Original Article

Survivorship and Clinical Results of Fixed Bearing All-Polyethylene Unicompartmental Knee Arthroplasty in the Thai Population: A Five to Ten Year Follow-up Study

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Background: Treatment of medial compartmental osteoarthritis with fixed-bearing all-polyethylene unicompartmental knee arthroplasty has had many positive results in long-term studies, but there have been no reports of survivorship rates among Thais or other Asian people.

Objective: To study long-term (five to ten year) clinical outcomes and survivorship of fixed-bearing all-polyethylene unicompartmental knee arthroplasty among Thai patients.

Materials and Methods: A retrospective study was conducted of survivorship and clinical outcomes of 67 consecutive unicompartmental knee arthroplasties (59 patients) which had been performed during the period July 2000 through February 2010 using cemented all polyethylene. All the patients had isolated unicompartmental disease. One patient died less than 10 years after the operation, and two patients were lost to follow-up, leaving 56 patients (64 knees) in the study with a minimum of five to ten years of follow-up. The average duration of follow-up was 62.6 months (range 60 to 120). Survivorship was analyzed using the Kaplan Meier survivorship curve, and clinical results were analyzed using the Knee Society score and Functional score.

Results: The average age of the patients at the time of their operation was 65 years (range 48 to 83). Forty-eight patients (74.6%) were female and eight (14.28%) were male. Twenty-eight knees (44%) were right side and thirty-six (56.25%) were left side. The average Knee Society and Functional scores at the last follow-up were 98.23 and 96.25, respectively. At that time, the average knee flexion arch was 138.57 degrees. One patient had undergone revision total knee arthroplasty at the seventh year postoperative due to infection. Kaplan-Meier analysis revealed a survival rate of 98.44% at ten years with revision of any reason as the end point.

Conclusion: The excellent survivorship results indicate that the use of cemented fixed-bearing all polyethylene in unicompartmental knee arthroplasty is safe and yields predictable results in the Thai population.

Keywords: Unicompartmental knee arthroplasty, All-polyethylene tibial component

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Isolated unicompartmental osteoarthritis of the knee is a common ailment. There are many operative treatment choices, e.g., high tibial osteotomy and unicompartmental knee arthroplasty. The choice of treatment is dependent on the age of the patient and their level of activity. The advantages of unicompartmental knee arthroplasty are preservation of bone stock, normal biomechanics, a lower level of invasiveness, better range of motion, and faster recovery[1]. Early reports on the results of unicompart-

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mental arthroplasty were discouraging[2,3], but more recent studies have reported ten-year survival in more than 90% of patients. This improvement in results is associated with advances in surgical technique, more precise preoperative patient selection, and improved implant design[4-9]. In Thailand, however, there have been no reports of the results of cemented all-polyethylene unicompartmental knee arthroplasty, in particular, no midterm results. The purpose of this study was to determine the clinical outcomes and survivorship rates for a minimum of five to ten years of all-polyethylene unicompartmental knee arthroplasty patients in the Thai population.

Materials and Methods

Following approval from the local ethics committee, we designed a retrospective study of unicompartmental knee arthroplasties carried out between July 2000 and February 2010. During that period, a single senior surgeon performed 67 consecutive all-polyethylene unicompartmental knee arthroplasties on 59 patients. One patient (one knee) died less than ten years after the operation as a result of causes unrelated to the unicompartmental arthroplasty. Two patients (two knees) were lost to follow-up and could not be contacted. A total of 56 patients (64 knees) were enrolled in the study. All patients were candidates for unicompartmental knee arthroplasty according to Kozinn and Scott[10]. Patients were candidates for the present study if prior to surgery they met all of the following criteria: symptoms of medial knee pain; no anterior knee pain; body weight less than 180 lbs (82 kg); intact ACL, PCL and collateral ligaments; varus deformity of less than 10° and passively correctable when applying valgus force; flexion arch of more than 90°; and flexion contracture less than 10°. Preoperative standing anteroposterior and lateral radiography confirmed a grade II or III osteoarthritic knee based on the Ahlback[11] classification. Patients were excluded if they suffered from an inflammatory joint disease which affected the knee, e.g., rheumatoid arthritis, gouty arthritis, or chondrocalcinosis, a post-traumatic knee, or a high tibial osteotomy knee. Age was not an exclusion criteria. The final decision to carry out a unicompartmental knee replacement was made intraoperatively after checking the ACL competency and the thickness of the lateral compartment cartilage. The condition of patellofemoral articulation was classified according to the Outerbridge[12] system, and was an exclusion criterion if greater than grade III. The implant design was an all-polyethylene fixed-bearing unicompartmental knee prosthesis, called Preservation (DePuy (Johnson & Johnson), Warsaw, IN, USA). The prosthesis consisted of a femoral component made of a cobalt-chromium alloy and one peg for femoral component fixation. The tibial component inserts were all-polyethylene. The shape of the tibial articulating surface was flat, to allow for unconstrained motion of the femur on the tibia, and had two pegs to provide enhanced fixation. The surgical instruments used included an extramedullary cutting jig for the femur and an extramedullary cutting attachment for the tibial component.

