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ORIGINAL ARTICLE

Which Approach for Total Hip Arthroplasty

Anterolateral or Posterior?

Jeya Palan MRCS (Eng), David J. Beard DPhil, David W. Murray FRCS (Orth), J. G. Andrew FRCS (Orth), John Nolan FRCS (Orth)

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Abstract The best approach to use when performing THA is controversial. We did a prospective, nonrandomized multicenter study of 1089 THAs to evaluate patient-centered hip scores and dislocation and revision rates when comparing anterolateral and posterior hip approaches at 5 years' followup. Patients were divided into two groups depending on which surgical approach was used: anterolateral or posterior. The primary outcome measure was change in Oxford hip score. At 5 years, there were no differences in change in Oxford hip score and in dislocation or revision rates between the groups.
Level of Evidence: Level II, therapeutic study. See the Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

J. Palan, D. J. Beard (✉), D. W. Murray
Botnar 2 Research Centre, Nuffield Department of Orthopaedic Surgery, University of Oxford, Nuffield Orthopaedic Centre, Oxford OX3 7LD, UK
e-mail: david.beard@orthopaedic-surgery.oxford.ac.uk

J. G. Andrew
Ysbyty Gwynedd District Hospital, Penrhosgarnedd, Bangor, Gwynedd, UK

J. Nolan
Norfolk and Norwich University Hospital, Norwich, UK

Introduction

Various surgical approaches for THA have been described [7, 9, 11, 14, 35], most often with various eponymous (and often confusing) labels associated with them. Two of the most commonly used approaches are the anterolateral (modified Watson-Jones [35]) and the posterior (Southern, Moore, Gibson, or posterolateral [11]) approaches.

According to Weber and Ganz [36], the anterolateral approach was described first by von Sprengel and Bardenheuer. It later was described by Bauer et al. [4] and was modified by Watson-Jones [35] and later by Harris [15], Muller [26], and Charnley [7]. The approach takes advantage of the intermuscular plane between the tensor fascia lata and gluteus medius [17], which are supplied by the superior gluteal nerve. Adequate exposure of the acetabulum necessitates neutralizing the abductor mechanism [17] either by performing a trochanteric osteotomy [7, 26] or by partial detachment of the anterior portion of the gluteus medius and minimus off the greater trochanter. The posterior approach which was described initially by von Langenbeck and then by Kocher according to Mehlman et al. [24], and later by Gibson [11], uses a gluteus maximus split and remains posterior to the gluteus medius and minimus [32]. The posterior hip capsule is divided and the external rotators (piriformis, superior and inferior gemelli, and obturator internus) are detached [23].

Orthopaedic surgeons continue to discuss which surgical approach is best for primary THA because both of these approaches have merits and limitations. A Cochrane review by Jolles and Bogoch [18] concluded, despite numerous studies examining the effect of surgical approach in THA, the quality and quantity of such trials were insufficient to enable a firm conclusion regarding whether one approach was superior to the other. In particular, of the four

prospective cohort studies included in the Cochrane review, only one study by Barber et al. [2] included functional outcomes using Harris hip score with a short followup of 2 years and involving only 49 patients. The effect of surgical approach on dislocation rates after primary THA also has been the primary focus of numerous studies [5, 16, 19, 23, 33], but to date, there is no firm consensus regarding which approach is associated with higher dislocation rates.

The effect of surgical approach on revision rates after primary THA also is subject to debate. Surgical approach has been presumed to affect implant failure rates [21]. However, a radiostereometric analysis study assessing the influence of surgical approach on cemented stem stability concluded there was no difference in stem positioning (with the Exeter™ stem), but the lateral approach may provide a survival advantage in other less rotationally stable stem designs compared with the posterior approach [12].

The purpose of the current prospective multicenter study was to examine the null hypothesis that there is no difference between the anterolateral and posterior approaches when assessing three key independent variables: functional outcome, dislocation rate, and revision rate, at up to 5 years' followup.

