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Posterior Mini-Incision With Primary Total Hip Arthroplasty: A Nine to Ten Year Follow Up Study

Yohei Yukizawa, MD, Lawrence D. Dorr, MD, Jeri A. Ward, RN, Zhinian Wan, MD

Keck Medical Center of USC, Department of Orthopedic Surgery, Los Angeles, California

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ABSTRACT

The question has been raised as to whether small incision surgery will compromise long term results of total hip arthroplasty. We report nine to ten years' outcome with posterior mini-incision. Radiographs were measured for component position, polyethylene wear, fixation, and osteolysis. Sixty-two of the original 86 patients (76 of 100 hips) were alive and available for study with 17 patients deceased (with known results) and seven (8%) lost to follow-up. The result was rated as excellent in 70 of 75 remaining hips (93%). Eighty-nine of 93 hips (96%) with known results had the original implants. Radiographically, wear was a mean 0.015 ± 0.009 mm/year, and no hip had impending failure. There were four revisions, 2 for dislocation, 1 for fracture, and 1 for loose cup.

Minimally invasive total hip arthroplasty is defined by a surgical technique with reduced tissue trauma to the skin and underlying tissues. The advantages of short incisions for total hip arthroplasty have included: less pain [1,2], more rapid recovery [1,3,4], decreased blood loss [2,4,5] and better cosmetic appearance [6,7]. For patients, the primary benefit has been a sense of less violation of their body and exceeding their expectations, which improves their confidence in their operation [7,8]. However, the question as to whether or not a short incision will compromise longer term outcomes [9–11] has little data to answer it. The purpose of this study was to report the results of patients with a posterior mini-incision approach for total hip arthroplasty at ten years follow up.

We previously reported the technique used for the posterior mini-incision for total hip arthroplasty, and the immediate postoperative results of 86 consecutive patients with 100 hips operated in 2004 [12]. These hips were operated using imageless computer navigation for confirmation of cup inclination and anteversion, and the articulation surface was metal against highly cross-linked polyethylene. The purpose of the previous publication was to detail the technique of the posterior mini-incision, demonstrate that the operation could be performed safely, that component positions could be reproducibly achieved with computer navigation, and to report the immediate postoperative results with these patients. The current study reports the outcomes of these patients/hips at their nine to ten year follow-up with clinical and radiographic evaluation done using the identical criteria of the previous study.

The index study showed that the mean incision length was 8.5 cm ± 0.9 cm, the operating time was a mean 85.6 minutes ± 20.8 minutes (range 60–150 minutes). Operative time was prolonged by a mean 19 minutes by using computer navigation. The time in the hospital was mean 73.1 hours (3 days) ± 17.4 hours (3/4th of a day) with all patients discharged home. At three months, 84 of 86 patients were using no assistive device. The radiographs showed the acetabular inclination was a mean 41° ±5° and anteversion was 22.6° ± 3.8°. Leg length was 0.1 mm ± 5.7 mm, and offset was 2.2 mm ± 5.3 mm different from the contralateral leg.

The results of these patients at 9 to 10 years after surgery are compared to the historic reports of total hip arthroplasty at the same time period postoperatively using conventional (standard) incisions.

Materials and Methods

A consecutive series of 86 patients (100 hips) underwent total hip arthroplasty by a mini-incision posterior approach between January and October 2004 [12]. At current follow up, 17 patients (20%) had died from a cause unrelated to the arthroplasty with their results known, and 7 patients (8%) were lost to follow up. For this study there were 62 patients with 76 hips. All were given a detailed explanation of this study and the alternatives to participation, and all were provided a written informed consent which was approved by our institutional review board. For patients not at their original addresses, follow up was done using social security numbers, and a private detective service. The mean age of the patients at the time of surgery was 63 years and 55 of 86 (64%) were women; at current follow up, the mean age was

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Reprint requests: Lawrence D. Dorr, M.D., Keck Medical Center of USC, Department of Orthopedic Surgery, 1520 San Pablo Street, Suite 2000, Los Angeles, CA 90033.

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Table 1
Patient Demographics.

Demographics	Data
Patients/hips total	86/100
Lost to follow-up	7/7
Patients/hips known	79/93
Dead	17/17
Patients/hips surviving.	62/76
Diagnosis, osteoarthritis	52
Osteonecrosis	10
Age, years	69±4
Complications	
Loose cup, aseptic	1*
Dislocation, acute	1*
Dislocation, late	2*
Femur fracture, acute	1
Femur fracture, late	1*
Revisions	4

Legend: * = Revision. Revision for 1 acute and 1 late dislocation was exchange of head and liner. Late periprosthetic femur fracture revised with new stem.

69 years (42–86 years) with 40 of 62 (64.5%) being women. At current follow up, 48 patients had a unilateral total hip arthroplasty, and 14 had bilateral implants for a total of 76 hips. The demographics are enumerated in Table 1.

Twenty-nine patients (35 hips) returned to the clinic for physical examination and radiographs; 25 patients with 30 hips returned the self-graded Harris hip score [13] by mail and 16 sent radiographs; 8 patients with 10 hips were graded by one of us (JW) by telephone. Radiographs were obtained in a total of 42 patients with 51 hips.

Outcomes used were the same as we have used for standard incisions. The clinical score for the longer term follow up in this study was the same patient-generated Harris hip score [13], as used in the original study; and patients graded themselves as excellent, very good, good, fair or poor (one patient with dementia was not included in these grades). For the 28 patients (35 hips) examined in our clinic, the range of motion was recorded as well as manual muscle testing for the strength of straight leg raise and sidelying abduction using a scale of 0–5 [14]. The use of any assistive walking device was asked of all patients. Complications of dislocation, infection, revision-reoperation were also recorded.

