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Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis (Review)

Jolles BM, Bogoch ER

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Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis.
Cochrane Database of Systematic Reviews 2006, Issue 3. Art. No.: CD003828.
DOI: 10.1002/14651858.CD003828.pub3.

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TABLE OF CONTENTS

[Intervention Review]

Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis

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Editorial group: Cochrane Musculoskeletal Group.
Publication status and date: Edited (no change to conclusions), published in Issue 1, 2010.

Citation: Jolles BM, Bogoch ER. Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis. *Cochrane Database of Systematic Reviews* 2006, Issue 3. Art. No.: CD003828. DOI: 10.1002/14651858.CD003828.pub3.

ABSTRACT

Background

Osteoarthritis (OA) of the hip is a progressive condition that has no cure and often requires a total hip arthroplasty (THA). The principal methods for THA are the posterior and direct lateral approaches. The posterior approach is considered to be easy to perform, however, increased rates of dislocation have been reported. The direct lateral approach facilitates cup positioning which may decrease rates of hip dislocation and diminishes the risk of injury to the sciatic nerve. However, there is an increased risk of limp. Dislocation of a hip prosthesis is a clinically important complication after THA, in terms of morbidity implications and costs.

Objectives

To determine the risks of prosthesis dislocation, postoperative Trendelenburg gait and sciatic nerve palsy after a posterior approach, compared to a direct lateral approach, for adult patients undergoing THA for primary OA and to update the previous review made in 2003.

Search methods

MEDLINE, EMBASE, CINAHL and Cochrane databases were searched and updated, from the previous search of 2002, to Oct 13, 2005. No language restrictions were applied.

Selection criteria

Published trials comparing posterior and direct lateral surgical approaches to THA in participants 18 years and older with a diagnosis of primary hip OA.

Data collection and analysis

Retrieved articles were assessed independently by the two reviewers for their methodological quality.

Main results

Four prospective cohort studies involving 241 participants met the inclusion criteria. The primary outcome, dislocation, was reported in two studies. No significant difference between posterior and direct lateral surgical approach was found [1/77 (1.3%) versus 3/72 (4.2%); relative risk (RR) 0.35; 95% confidence intervals (CI) 0.04 to 3.22]. The presence of postoperative Trendelenburg gait was not significantly different between these surgical approaches. The risk of nerve palsy or injury (all nerves taken together) was significantly higher among the direct lateral approaches [1/43 (2%) versus 10/49 (20%); RR 0.16, 95% CI 0.03 to 0.83]. However, there were no significant differences when comparing this risk nerve by nerve for both approaches, in particular for the sciatic nerve. Of the other outcomes considered only the average range of internal rotation in extension of the hip was significantly higher (weighted mean difference 16 degrees, 95% CI 8 to 23)

in the posterior approach group (mean 35°, standard deviation 13°) compared to the direct lateral approach (mean 19°, standard deviation 13°).

Authors' conclusions

The quality and quantity of information extracted from the trials performed to date are insufficient to make any firm conclusion on the optimum choice of surgical approach in adult patients undergoing primary THA for OA.

PLAIN LANGUAGE SUMMARY

Total hip arthroplasty for osteoarthritis

This summary of a Cochrane review presents what we know from research about the effects of a posterior or lateral approach in total hip replacement surgery for osteoarthritis. The review shows that:

In people with osteoarthritis of the hip, there is not enough evidence to be certain about whether the posterior (back) or the lateral (side) approach to total hip replacement surgery is better.

What is osteoarthritis of the hip and what types of total hip replacement surgery are there?
Osteoarthritis (OA) is the most common form of arthritis that can affect the hips. In some people, the damage and pain in the hip may be severe enough for surgery. In these people, the whole hip joint can be replaced by an artificial joint with total hip replacement surgery.

In total hip replacement surgery, the surgeon can make the cut from the posterior (back) or lateral (side) of the hip. Some surgeons believe that the posterior approach is better because people may have less problems walking after surgery. Other surgeons believe that the lateral approach is better because people may have less chance of nerve damage and less chance of dislocating their hip after surgery. Dislocating a hip causes pain and people may need to go to hospital to put the hip back in place.

What are the results of this review?
People in the studies had total hip replacement surgery that was either done from the posterior (back of the hip) or from the lateral (side of the hip).

Benefits of posterior and lateral approach
In people who had total hip replacement surgery:

the posterior approach may improve range of motion more than the lateral approach
the posterior and lateral approaches may improve function about the same

But there is not enough evidence to be certain about these benefits.

Harms of posterior and lateral approach
In people who had total hip replacement surgery:

the chance of dislocating the hip after surgery may be about the same with either the posterior or lateral approach
the chance of having difficulty walking may be about the same with either the posterior or lateral approach
the posterior approach may cause less nerve damage than the lateral approach

But there is not enough evidence to be certain about these harms.