Materials and Methods

We prospectively followed 1035 patients with 1089 THAs having either an anterolateral (699 THAs) or posterior approach (390 THAs). The decision to use either the anterolateral or posterior approach was at the operating surgeon's discretion. The power of the study was sufficient (93%) to detect a two-point change in our primary outcome measure, the Oxford hip score (OHS). Murray et al. [27] recently defined a difference of two points in the change in OHS (ΔOHS) as being the minimum clinically important change as seen from the patient's perspective. A two-point difference potentially could mean the difference between having "little difficulty" with a particular activity to having "extreme difficulty," as determined by the questions in the OHS. The OHS has been validated against numerous scoring systems, including the WOMAC and SF-36 scores [28], and is a sensitive outcome tool in assessing the success of THA in the short term [8, 10, 28].

There were 272 male (39.1%) and 424 female (60.9%) patients in the anterolateral group and 140 male (35.9%) and 250 female (64.1%) patients in the posterior group. In three cases, the gender was not noted. In the anterolateral group, there were 38 (5.4%) bilateral THAs, and in the posterior group, there were 16 bilateral THAs (4.1%). The mean body mass index was 27.5 kg/m^2 in the anterolateral group and 27.0 kg/m^2 in the posterior group. The mean ages of patients in the anterolateral and posterior groups were 68.4 years and 67.4 years, respectively. The most common primary diagnosis in both groups was primary osteoarthritis. There were no differences in patient demographics between the two groups (Table 1). The period of patient enrollment in the study was between January 1999 and January 2002 and all patients were followed up for 5 years, at which point, no additional followup was initiated. Data were incomplete in 290 of the 1089 hips (27%) and were dependent on the type of outcome being

Table 1. Patient demographics and preoperative diagnosis

Patient demographic	Anterolateral group	Posterior group	p Value
Gender (total)	696	390	0.166
Male	272	140	
Female	424	250	
Mean age (years) ± 1 SD	68.4 ± −10.7	67.4 ± 11.1	0.115
Mean BMI (kg/m^2) ± 1 SD	27.5 ± 4.9	27.0 ± 5.0	0.124
Preoperative diagnosis*			0.172
Primary OA	609 (87.2%)	321 (82.3%)	
Secondary OA†	31 (4.4%)	22 (5.6%)	
Inflammatory‡	34 (4.9%)	24 (6.2%)	
Fracture§	10 (1.4%)	5 (1.3%)	
Osteonecrosis‖	12 (1.7%)	17 (4.4%)	
Deposition/metabolic¶	2 (0.3%)	1 (0.3%)	
Total	698**	390	

* Relative frequency is shown in parentheses as a percentage; †example: Legg-Calvé-Perthes disease, developmental dysplasia of the hip; ‡example: rheumatoid arthritis, juvenile rheumatoid arthritis; §example: fracture of femoral head with or without dislocation; ‖example: idiopathic, posttraumatic, steroid associated; ¶example: metabolic bone disease; **one primary diagnosis was missing for the anterolateral group; SD = standard deviation; BMI = body mass index; OA = osteoarthritis.

examined. These included 43 of the 1089 patients (3.9%) who were lost to followup, 133 (12.2%) who died between recruitment and the 5-year assessment, 58 (5.3%) who refused further participation at some stage between recruitment and the 5-year followup, and 56 (5.1%) who did not have either preoperative data recorded for type of approach or complete sets of outcome data for 5 years followup.

Surgery was performed by numerous consultant and nonconsultant surgeons. In the anterolateral group, there were 402 consultant-level surgeons and 286 registrar-level surgeons. In the posterior group, there were 301 consultant-level surgeons and 88 registrar-level surgeons. There was a difference ($p < 0.001$) between the two groups in terms of the training grade of the operating surgeon. The anterolateral and posterior approaches used in this series were similar to the techniques described by Roberts et al. [32] and by Hoppenfeld and deBoer [17].

