

# The epidemiology and surgical outcomes of patients undergoing primary total hip replacement: an Asian perspective

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## ABSTRACT

**Introduction:** The number of total knee replacements far exceeds the number of primary total hip replacements (THR) in Singapore. There is a paucity of data regarding patients who undergo THR in Singapore. This paper aimed to study the epidemiology and early postoperative outcomes of patients receiving primary THR in a single tertiary institution.

**Methods:** This is a retrospective study of all patients undergoing primary THR between January 2003 and December 2005. The following variables were analysed: patient demographics, surgical approach, mode of implant fixation, postoperative complications and functional outcomes using D'Aubigne and Postel scoring.

**Results:** There were a total of 115 patients who underwent primary THR over a 36-month period. The mean age of patients was 55 (range 23–80) years. The male-to-female ratio was 1:2. The most common diagnoses in descending order were as follows: inflammatory arthritis, osteoarthritis, avascular necrosis, hip dysplasia and post-traumatic osteoarthritis. Patients were evaluated at a mean follow-up of 41 months, with 90.8 percent having excellent and good outcomes. There were no statistical differences between the surgical approach and implant fixation with regard to postoperative outcome.

**Conclusion:** In Asian patients, the three commonest aetiologies for degenerative hip arthritis were inflammatory arthropathies, primary osteoarthritis and avascular necrosis. Regardless of diagnosis, the patient groups had comparable functional outcomes following THR.

**Keywords:** arthropathy, degenerative hip arthritis, hip replacement, primary total hip replacement, total hip replacement

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## INTRODUCTION

Unlike knee arthritis, hip arthritis is an uncommon disorder in the Asian population.<sup>(1)</sup> In patients with moderate-to-severe degenerative arthritis, and which is unresponsive to conservative treatment, total hip replacement (THR) is a standard treatment option.<sup>(2-6)</sup> The evolution of THR involved the use of simple biomaterials, such as ivory components and a primitive cement-mix consisting of pumice powder, plaster of Paris and glue. As expected, they all had high failure rates. Modern materials (e.g. stainless steel, cobalt-chromium alloy, acrylics and acrylic resin cements) came into use in the middle of the 20th century. In 1962, Sir John Charnley introduced the concept of low-friction arthroplasty techniques, and these remain the gold standard<sup>(6)</sup> against which other prostheses are measured. There is, however, a paucity of epidemiological and functional outcome data on Asian patients undergoing THR. This study reviewed the clinical characteristics and postoperative outcomes of Asian patients undergoing THR in a tertiary institution in Singapore.

## METHODS

A retrospective study was conducted reviewing all patients who underwent primary total hip replacement in our institution between January 2003 and December 2005. Patients who had revision hip replacement were excluded from this study. Senior orthopaedic surgeons performed all surgical procedures in laminar-flow operating rooms and patients were administered broad-spectrum antibiotics for prophylaxis. Patients were placed in a lateral position and procedures were performed either through an anterolateral or posterior approach. Postoperative rehabilitation protocol allowed all patients immediate weight-bearing as tolerated on postoperative day one. All patients received

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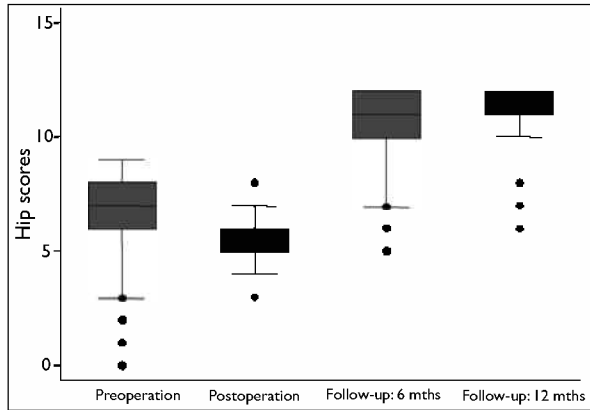


Fig. 1 Boxplot shows hip scores.

antithrombotic stockings and low molecular weight heparins from the first postoperative day and the latter was only discontinued at discharge. In high-risk patients (e.g. with prior history of deep vein thrombosis), extended oral pharmacological prophylaxis (i.e. warfarin) was continued for a period of six weeks.

