extensile exposure, same-day bilateral total hip replacement, and inflammatory polyarthritis. The patients were informed that they would be blinded for six months with regard to the technique that had been used.

Two hundred and sixty-three patients (293 hips) underwent primary total hip arthroplasty during this time-period. Thirty patients (sixty hips) had a same-day bilateral operation, and two patients (two hips) had rheumatoid polyarthritis. One hundred and seventy-one of the 231 patients who were eligible chose not to enroll in the study, all because they would have no choice with regard to the incision. Sixty patients (sixty hips) consented to participate in the study and were randomized into two groups. Enrollment was stopped after the sixty hips had been included because of the difficulty of recruiting patients and because 80% statistical power to detect a difference, at the 0.05 level, in the comparison of the pain and function criteria had been achieved.

Treatment Protocol

The patients were actively encouraged to follow the protocols rather than allow a passive recovery. Each patient attended a preoperative class that explained the operation, the preoperative and postoperative care, and the postoperative recovery and rehabilitation[25]. They were taught to use an analog scale of 0 to 10 points (with 0 indicating no pain and 10 indicating the worst pain) and instructed regarding the postoperative rehabilitation program. Fifty-seven of the sixty patients donated one unit of autologous blood at least two weeks preoperatively, and the blood was reinfused into each patient intraoperatively or early in the postoperative period. A patient was discharged home when he or she, the physical therapist, and the physician agreed that the patient was able to function independently.

The same anesthesia and operating teams were involved in every procedure. The operations were performed by two surgeons (L.D.D. and W.T.L.), one of whom had experience with 400 posterior minimally invasive total hip arthroplasties and the other of whom had performed 100 such procedures prior to the onset of the study[5,10,25]. Twenty-nine patients treated with a small incision and twenty-seven patients treated with a long incision received epidural anesthesia with 60 to 80 mg of 1% ropivacaine (Naropin) and 80 mg of 1.5% to 2% lidocaine with epinephrine. No narcotics were used in the epidural. The patients were sedated with propofol (Diprivan). One patient treated with a mini-incision and three treated with a long incision had general anesthesia. No intravenous narcotics were used during the operation with either anesthesia regimen. Patients with epidural anesthesia were not intubated, and the airway was controlled with laryngeal mask anesthesia. The epidural catheter was removed in the operating room at the completion of the procedure; the patients were awake and able to move the lower limbs in the recovery room.

Surgical Technique

The length of the small incisions was 10 ± 2 cm, and the length of the long incisions was 20 ± 2 cm. If a patient was randomized to the mini-incision group, the operation was performed entirely through the small incision; then, during the completion of the closure of the wound, the skin incision alone was extended to 20 cm. Thus, all of the skin incisions in the two groups were ultimately of the same length and, except for the operating team, everyone involved in the study (i.e., the patient, nurses, physical therapists, occupational therapists, and those who performed the data collection) was blinded to the actual extent of the deep-tissue surgery.

The Navitrack Imageless Computer Hip System (ORTHOsoft, Montreal, Quebec, Canada) was used for twenty-seven of the thirty mini-incision operations and for twenty-four of the thirty long-incision procedures. The posterior mini-incision arthroplasties were done with instrumentation specific for that procedure[25]. In our technique, there were five differences between the mini and long-incision operations: (1) no incision was made into the tensor fasciae latae in the mini-incision group; (2) the gluteus maximus muscle was split for only 6 cm in the mini-incision group compared with 10 to 12 cm in the long-incision group; (3) in the mini-incision group the only capsular incisions were a 3 to 4-cm posterior capsular flap that

was repaired at the completion of the operation and an incision through the medial aspect of the capsule, whereas in the long-incision group the anterior-superior aspect of the capsule was excised and the medial aspect of the capsule and the reflected head of the rectus femoris muscle were incised; (4) the gluteus maximus tendon was not released from its insertion onto the femur in the mini-incision group, but it was released in the long-incision group and then repaired at the completion of the arthroplasty; and (5) the quadratus femoris muscle was not released from its insertion onto the femur in the mini-incision group, but it was released in the long-incision group.