In all patients, a cemented Exeter™ femoral stem (Stryker Howmedica Osteonics, Mahwah, NJ) was used with various acetabular components. The acetabular cups used were Trilogy® (Zimmer, Inc, Warsaw, IN), Elite Plus™, Charnley® Standard, Ogee®, and Flanged (DePuy Orthopaedics, Inc, Warsaw, IN), Exeter™ (Stryker), and Plasma-Cup (Aesculap, Tuttlingen, Germany) and included cemented and cementless cups. The femoral head sizes used were 22 mm, 26 mm, and 28 mm. In the anterolateral group, there were 190 hips with the 22-mm head, 256 hips with the 26-mm head, and 253 hips with the 28-mm head. In the posterior group, there were 71 hips with the 22-mm head, 114 hips with the 26-mm head, and 204 hips with the 28-mm head.

As the primary outcome, we determined the OHS preoperatively and postoperatively, with data being collected by a dedicated research assistant at each of the participating centers. We deemed this the most appropriate instrument for evaluating the effectiveness of THA from the patients' perspective [10, 28]; it primarily assesses pain and function. The OHS is scored from 12 (best) to 60 (worst) and consists of 12 questions, each scored from 1 to 5. We calculated the change in OHS (ΔOHS) at 3 months and at 1, 3, and 5 years postoperatively.

Secondary outcome measures included complication rates of dislocation and revision surgery. A comparison of dislocation rates also was performed depending on the size of femoral heads used (22 mm, 26 mm, 28 mm). Revision surgery was performed for all reasons, including infection, aseptic loosening, and recurrent dislocations.

For the normally distributed numeric outcome measures (OHS and ΔOHS), ANOVA was used to compare differences in data between the groups. We analyzed nonparametric categorical and frequency data with chi square and Fisher's exact tests. SPSS® 12.0.1 for Windows® (SPSS Inc, Chicago, IL) was used for all analyses.

Results

We found no differences between the anterolateral and posterior groups in absolute postoperative OHS or ΔOHS at 3 and 5-year followups (Table 2). There were initial differences in ΔOHS at 3 months and 1 year, with the posterior group having an increased ΔOHS compared with the anterolateral group.

There were no differences ($p = 0.833$) in dislocation rates between the anterolateral and posterior approaches. When dislocation rates were reviewed in conjunction with different femoral head sizes, there were no differences

Table 2. Absolute OHS and ΔOHS between the anterolateral and posterior groups

OHS	Total number of cases	Anterolateral group		Posterior group		p Value*
		Number	Mean (1 SD)	Number	Mean (1 SD)	
Preoperative OHS†	1089	699	44.0 (8.0)	390	44.6 (7.6)	0.241
Postoperative OHS†						
3 months	926	592	25.7 (8.0)	334	24.4 (7.4)	0.013
1 year	888	580	20.7 (8.7)	308	19.2 (7.7)	0.011
3 years	809	491	20.3 (9.2)	318	20.2 (9.0)	0.891
5 years	799	498	19.9 (8.9)	301	20.2 (9.0)	0.708
ΔOHS‡						
3 months	926	592	18.3 (9.8)	334	20.3 (9.0)	0.001
1 year	888	580	23.1 (9.6)	308	25.5 (9.0)	< 0.001
3 years	809	491	23.4 (9.9)	318	24.2 (9.7)	0.256
5 years	799	498	23.8 (9.5)	301	24.4 (9.0)	0.329

* Calculated using analysis of variance; †OHS: 12 (best) to 60 (worst); ‡ΔOHS: 0 (worst) to 48 (best); OHS = Oxford hip score; ΔOHS = change in Oxford hip score.

Table 3. Dislocation rates and femoral head sizes comparing approaches

Femoral head size (mm)	Dislocation rates		p Value
	Anterolateral group	Posterior group	
22	9/190 (4.7%)	3/71 (4.2%)	0.58
26	2/256 (0.8%)	2/114 (1.8%)	0.362
28	4/253 (1.6%)	4/205 (2.0%)	0.515
Total	15/699 (2.1%)	9/390 (2.3%)	0.833

between the two approaches with the 22-mm ($p = 0.58$), 26-mm ($p = 0.515$), and 28-mm head sizes ($p = 0.362$) (Table 3). There were no differences ($p = 0.601$) in revision rates between the two approaches.