The operation was performed by a single senior surgeon using a minimally invasive surgery [MIS] technique. After arthrotomy, the anterior cruciate ligament [ACL] was inspected and tested for competency by clamping, and then the lateral compartment of the femoral condyle as well as the patellofemoral joint articulation were checked for the presence of erosion or fibrillation. The surgical goal was surface replacement arthroplasty without ligament release or overcorrection of medial soft tissue in either group. The tibial bone resection was performed using an extramedullary guide with following the patient's natural slope. Bone resection of the distal femur was carried out with an intramedullary alignment guide. The tibial and femoral components were cemented with antibiotic bone cement. All patients received [*Zinacef] for one day as infection prophylaxis. Deep vein thrombosis [DVT] prophylaxis was managed with mechanical foot pumps rather than chemical thromboprophylaxis. Clinical evaluation was made based on the Knee Society score and functional score for all patients.

Statistical analysis

Using 'revision of the prosthesis for any reason' as the end point, a life table was constructed and rates of survival determined using the Kaplan-Meier survival analysis[13].

Results

Preservation-type unicompartmental knee arthroplasties with all-polyethylene tibial components were performed at our institute between July 2000 and February 2010 for the treatment of medial compartment knee osteoarthritis, a total of 59 patients. One patient died from causes unrelated to the study and two patients that underwent operations did not return for follow-ups, so a total of 56 patients (64 knees) were

available for retrospective review. There were eight males (14.28%) (one with bilateral knees) and 48 females (74.6%) (seven with bilateral knees). The mean age was 65 years (range 48 to 83). A total of 28 implants (44.4%) were right side and 36 (56.25%) were left side (Table 1). Etiology of all the patients was osteoarthritic knee. The mean follow-up period was 62.6 months (range 60 to 120). The average range of knee flexion was 118° (range 110° to 125°) preoperatively and 138.57° (range 100° to 150°) at the time of the final follow-up. The average Knee Society score improved from 85 points (range 80 to 89) preoperatively to 98.23 points (range 90 to 99) at the time of the last follow-up, and the average Knee Society functional score improved from 80 points (range 72 to 86) to 96.25 points (range 89 to 99) (Table 2). The preoperative mechanical axis of the lower limb was 174.12° (range 172° to 177°). There was no overcorrection of mechanical axis alignment. The mechanical axis of the lower limb post-operation and at the final follow-up were 176.25° (range 173° to 177°) and 175.30° (range 172° to 177°), respectively (Table 3).

The Kaplan-Meier analysis of survivorship of the patients representing all 64 knees revealed a ten-year survival rate of 98.44% (95% confidence interval) (Table 4) [*analysis of revisions for any reason with radiographic loosening as the end point is shown in Figure 1]. Within the ten years of follow-up, one case was revised due to radiolucency beneath the tibial component and subsidence (which is a sign of loosening) resulting from infection after an operation at seven years post-op. Another case had some degree of instability from polyethylene wear and the radiograph

Table 1. Patient demographic data at the time of surgery

Characteristic	Mean	SD	Minimum	Maximum
No. patients	56	-	-	-
No. knees	64	-	-	-
Age (years)	65	5.29	48	83
Male (%)	8 (14.28)	-	-	-
Female (%)	48 (74.6)	-	-	-
Right knee (%)	28 (44.4)	-	-	-
Left knee (%)	36 (56.25)	-	-	-
Weight (kg)	63.39	6.74	47	76.50
Hight (cm)	156.55	6.63	147	170
BMI (kg/m^2)	25.90	2.67	19.90	30

Table 2. Knee Society, Functional Score, and flexion arch pre-op and at last follow-up

	Pre-operative				At last follow-up			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
Knee Society score	85	5.25	80	89	98.23	6.11	90	99
Functional score	80	6.06	72	86	96.25	7.99	89	99
Flexion arch	118	7.75	110	125	138.57	8.98	100	150

Table 3. Mechanical axis and alignment from radiographic data pre-op, post-op, and at last follow-up

	Pre-operative		Post-operative		At last follow-up	
	Mean	Range (min-max)	Mean	Range (min-max)	Mean	Range (min-max)
Mechanical Axis Alignment (degrees)	174.12 (1.24)	172 to 177	176.25 (1.00)	173 to 177	175.30 (1.28)	172 to 177

Table 4. Life table analysis of all-polyethylene unicompartmental knee patients

Years after surgery	Number at start (knees)	Dead (knees)	Lost to follow-up (knees)	Revision (knees)	Annual success rate (%)	Annual failure rate (%)	Survivorship rate (%)	95% Cl limit
0 to 1	67	0	0	0	100	0	100	98 to 100
1 to 2	67	0	0	0	100	0	100	98 to 100
2 to 3	67	1	1	0	100	0	100	98 to 100
3 to 4	65	0	1	0	100	0	100	98 to 100
4 to 5	64	0	0	0	100	0	100	98 to 100
5 to 6	64	0	0	0	100	0	100	98 to 100
6 to 7	64	0	0	1	98.44	1.56	98.44	97 to 100
7 to 8	64	0	0	0	100	0	98.44	97 to 100
8 to 9	64	0	0	0	100	0	98.44	97 to 100
9 to 10	64	0	0	0	100	0	98.44	97 to 100
10 to 11	64	0	0	0	100	0	98.44	97 to 100