A standardized multimodal analgesic protocol, which does not include parenteral narcotics, was used for the management of postoperative pain in each patient as previously described[5,25].

Prophylaxis against deep vein thrombosis included administration of Ecotrin (oral enteric-coated acetylsalicylic acid), use of bilateral intermittent pneumatic compression calf devices (FP 5000; Huntley Health Care, Eatontown, New Jersey), and rapid mobilization of the patient. Discharge medications for the patients included Celebrex (celecoxib), 200 mg twice daily, for three weeks and whatever pain medications the patient used in the hospital.

Functional rehabilitation was begun on the day of the surgery for all but four patients (two in each group). Patients were treated by physical therapists twice a day, and they began walking independently within their hospital room when that was approved by the physical therapists. After discharge, the patients were instructed to walk every day, gradually increasing their distance with a goal of 1 mile (1.6 km). No physical therapy following discharge was prescribed.

Data Collection

All data were collected prospectively each day during the hospitalization by individuals who were blinded to the operative technique used for that patient. The data were analyzed by a research team that was not directly involved with the patient care.

The preoperative clinical data that were recorded included age, gender, left or right hip, diagnosis, weight, height, body mass index, Harris hip score, and American Society of Anesthesiologists (ASA)[26] grade. The hemoglobin and hematocrit levels were determined just prior to the operation and again on the first postoperative day. All fifty-seven patients who had predonated autologous blood received that blood as a transfusion; no allogeneic blood was given.

Intraoperative data included the duration of the surgery, the length of the incision, intraoperative complications, and technical difficulties. Intraoperative blood loss was estimated and combined with the blood loss accumulated in a Hemovac drain that was left in place only for the first eight to twelve hours after surgery.

A cementless Converge cup (Zimmer, Warsaw, Indiana) was used in all sixty patients. The cup had a Durasul liner (Zimmer) in twenty-seven mini-incision procedures and twenty-four long-incision procedures, and it had a Metasul liner (Zimmer) in three mini-incision procedures and six long-incision procedures ($p = 0.82$). The femoral component was a noncemented Anatomic Porous Replacement stem (Zimmer) in twenty-nine hips with a mini-incision and twenty-eight hips with a long incision. A cemented Apollo stem (Zimmer) was used in the remaining three hips.

The pain score was verbalized by the patient to the nursing staff prior to administration of medication and again thirty minutes after the medication had been taken. Any administration of parenteral narcotics was recorded. The pain medications were converted to equianalgesic milligrams of morphine, with use of conversion tables, for statistical comparison of the amount of medications used for each patient[27]. These tables gave the conversions to milligrams of morphine by percentage (e.g., 50% to 67% of the estimated oral equianalgesic dose), so there was some approximation of the conversion doses for these medications.

Functional activities were recorded daily by the physical therapists. They recorded the distance walked, the ability of the patient to transfer and walk safely, and the assistive device used for safety during the second of two daily physical therapy sessions on each postoperative day and at the time of discharge. The time of discharge was determined as the number of hours between the patient's return to a hospital room from the recovery room and the time that he or she was discharged from the hospital.

Postoperative follow-up data were collected at six weeks and six months with use of a patient-generated Harris hip score and the patient's grade of the result as excellent, very good, good, fair, or poor[28]. Manual muscle testing was performed to evaluate the strength of straight-leg raising and hip abduction, which was graded on a scale of 0 to 5[29]. The questionnaires used to obtain the patient-generated data were either completed by the patient during the office visit or were mailed to the patient for completion.