Discussion

The question regarding which surgical approach to the hip to use to implant an artificial hip prosthesis has been debated extensively. Despite this, there is no consensus regarding which approach is best for primary THA. The advantages and disadvantages of each approach have been well documented and the choice of which approach to use has largely depended on surgeon preference, which in turn is a reflection of the surgeon's training and experience. We assessed the effect of two common surgical approaches to the hip on functional outcomes, dislocation rate, and revision rate as objective measures of success after primary THA.

We note several limitations. At 5 years, there were numerous patients ($n = 290$) with incomplete data with the potential to influence the final results from the study. Incomplete data for the majority of patients ($n = 163$) occurred within the first year of followup. We believe this is the main limitation of this study. However, analysis of the patient demographics suggested these patients did not differ in characteristics and therefore their results were likely similar to those of patients with complete data. In reality, only 43 patients (3.9% of the sample) were truly lost to followup. The remainder were accounted for and consisted of patients who did not have complete data for some variables at various followups and patients who died or refused to continue in the study. In a large study such as this, it is expected some data will be incomplete. The alternative is to present data with complete variables only. In a study with so many variables, this would influence the sample size. We believe it is more appropriate and representative to give the sample size for each variable on which analysis was performed by providing the number of cases in the overall total number of hips reviewed (1089) that had data for a particular variable. The study also included all operations performed by a mixture of consultant-level surgeons and trainee surgeons, which may have affected clinical outcomes, although a couple studies have shown no such differences [25, 30].

The advantages of the anterolateral approach are decreased incidence of dislocations [23, 37] and providing good exposure of the acetabulum [31]. There are apparent drawbacks, however. The anterior part of gluteus medius can limit the proximal femoral exposure, necessitating tenotomy of these fibers [23]. The inferior branch of the superior gluteal nerve is also vulnerable to damage [3, 6]. Both of these factors can cause abductor weakness [1, 13] and this in turn can lead to an increased incidence of patients having a postoperative limp [31] and diminished patient satisfaction [6]. The posterior approach has the benefits of preserving abductor function [13] and providing good exposure of the proximal femur and acetabulum. The main disadvantage seems to be the reportedly higher dislocation rates compared with those of other approaches [22, 31, 34, 37].

Our data suggest, in the medium term (5 years), there is no difference in the clinical benefit of surgery as defined by the change in OHS (ΔOHS) or in the absolute postoperative OHS between patients who underwent a posterior approach compared with those who had an anterolateral approach. The initial difference at 1 year in ΔOHS between the posterior and anterolateral groups may be attributable to increased trochanteric pain [29] and increased gait abnormalities [20] in the latter group during the immediate postoperative period.

We observed no differences in dislocation and revision rates between the two approaches. Contrary to traditional orthopaedic teaching associating the posterior approach with an increased risk of dislocation [5, 34], we found no difference in dislocation rates between the anterolateral and posterior approaches. The data, however, support those of Hedlundh et al. [16] and the meta-analysis by Jolles and Bogoch [18], who also reported dislocation rates were not influenced by surgical approach. Our overall incidence of dislocation by 5 years was 1.9% (21 of 1089 cases). The dislocation rate was 1.7% in the anterolateral group and 2.3% in the posterior group. This is similar to the dislocation rates associated with these particular approaches described by Masonis and Bourne [23] after a comprehensive literature review. Dislocation rates seem more related to femoral head size than to type of surgical approach [5].

Despite patients in the posterior approach group having a better clinical outcome initially in terms of pain and function, in the longer term, we observed no differences in OHS or rates of dislocation and revision between the two approaches at 5 years. Both approaches have their purported advantages and disadvantages, but overall, from a

patient's perspective, it would seem the success of a primary THA is independent of surgical approach.

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