BACKGROUND

Osteoarthritis affects 10% of the population, and mainly weight-bearing joints such as the hips (5%) (Hoaglund 2001; Arthritis Soc. 2005). Osteoarthritis of the hip is characterized by loss of articular cartilage of the hip joint. It may be primary, i.e. idiopathic, or secondary i.e. following hip diseases during childhood, trauma, osteonecrosis, previous joint infection or other conditions (Greene 2001). Osteoarthritis of the hip is a progressive condition that has no cure. The usual clinical course is deteriorating gait, increasing pain and stiffness that will ultimately require a total hip arthroplasty (THA) (2.5% of people 40 years to 84 years of age) (Oishi 1998). A THA refers to replacement of both parts of the hip joint (acetabulum and femoral head) with prosthetic implants (cup, head and stem).

Many different surgical approaches to the hip have been described. Currently, the principal methods for THA are the posterior and direct lateral approaches (Brown 1995; Byström 2003). The posterior approach entails a curved incision centered on the posterior aspect of the greater trochanter. The fascia lata is incised in line of the incision and the fibers of the gluteus maximus split by blunt dissection. The short external rotators are then detached close to their femoral insertion and reflected exposing the posterior aspect of the hip joint capsule. The capsule can be either incised or excised, although most surgeons are preserving it (Moore 1959).
The direct lateral approach entails a longitudinal skin incision centered over the greater trochanter. The gluteal fascia and iliotibial band are exposed and divided in the line of the incision. The insertion of the gluteus medius is incised down to the bone, prolonged distally through the vastus lateralis and medially with the insertion of the anterior portion of the gluteus minimus. The capsule of the hip comes into view and can be either incised or excised (Hardinge 1982).

The posterior approach is generally considered to be easy to perform, using less extensive tissue dissection which gives shorter operation times and less blood loss. It allows a good exposure of the femur that may reduce the risk of femoral fracture during the procedure. It is considered to be associated with less problems with gait since the abductor muscles are not dissected. However, it is often more difficult to see the acetabulum and increased rates of dislocation have been reported (Woo 1982; Paterno 1997; Li 1999).

The advantages proposed for the direct lateral approach are that it allows good exposure of the acetabulum, facilitating cup positioning which may decrease rates of hip dislocation. It also diminishes the risk of injury to the sciatic nerve which is not close to the operative field. However, there is an increased risk of damage to the superior gluteal nerve as well as to the gluteus medius muscle resulting in trouble with limp (Baker 1989; Downing 2001). Insertion of long stems or further revision by the same approach is also more difficult. Increased heterotopic ossifications have been reported (Mulliken 1998).

Dislocation of a hip prosthesis is a clinically important complication after THA, in terms of morbidity implications and costs. It implies a new hospitalisation for the patient who is not able to move his/her hip anymore until the head of the prosthesis is moved back in its socket, usually under a short general anaesthesia. Dislocation has been reported in 0.5% to 6% of participants undergoing primary THA and 6% to 10% for revision THA. This does not seem to decrease with increasing experience. The influence of the surgical approach of the hip on the dislocation rate has often been debated but no clear consensus has been established and no systematic review has previously been published (McCollum 1990; Morrey 1992; Turner 1994; Huten 1999; Jolles 2002) with the exception of the first publication of this Cochrane review (Jolles 2004).

OBJECTIVES

Primary objective:
To determine, based on evidence from randomised trials, the risk of prosthesis dislocation after a posterior approach, compared to a direct lateral approach, for adult participants undergoing total hip arthroplasty (THA) for primary osteoarthritis.

Secondary objectives:
To determine, based on evidence from randomised trials, the risk of postoperative Trendelenburg gait after a posterior approach, compared to a direct lateral approach, for adult patients undergoing THA for primary osteoarthritis.
To determine, based on evidence from randomised trials, the risk of sciatic nerve palsy after a posterior approach, compared to a direct lateral approach, for adult patients undergoing THA for primary osteoarthritis.

METHODS

Criteria for considering studies for this review

Types of studies

All published randomised controlled trials comparing total hip arthroplasty (THA) by posterior and direct lateral surgical approaches. Quasi-randomised trials (for example, allocation by alternation or date of birth) and inadequately concealed prospective comparative studies were considered for inclusion.

Types of participants

Any patient 18 years old or older having a THA with a diagnosis of primary hip osteoarthritis .

Types of interventions

Posterior or direct lateral surgical approaches for THA.

Types of outcome measures

Adverse outcomes
1) Prosthesis dislocation rate. Only true dislocations, documented by X-rays, were considered.
2) Rate of Trendelenburg gait, as defined by Hardcastle (Hardcastle 1985).
3) Rate of nerve palsy or injury, as documented by an electromyographic study (EMG).
4) Rate of sciatic nerve palsy or injury, as documented by an electromyographic study (EMG).
5) Pain, as documented by a visual analogue scale (VAS).