Gait analysis was performed preoperatively and at six weeks and three months postoperatively with the Intelligent Device for Energy Expenditure and Activity (IDEEA) (MiniSun, Fresno, California)[30]. This gait analysis can be performed in an office hallway and provides accurate recordings of the onset, duration, and frequency of stride characteristics as well as detailed analysis of each phase of the gait cycle[30]. The gait performance exercise consisted of patients walking freely at a comfortable stride speed, with or without an assistive device as needed, for 200 ft (61 m) (slow walking); walking at the quickest rate possible for 200 ft (fast walking); and walking through a marker course to evaluate a defined cadence pattern for 200 ft (zigzag walking). Fifteen parameters of gait analysis were measured, including velocity, cadence, stride length, step length, single support, double support, single/double support ratio, swing duration, step duration, cycle duration, pulling acceleration, swing power, ground impact, foot fall, and push-off.

Radiographic Analysis

An independent investigator (Z.W.), blinded to the surgical technique, measured the immediate postoperative and six-

TABLE I Demographic Characteristics

	Mini-Incision (N = 30)	Long Incision (N = 30)	P Value
Gender (F:M)	13:17	16:14	0.30
Side (R:L)	18:12	18:12	1.00
Age* *(yr)*	70.3 ± 9.7 (44-84)	63.9 ± 13.6 (34-87)	0.39
Weight* *(kg)*	82.3 ± 19.0 (50.0-127.3)	91.2 ± 24.2 (49.1-147.7)	0.12
Height* *(m)*	1.7 ± 0.1 (1.6-1.9)	1.7 ± 0.1 (1.5-2.0)	0.72
Body mass index*	27.6 ± 4.5 (18.9-37.8)	30.2 ± 6.5 (22.6-49.4)	0.07
Preop. pain score†	21.3 ± 7.3	21.3 ± 6.8	1.00
Preop. limp score†	4.5 ± 4.03	5.3 ± 3.8	0.73
Preop. Harris hip score†	64.40 ± 12.80	63.33 ± 14.15	0.87
American Society of Anesthesiologists (ASA) grade (1/2/3/4)	2/17/10/1	2/14/13/1	0.51

*The values are given as the mean and standard deviation with the range in parentheses. †The values are given as the mean and standard deviation.

month follow-up anteroposterior pelvic and Lauenstein lateral radiographs to determine the inclination, anteversion, and fixation of the cup; the fit and alignment of the cementless stem; and the quality of the cement mantle in the three patients with a cemented stem. Cup inclination was measured from the inter-teardrop line[31]; cup anteversion, with use of the method of Dorr and Wan[32]; and cup fixation, with the method of Udomkiat et al.[33]. Stem alignment was measured on the anteroposterior pelvic radiograph[31], and the quality of the cement of the cemented stems was assessed with the method described by Barrack et al.[34]. Comparison of the limb lengths was based on the distance from the midpoint of the lesser trochanter to the interischial line, and the offset was determined by comparison of the distance from the center of the femoral head to the femoral shaft axis. Heterotopic ossification was graded with the method of Brooker et al.[35].

Statistical Analysis

Statistical analysis was done with use of the SPSS software package (SPSS, Chicago, Illinois). A Kolmogorov-Smirnov test for normal distribution was used before further statistical analysis was conducted. A chi-square test was used for dichotomous values, and t tests were done for continuous values. The Mann-Whitney U test was done for nonparametric variables. General linear model repeated-measures analysis was used to compare gait characteristics, and this test provides analysis of variance when the same measurement is made several times on each subject. A p value of <0.05 was considered to be significant for each alpha analysis. Power analysis was done for each statistical comparison performed.

Because the difference in body mass index between the two study groups (27.6 compared with 30.2) had a p value of 0.07, a univariate analysis of variance (analysis of covariance) was done to identify any influence of demographics on the comparison between the two groups. Use of pain medicine and the pain score before and after administration of the medicine on the day of the surgery and on the first and second postoperative days were selected as the dependent variables; the type of incision (mini or long) and gender were selected as the fixed factors; and age, weight, and body mass index were selected as the covariates.