Following discharge, patients were reviewed at six weeks, six months and 12 months. Thereafter, all patients were followed-up yearly and components were assessed using anteroposterior and lateral radiographs. For our study, patient biodata (e.g. age, gender, diagnosis, comorbidities, ASA category) were collected and entered into a standardised protocol form that was updated in subsequent reviews. Pre- and postoperative outcomes were evaluated using the D'Aubigne and Postel score.<sup>(7)</sup> Radiolucent zones around the femoral stem and acetabular cup were graded using the Gruen et al.<sup>(8)</sup> and DeLee and Charnley<sup>(9)</sup> classification zones, respectively. Authors who were not involved in the original surgical procedure did all the clinical and radiographical assessments. Generalised estimating equations with linear link functions and unstructured correlation patterns were applied to analyse the hip scores over time. In addition, sign rank tests, Fisher exact tests and the Spearman correlation were applied in univariate analyses. The data was analysed with Stata 9.0 (Stata Corp, Texas, USA). All statistical tests were carried out at a 5% level of significance.

## RESULTS

The study cohort comprised 69 (78 hips) women and 35 (37 hips) men. The male-to-female ratio was 1:2. Mean age at the time of THR was 55 (range 23–80) years. The racial distribution of our cohort somewhat paralleled our country's demographics: Chinese with 97 hips (84.3%); Malays with 11 hips (9.6%); Indians with six hips (5.2%); and one Thai patient (0.9%). Mean time from index surgery to most recent follow-up was 41 (range 3–59) months. Most

of the patients (59.3%) had two or more comorbidities at the time of surgery and the three most common comorbidities were inflammatory arthropathies, hypertension and dyslipidaemia. The patients were predominately in the ASA 2 category (61.7%). There were 60 right and 55 left THR; 11 cases were performed as staged bilateral procedures. The different diagnoses that were recorded were inflammatory arthritis (32.2%), osteoarthritis (28.7%), avascular necrosis (22.6%), hip dysplasia (9.6%) and post-traumatic osteoarthritis (6.9%). Of the original 104 patients (115 hips), three (2.9%) were lost to follow-up (range 3–18 months). However, these patients were contacted and telephone survey confirmed neither revision nor any clinical complaints.

The operative approach was anterolateral in 57 hips and posterior in 58 hips. The average acetabular cup size used was 52 (range 46–64) mm, and all were press-fitted and fixation was augmented with screws. The average femoral head diameter was 28 (range 22–32) mm. In this study, 90.4% (104 hips) of the THR patients were cementless. There was statistically a higher usage of cemented stems in patients aged above 60 years ( $p = 0.02$ ). All femoral stems were proximally coated implants. Hybrid THR (i.e. cementless acetabular cup fixation with cemented femoral stem) was done in 9.6% of the cases (11 hips). In almost all cases (114 hips), the bearing option used was metal-on-polyethylene. One patient who was 30 years old, with a diagnosis of systemic lupus erythematosus, had ceramic-on-ceramic THR done. In our practice, due to the limited availability of rehabilitation centres, patients were discharged directly home in 94% of the cases; rehabilitative teams managed 6% of the patients. Thus, the mean hospital length of stay was 8.9 (range 4–21) days. Mean follow-up was for 41 (range 3–59) months.

The preoperative and postoperative outcomes were evaluated using the D'Aubigne and Postel score. The d'Aubigne and Postel rating system, subsequently modified by Charnley, allows the variables of pain, function and motion to be scored from 0 to 6 points for each category; various authors have cited this to be a reliable index.<sup>(10)</sup> Based on this scoring system, 88.5% had excellent results while 2.3% had good results. Generally, the hip scores showed a progressive upward trend after the THR (Fig. 1). There was an initial dip in the scores at discharge, which is attributable to postoperative recovery. There was a statistically significant improvement in hip scores six months following the index procedure ( $p < 0.001$ ). However, the postoperative improvement in hip scores could not be attributed to the demographics (age, gender, ethnicity), ASA grading, approach, bearing types and