Radiographic data from this longer term study were measured from an anterior-posterior pelvic radiograph and a lateral modified Lauenstein (Cleave) view. Cup positions were measured using the same methods as in the original study: inclination by Callaghan et al [15], and anteversion by the modified method of Ackland et al [16]. The annual linear polyethylene wear was measured by the method of Wan et al [17]. All radiographic measurements were performed by a research fellow (YY) who had not been involved with the surgery or original study.

All patients were operated with the same surgical technique by a single surgeon (LDD) [12]. The surgeon had 25 years experience with a posterior incision with a volume of more than 4000 total hip arthroplasties with that incision for both primary and revision total hip arthroplasties. The computer navigation program was developed during 2003 and the learning curve for its use during this time and in 2004 is documented [18]. The patients in this study were in the final groups of this learning curve of computer use. The minimally invasive posterior mini-incision had been performed for two years by the surgeon with a volume of 200 hips prior to this study group in 2004. The anesthesia for these patients was epidural with sedation. The skin incision was located at the posterior edge of the greater trochanter with an 8–10 cm length and extended proximal from the level of the vastus tubercle to just proximal to the posterior tubercle of the greater trochanter. The exposure of the hip was done by three dissections of hip tissues: the first was separation of the gluteus maximus for 6–8 cm along the posterior edge of the greater trochanter; the short external rotators were released in a single flap with the posterior capsule sparing the quadratus femoris, and this flap was repaired at the completion of the operation; the third incision into hip tissue was the inferior medial capsule (over the transverse acetabular ligament) which allowed retraction of the femur anteriorly with minimal tension on the sciatic nerve. In our technique, the gluteus maximus tendon insertion onto the femur, and the tensor fascia (iliotibial band) were not incised. The only difference in technique today is we preserve the piriformis tendon.

A cementless titanium/aluminum/vanadium alloy Converge cup (Zimmer, Warsaw, IN) was implanted into all hips using imageless computer navigation instrumentation (Orthosoft, version 1 software, Zimmer, Warsaw, IN). This software allowed the cup inclination and anteversion to be determined in the functional plane (radiographic plane of Murray [19]) rather than the anatomic plane. The center of rotation in the superior and medial planes could be controlled by monitoring the depth of reaming. The articulation surface was Durasul highly cross-linked polyethylene (Zimmer, Warsaw, IN) with a cobalt-chromium metal head. Non-cemented stems were used in all patients. The stems used were the anatomic porous replacement (APR) in 85 hips, Wagner in 3 hips, precedent in 4, and natural in 8 hips (all were titanium/aluminum/vanadium metal alloy and manufactured by Zimmer, Warsaw, IN). All of these stems had diaphyseal grit blasting which included the stem tip. Stems were selected by the design needed for the anatomy and geometric deformity of individual patients.

The postoperative protocol was full weight bearing ambulation on the day of surgery, and discharge using the least assistive device necessary. Fifty of 86 patients (58%) were initially discharged using a cane.

Statistical analyses were performed using SPSS Version 2 software, (SPSS, Japan Inc., Tokyo, Japan). For analysis for all measurements, the means and standard deviations were calculated. A Kolomogrov–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. Differences in the variables were statistically examined with the use of a paired Student's t-test or Wilcoxon t-test. A P value of less than 0.05 was considered to be statistically significant.

Results

A summary of the patient demographics and complications ais listed in Table 1. At this follow up the mean value of the Harris hip score was 95.1 ± 12.7. Ten of 62 patients (16%) reported pain in other joints or their back, and 51 (84%) had no or mild pain of the hip. The Harris total pain score decreased from 43.9 ± 0.6 at 3 months after surgery to 40.8 ± 7.3 at current follow up ($P < 0.01$). Fifty-five of 62 patients (90%) used no assistive device compared to 82 of 84 (98%) at 3 months; muscle strength graded a mean 4.7 (range, 3–5) for straight leg raise and mean 4.6 (range, 4–5) for sidelying abduction compared to a score of 4.9 ± 0.3 for both tests at 3 months. Fifty-six of 62 (90%) of patients graded their result as excellent in 70 of 75 hips (93%), 4 (6%) patients (4 hips) as very good, and 1 patient (1 hip) 1% as fair. One patient had severe dementia and was not graded. Because 7 patients (7 hips) were lost to follow up, 75 of 79 (95%) patients and 89 of 93 (96%) were known to have retained their original components.

The current 10 year radiographic findings showed no change in inclination or anteversion of the cup from 3 months postoperative (Table 2). Radiographic outliers (these can differ from computer navigation values) from the Lewinnek et al [20] safe zone at 3 months were inclination <30° in one patient and >50° in four patients; for anteversion <5° was none, and >25° was two patients. At ten years, inclination <30° was one patient, and >50° was two patients; for anteversion <5° was none and greater than 25° was five patients. Linear wear was a mean 0.015 mm/yr ± 0.009 mm/yr (range, 0.01 mm to 0.04 mm/yr). The wear for each head size used is listed in Table 2. No hip had new or progressive radiolucent lines suggestive of impending failure of the cup or stem [21,22]. Mild stress shielding was observed in 36 of 51 hips (71%), and no moderate or severe stress shielding was observed [23].