Results

There were no significant differences between the two groups with regard to the demographic factors or the preoperative body mass index, pain score, limp score, patient-generated Harris hip score, or ASA grade (Table I). Twenty-seven patients in the mini-incision group and twenty-five patients in the long-incision group had a diagnosis of osteoarthritis; the remaining patients had posttraumatic arthritis, developmental dysplasia of the hip, or osteonecrosis.

The surgical times and hematologic parameters for the two groups are presented in Table II. There was a significant postoperative reduction in the hemoglobin and hematocrit levels in each group ($p = 0.001$), but there were no significant differences between the groups. Fifty-seven of the sixty patients received an intraoperative transfusion of one unit of autologous blood, which was part of the anesthetic protocol.

Patients with a long incision had more pain before the administration of medications on each postoperative day. The differences were significant on day 1 and at the time of discharge (Table III). The doses of pain medication (measured in equianalgesic milligrams of morphine) in the mini-incision and long-incision groups, respectively, were 32.7 ± 17.3 mg and 33.7 ± 24.1 mg on the day of surgery; 45.6 ± 20.3 mg and 50.9 ± 19.5 mg on day 1; and 31.2 ± 22.9 and 41.5 ± 20.0 mg on day 2. Intravenous narcotics were needed by seven (23%) of the thirty patients who had a long incision and by one patient (3%) who had a mini-incision ($p = 0.03$, power = 0.7).

The two groups differed significantly with regard to the

TABLE II Intraoperative and Hematologic Data

	Mini-Incision*	Long Incision*	P Value
Incision length *(cm)*	9.8 ± 1.0	19.78 ± 1.2	0.0001†
Surgical time *(min)*	99.69 ± 24.57	110.67 ± 40.61	0.20
Intraoperative blood loss *(mL)*	295.0 ± 124.12	348.3 ± 131.0	0.64
Blood loss in drain *(mL)*	57.3 ± 63.5	60.0 ± 68.7	0.89
Total blood loss *(mL)*	352.3 ± 145.5	408.3 ± 158.3	0.12
Hemoglobin (g/L)			
Preop.	134 ± 13	135 ± 13	0.96
Postop.	105 ± 11	104 ± 13	0.95
Hematocrit *(%)*			
Preop.	39.4 ± 4.3	40.7 ± 4.4	0.25
Postop.	32.5 ± 4.0	32.4 ± 2.9	0.93

*The values are given as the mean and standard deviation. †The difference was significant.

need for an assistive device. Patients with a mini-incision used less support for walking on postoperative days 1 and 2. On day 1, eight used a cane, seven used one crutch, twelve used two crutches, and none used a walker, whereas the respective numbers for the patients with a long incision were two, thirteen, nine, and three ($p = 0.044$). On day 2, five patients in the mini-incision group used a cane, four used one crutch, six used two crutches, and four used a walker; the respective numbers for the patients treated with a long incision were zero, six, nine, and ten ($p = 0.048$). (The numbers do not equal thirty because some patients were discharged home on the mornings of day 1 and day 2.) Twenty-six (87%) of the thirty patients treated with a mini-incision used a single assistive device (a cane or single crutch) at the time of discharge compared with sixteen (53%) of the patients treated with a long incision ($p = 0.005$, power = 0.83). There was no significant difference in walking distance at the time of discharge between the two groups.

The length of the hospital stay was shorter in the mini-incision group (63.2 ± 13.3 hours compared with 73.6 ± 23.5 hours in the long-incision group; $p = 0.04$, power = 0.52). Twenty-nine (97%) of the thirty patients with a mini-incision and twenty (67%) of the thirty with a long incision achieved the goal of discharge by the second postoperative day ($p = 0.003$, power = 0.91). Fifty-nine of the sixty patients were discharged to home. One patient with a mini-incision was discharged to a rehabilitation unit.