**Table I. Longitudinal analysis (generalised estimating equations) of hip score.**

Variable	n	Coefficient	95% CI
Hip score at baseline*	115	0.20	0.06–0.34
Age (years)			
< 60	73	Reference	Reference
≥ 60	42	-0.08	-0.67–0.51
Gender			
Male	37	Reference	Reference
Female	78	0.33	-0.23–0.88
Ethnicity			
Chinese	97	Reference	Reference
Malay	11	-0.48	-1.18–0.23
Indian	6	-0.39	-1.39–0.61
Other*	1	2.82	0.27–5.37
Approach			
Anterior	57	Reference	Reference
Posterior	58	-0.15	-0.62–0.33
Implant			
Uncemented	104	Reference	Reference
Hybrid	11	-0.53	-1.42–0.37
ASA status			
1	9	Reference	Reference
2	71	0.19	-0.76–1.13
3	35	0.23	-0.89–1.35
Comorbid conditions			
0	12	Reference	Reference
1	33	0.14	-0.73–1.01
2	25	-0.02	-0.92–0.88
≥ 3	25	0.47	-0.45–1.38
Missing	20	–	–
Rheumatoid arthritis			
Absent	97	Reference	Reference
Present	18	1.25	-0.24–2.74
Systemic lupus erythematosus			
Absent	95	Reference	Reference
Present	20	0.23	-1.35–1.81
Osteoarthritis			
Absent	82	Reference	Reference
Present	33	0.55	-1.01–2.10
Avascular necrosis			
Absent	89	Reference	Reference
Present	26	1.52	-0.02–3.06
Dysplastic			
Absent	104	Reference	Reference
Present	11	0.32	-1.20–1.84
Trauma			
Absent	107	Reference	Reference
Present	8	-1.51	-3.82–0.80
Visit *	115	2.60	2.39–4.38

\* Statistically significant at 5%

presence of comorbid conditions (Table I).

The various implant and non-implant related complications are listed in Table II. There were three patients in this series that had deep infection. In two patients, this was diagnosed less than six weeks after the index procedure. Both patients had no predisposing factors and had *Staphylococcus aureus* positive wound cultures. They were successfully salvaged with wound debridement, liner exchange and intravenous antibiotics. One patient had methicillin-resistant *Staphylococcus aureus* infection and required eventual implant removal with insertion of cement-spacer. The patient declined any further revision surgery; she had rheumatoid arthritis and Cushing's disease. One patient

with osteoarthritis of the hip had femoral loosening at 12 months and underwent revision arthroplasty. There were no cases of acetabular cup loosening. In this series, there were four dislocations following THR with all occurring within three months following the index procedure. All was related to the posterior approach and all was treated with closed reduction and managed with a hip brace for six weeks. There were no recurrent hip dislocations.

## DISCUSSION

Primary osteoarthritis accounts for as many as 75% of cases in numerous overseas studies, much higher than the 32% in our study.<sup>(3,11,12)</sup> Callaghan et al reported that in their case

**Table II. Various types of complications incurred in the study population.**

Complication	Incidence (%)
Implant-related	8 (7.0)
Hip dislocation	4 (3.5)
Loosening	1 (0.9)
Deep infection	3 (2.6)
Non-implant related	11 (9.6)
Superficial wound infection	3 (2.6)
Deep venous thrombosis	2 (1.7)
Urinary tract infection	3 (2.6)
Acute coronary syndrome	2 (1.7)
Cerebrovascular accident	1 (0.9)

series of 336 patients, the diagnoses consisted of 74% with osteoarthritis and only 1% with avascular necrosis.<sup>(13)</sup> Oishi et al noted that primary osteoarthritis was as high as 60% in the white population, whereas it was about half (30%) in the Japanese population.<sup>(12)</sup> Our patient demographics match the latter study, with 32.2% of patients having primary osteoarthritis. A previously-reported cadaveric study by Das De had also confirmed that primary degenerative conditions of the hip are uncommon in the Asian population.<sup>(1)</sup> The mean age of our patients undergoing THR is 55 years, and this is considerably lower than that reported in various other series. Most series report the common age group as 60–75 years.<sup>(3)</sup> A quarter of our patients had advanced avascular necrosis of the hips and a third had inflammatory hip arthropathies. These conditions predominantly affect the younger patients.