Table 5. Cause of revision

Case	Sex	Age of revision	Revised at (months)	Pre-operative diagnosis	Operative finding
1	Female	73	84	Septic loosening	Loose tibial, femoral component
2	Female	81	-	Instability	Awaiting surgery

showed narrowing of the joint space at the last follow-up. However, that patient decided not to have an operation (Table 5).

The most common complaint in unicompartmental knee arthroplasty is anterior knee pain. In our study, we found the proportions of anterior knee pain in all patients were as follows: no anterior knee pain was reported in 57 knees; four knees were occasionally painful with some activity, particularly deep knee flexion and getting up from a chair; and three knees were mildly painful and did not affect the patient's daily activities. None of these symptoms suggested a need for revision.

Discussion

The purpose of the present study was to evaluate the outcomes and survivorship of preservation-type all-polyethylene tibial unicompartmental knees in Thai patients. Use of medial unicompartmental knee arthroplasty for treatment of medial osteoarthritic knee is well documented, with survivorship of 90% and 95% at 10 years[14,15]. In terms of clinical outcome and functional results, the present study found the mean flexion arch, 138.57°, was quite high when compared to other recent series (121°, Berger et al[16], 125°, Naudie et al[17], and 128°, Argenson et al[14]). This could be due to differences in patient morphology, particularly differences in proximal thigh muscle and fatty tissue between Asian and Caucasian patients as well as specific patient selection criteria. The survival rate in our series was generally similar to metal-backed tibial implant designs series and to mobile-bearing design series, both of which have shown

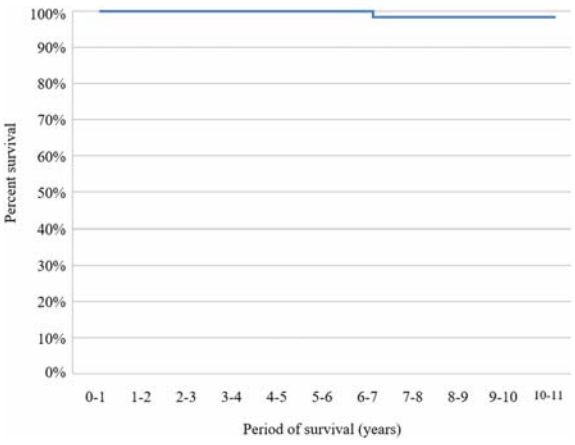

Figure 1. Kaplan-Meier survivorship curve: Revision or loosening as the end point

favorable results including survival rates of 90% to 98%[14,16,17] and 95% to 98%[7,9], respectively, at the 10 year follow-up. However, all-polyethylene fixed-bearing designs have shown variable results in some other studies. Romanowski and Repicci[20], using an all-polyethylene inlaid tibial design, reported a 98% survivorship at the eight-year follow-up. In contrast, Mariani et al[21] evaluated a different all-polyethylene bearing design and found a high failure rate of 38% at the 12-month follow-up. Even though excessive wear of the polyethylene is often a mode of failure after unilateral knee arthroplasty[6,22,23], one of the implanted knees in our series was revised due to loosening at the minimum follow-up of seven years. Infection is a serious complication in all kinds of knee arthroplasty, but a rarely reported complication in unicompartmental knee arthroplasty[24,25]. Most authors report no cases of infection in UKA, e.g., Bartley et al[22,23]. In contrast, one revision occurred in our series due to an infection which occurred seven years after the operation. The patient had chronic renal failure, low immunity, and needed hemodialysis three times per week, so it was likely a hematogenous infection. The patient was treated using a two-stage procedure with a good results. A limitation of this study was that two patients were lost to follow-up, representing 3.3% of the patients. Advantages of our series include the precise criteria, the use of a single identical type of prosthesis, and the fact that all operations were conducted by a single surgeon.

Conclusion

Unicompartmental knee arthroplasty with an all-polyethylene tibial component is one of the successful procedures available for medial osteoarthritis. Our results, with a follow-up of five to ten years, confirm that the clinical results and survivorship rates are similar to those in previously published long-term series. However, we believe that proper patient selection and meticulous surgical techniques are key to success.

What is already known on this topic?

Fixed-bearing all-polyethylene unicompartmental knee provides good survivorship and excellent average Knee Society and Function scores in Western patients.

What this study adds?

Survivorship and clinical outcomes in ten year follow-ups of Thai (Asian) patients treated with fixed-bearing all-polyethylene unicompartmental knee arthroplasty are comparable to those in Western populations.

Potential conflicts of interest

The authors declare no conflict of interest.

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