By six weeks postoperatively, there was no difference in the clinical outcome between the two groups as measured with the patient-generated Harris hip score and with manual muscle testing of straight-leg-raising and side-lying-abduction (gluteus medius) power. The mean patient-generated Harris hip score at six months was 96.8 points for the patients with a small incision and 96.0 points for those with a long incision. At six months, the outcome, as assessed by the patient, was excellent in twenty-one patients in the mini-incision group and twenty-seven in the long-incision group, very good in eight patients in the mini-incision group and one patient in the long-incision group, good in two patients in the long-incision group, and fair in one patient in the mini-incision group.

Complete gait-analysis data were obtained for twenty-five patients (thirteen with a mini-incision and twelve with a long incision). The demographic characteristics were comparable between these two groups. All patients showed improvement, between the preoperative and postoperative evaluations, in all gait-analysis characteristics ($p = 0.001$), and no differences were observed between the patients with a mini-incision and those with a long incision.

Radiographic measurements showed no significant differences between the two groups. The measurements of clinical importance are listed in Table IV. Only one hip in each group had any heterotopic ossification, which was Grade 1 in

TABLE III Pain Scores

	Pain Scores	
	Mini-Incision*	Long Incision*
Day of op.		
Before medication	2.5 ± 1.6	3.3 ± 1.7
After medication	1.3 ± 1.1	1.8 ± 1.3
1st postop. day		
Before medication	2.6 ± 1.0	3.4 ± 1.0†
After medication	1.7 ± 1.0	1.6 ± 1.0
2nd postop. day		
Before medication	2.5 ± 1.5	3.1 ± 1.2
After medication	1.0 ± 1.0	1.5 ± 1.0‡
Time of discharge	2.2 ± 1.0	3.1 ± 0.9§

*The values are given as the mean and standard deviation. †$P = 0.002$. ‡$P = 0.05$. §$P = 0.002$, power = 0.81.

TABLE IV Radiographic Measures

Measure	Mini-Incision*	Long Incision*	P Value
Cup inclination *(deg)*	42.6 ± 4.7	41.7 ± 6.7	0.56
Cup anteversion *(deg)*	25.2 ± 4.9	24.7 ± 4.2	0.65
Stem alignment *(deg)*	0.7 ± 1.1	1.0 ± 1.5	0.79
Limb-length discrepancy *(mm)*	−0.9 ± 6.2	0.7 ± 6.7	0.19
Offset (mm)	4.0 ± 6.5	1.8 ± 5.5	0.18

*The values are given as the mean and standard deviation.

one and Grade 2 in one. The change in the center of rotation of the hip was within 5 mm in both groups.

There were no intraoperative complications or technical difficulties. None of the incisions required intraoperative conversion to a longer incision. There were two reoperations in each group. In the mini-incision group, one reoperation was done to treat an infection and the other was done because of a periprosthetic fracture. In the long-incision group, both reoperations were done to treat a periprosthetic fracture. The three periprosthetic fractures were sustained in falls at home. There were no dislocations during the first postoperative year. One patient with a long incision had a symptomatic deep venous thrombosis in the calf diagnosed at three months.

Discussion

Compared with the traditional posterior incision, the posterior minimally invasive operation provided better perioperative pain control, resulted in better early function, and allowed an earlier discharge to home. Cosmetic appearance was not a factor because all patients had a skin incision of the same length. The primary benefits of the mini-incision procedure were derived in the early perioperative period as no significant clinical differences were observed during subsequent follow-up assessments. These early differences may have been measured in our patients but not in other randomized studies[4,9] because we encouraged patients to achieve these goals rather than permitting passive recovery.