In general, it has been reported that patients with fewer comorbidities experience fewer complications.<sup>(13,14)</sup> Jain et al studied the effects of 959,839 patients undergoing shoulder, hip, knee arthroplasty from the 1998–2000 National Inpatient Samples (NIS) data, and found that postoperative complications were more likely to occur in patients with hypertension, diabetes mellitus and obesity, compared to patients without comorbidities.<sup>(15)</sup> In our study, there was no statistical correlation between the complication rate and the associated number of comorbidities in the patient. However, the authors do acknowledge that our series numbers are smaller than those of previous studies.

Both cemented and cementless implants show equally good and predictable results.<sup>(16–18)</sup> There is often a regional variation in the types of implant fixation opted by surgeons during THR. Herberts and Malchau reported that the use of cementless implants for Sweden is 4%, Norway 14%, Finland 45% and United States 50%.<sup>(19)</sup> In our study, 90.4% of patients had cementless implant fixation and this can be related to a generally younger patient cohort. THR usually shows poorer results in patients with osteonecrosis compared to those with osteoarthritis. The present results

using cementless arthroplasty seem to be somewhat better than those reported for cemented arthroplasty in patients suffering from osteonecrosis.<sup>(20,21)</sup> However, implant choice should also be based on preoperative radiographical assessment. There was one patient in our study who incurred aseptic loosening. In this 62-year-old male patient, the proximal femoral bone stock was optimal; however, he had metaphyseal-diaphyseal mismatch leading to a slight undersizing of the implant. This probably resulted in early aseptic loosening. The optimal choices for this patient would be either a cemented implant or a modular cementless implant. At revision, the surgeon opted to use a modular cementless implant and at four years follow-up, the patient had optimal functional outcome with no clinical complaints. There are various alternative-bearing options that have been utilised in THR. However, metal-on-polyethylene has one of the most-established track records.<sup>(3,4,10,22)</sup> Similarly, our local experience was mainly limited to metal-on-polyethylene bearings. Though newer bearing such as metal-on-metal bearing have 20–100 times lower wear rates, raised blood ion levels in these patients is an unresolved issue.<sup>(23)</sup> Moreover, there have been recent reports of probable implant loosening with metal-on-metal articulations.<sup>(24)</sup>

The deep wound infection rate was slightly higher in our study at 2.6% than the commonly-quoted rate of less than 1%. Philips and Barrett, using medicare data, found a deep infection rate of 0.2% during the first 26 postoperative weeks among 58,521 patients who had primary total hip arthroplasties for any reason other than fracture from 1995 to 1996.<sup>(25)</sup> Our study showed a non-statistical increase in deep infection with the posterior approach. In this study, all infections occurring over a time period of 36 months were reviewed. Only two patients had infection within six weeks and the third patient had deep infection 11 months after the index procedure, which was attributable to immunoparesis due to rheumatoid arthritis and corticosteroid intake. Therefore, the differing infection rate is attributable to the smaller patient cohort with data being reported over an extended time period. The incidence of early dislocations (generally within one year) ranges from 1.9% to 4%.<sup>(11,26)</sup> The overall dislocation rate is 3.5% in our series and is comparable to previous studies. The posterior approach increases the likelihood of dislocation (though not statistically significant,  $p = 0.06$ ) and this finding matches other reports.<sup>(26)</sup> To increase hip stability, larger bearing options are currently recommended.<sup>(27)</sup>

However, our study does not show any significant association between head diameter and the hip dislocation rate ( $p = 0.99$ ). The authors acknowledge some of the study

limitations. The study period was short and this was an early review. However, the main objective was to review the epidemiology of patients who underwent THR, and to correlate this data to functional outcomes. Furthermore, this series reflects on Singapore's local population and may not be representative of all Asians. We conclude that in the Asian population presenting for THR population, inflammatory arthropathies, primary osteoarthritis and avascular necrosis are the most common diagnoses. Regardless of diagnosis, the patient groups have comparable functional outcomes following THR. Moreover, there are no clinical outcome differences between posterior and anterior approaches.

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