Most of the benefits of posterior small-incision total hip replacement have been inferred from retrospective cohort studies or prospective case series with or without comparison with historical or matched cohorts[2,3,5-8,10-18]. In a randomized study of twenty-eight patients treated with a small (8-cm) incision and thirty-two patients treated with a 15-cm incision, Chimento et al.[4] found less blood loss and less limping in the small-incision group at six weeks but no functional difference between the groups at one and two years postoperatively. In another randomized study, Ogonda et al.[9] compared 109 patients with an incision of ≤10 cm with 110 patients with an incision of 16 cm and found the only difference to be less blood loss in the mini-incision group; all other radiographic and functional parameters were comparable at six weeks. Although Chimento et al. found less limping at six weeks in their mini-incision group, neither we nor Ogonda et al.[9,36,37] found any differences in the results of the clinical examination or gait analysis at six weeks or thereafter. The surgical technique used by Chimento et al., for both the long and small incisions, was similar to ours, with release of the gluteus maximus tendon and the quadratus muscle in the long-incision group. Ogonda et al. described their surgical techniques simply as differing in terms of the length of the skin incision[9].

Our in-hospital results favoring use of the small incision may be attributable to our technique of surgical dissection of deep tissues, our pain management technique (which did not differ between groups), or the temporal challenges placed on the goals to be met; it is not possible to quantify the influence of those factors. The similarity of the results between the small-incision and long-incision groups by six weeks in our study and in the other two randomized studies[4,9] suggests that, regardless of the details of the surgical technique, the ultimate results of the two procedures, performed by experienced surgeons, are equivalent.

There are several limitations of this study. The first limitation was the size of the comparative groups, which did not allow the power to reach 80% in the analyses of several measurements. On the other hand, we did have adequate power to measure differences in pain and function. The second limitation of this study is its generalizability. We have a dedicated joint-replacement team and do not know how reproducible these results would be without such a team. Thirdly, we used computer navigation for predictable component placement, which is not universally employed in small-incision surgery. We recognize, however, that satisfactory component placement in posterior mini-incision operations without the use of computer navigation has been documented[2-6,8,9,11,12,16,17]. A fourth limitation is that our randomized groups were enrolled from a pool from which 171 patients had been eliminated. This created a selection bias, not between the randomized groups but in a comparison of our results with those in other studies. This is an inherent possibility in all randomized studies in which the investigators do not enroll 100% of the patients who are candidates for the study. A fifth limitation of this study was that we did not assess the long-term results for these patients. However, we consider the primary benefits of small-incision surgery to be derived in the early perioperative

period, and we compared the results in that period. We also assume that if there is no increase in complications or changes in the positions of the component, there is no reason to believe that the long-term results would differ from those seen in the short term[38]. The sixth limitation was that our technique for conventional total hip arthroplasty may differ from that of other surgeons. We routinely released the gluteus maximus tendon and quadratus femoris muscle and incised the anterior-superior aspect of the capsule.

The most prevalent complication in these patients was postoperative fracture from a fall, which occurred in both the short and the long-incision groups. The gait analysis showed significant postoperative improvement in all of the patients who were evaluated, but the measurements were not normal in either group. Therefore, in the first six postoperative weeks, some patients do not have adequate lower-limb strength or balance to be completely safe. Rapid-recovery protocols may give patients the confidence to perform activities, or walk without assistive devices, before they should. We now emphasize to patients that they have reduced lower-limb strength and balance and that they need to be safe and not exceed their capabilities. For instance, older patients, who have the most difficulty with balance, are encouraged to use a walker when they get up at night until they have regained a safe level of balance.

This study demonstrated in-hospital benefits of the posterior mini-incision total hip replacement for early reduction of pain and increases in function. All other measured clinical outcomes were equivalent by six weeks. We believe that the surgeon and the patient should make the ultimate decision about the operation and, if a long incision is preferable, it should be performed. If the patient's surgical preference cannot be chosen, additional time should be spent in educating that patient about the reasons necessitating the surgeon's recommendation. A patient who feels that he or she is a part of the medical decision-making process is more likely to take responsibility for the outcome. We continue to do mini-incision surgery as we have shown that it is safe and that it provides early pain relief and good functional results. ■

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