Functional outcomes
1) Harris Hip Score (Harris 1969)
2) WOMAC Score (Western Ontario and McMaster Universities Osteoarthritis Index, Bellamy 1988)
3) Range of motion
4) Leg length discrepancy

Data for the following outcomes were sought:

1) Operative details
a. Length of incision (in millimetres)
b. Operative time (in minutes)
c. Operative blood loss (in millilitres)
d. Post-operative blood transfusion (in units)

2) Perioperative complications
a. Intra-operative fracture at the time of surgery (acetabulum or femur)
b. Periprosthetic fracture after surgery
c. Superior gluteal nerve palsy
d. Obturator nerve palsy
e. Femoral nerve palsy
f. Damage to other anatomical structures
g. Other surgical complications (as detailed in each study).

3) Post-operative complications
a. Superficial wound infection.
b. Deep wound infection (infection around the implant)
c. Superficial hematoma
d. Deep hematoma
e. Thromboembolic complications (deep thrombosis or pulmonary embolism)
f. Heterotopic ossification
g. Pneumonia
h. Bladder infection
i. Any medical complication (as detailed in each individual study)

4) Post-operative care outcomes
a. Days to mobilisation
b. Length of hospital stay (days)
c. Length of rehabilitation centre stay (days)

5) Complications related to the implant
a. Cup loosening
b. Stem loosening
c. Polyethylene wear
d. Head fracture
e. Other complications (as detailed in each study).

6) Final outcome measures
a. Days to dislocation
b. Reoperation rate
c. Survival rate of prosthesis
d. Mortality
e. Residence at final follow-up (return to living at home, discharge location)
f. Mobility (use of walking aids, return of mobility)
g. Other functional outcomes as listed in each study
h. Health related quality of life measures

Search methods for identification of studies

Relevant randomised controlled trials were selected from those identified by application of the general search strategy developed by the Musculoskeletal Review Group (update from the end of 2002 to Oct 13, 2005). The latter included:

a) computer aided searching of various computer databases, MEDLINE (1982-2005), EMBASE (1982-2005), CINAHL (1982-2005), as well as the Cochrane Musculoskeletal Group Trials Register, the Cochrane Controlled Trials Register (CENTRAL/CCTR), the Health Technology Assessment database (HTA) and the Database of Abstracts of Reviews of Effectiveness (DARE) (2005). A trained medical librarian was consulted to develop an optimal search strategy.

Search terms that were used are shown in Appendix 1.

b. investigation of the bibliographies of retrieved studies,

c. entering identified trials into Science Citation Index to identify articles that quoted the original study.

Unpublished data were not sought, but authors of published trials were contacted to clarify or provide additional information.

No language restriction were applied. The search covered the period from January 1982 to October, 2005. Studies before 1982 were not included in order to have articles dealing with the Hardinge approach (published in 1982) and describing results of modern implantation techniques and modern types of prostheses.

Data collection and analysis

STUDY SELECTION
Two reviewers (BMJ, ERB) independently assessed all potential abstracts and published reports that were identified by the literature search. Consensus was reached through discussion of any disagreements. Reasons for excluded studies were noted. The two reviewers were not blinded to authors, institution or journal of the publication.

QUALITY ASSESSMENT
Quality of included trials was evaluated independently by the reviewers, using the following 18 criteria adapted from Verhagen (Verhagen 1998) and Van Tulder (Van Tulder 1997). There are 3 potential answers to the following questions: Yes (score of 1), Can't Tell (score of 0) and No (score of 0). A maximum score of 17 can be achieved.

Patient Selection
a. Were the eligibility criteria specified?
b1. Was a method of randomization performed?
b2. Was the treatment allocation concealed?
c. Were the groups similar at baseline regarding the most important prognostic indicators?

Interventions
d. Were the index and control interventions explicitly described?
e. Were the surgeons experienced in both operations prior to the trial?
f. Were co-interventions avoided or comparable?
g. Was the compliance acceptable in all groups?

Outcome Measurement
h. Was the outcome assessor blinded to the intervention?
i. Were the outcome measures relevant?
j. Was the timing of follow-up appropriate?
k. Was a long-term follow-up performed?
l. Was the timing of the outcome assessment in both groups comparable?
m. Were other complications described?
n. Was the withdrawal/drop-out rate described and acceptable?

Statistics
o. Was the sample size for each group described?
p. Did the analysis include an intention-to-treat analysis?

q. Were point estimates and measures of variability presented for the primary outcome measures?

DATA EXTRACTION
Each reviewer extracted data independently using pre-designed standardized data abstraction forms. One reviewer entered data into RevMan and the other cross-checked the printout against his own data abstraction forms. Discrepancies were resolved by a consensus of the two reviewers. Information from the primary author was obtained when published article provided inadequate information to the review.

DATA SYNTHESIS AND ANALYSIS
For each study, relative risks and 95% confidence limits were calculated for dichotomous outcomes, and weighted mean differences and 95% confidence limits calculated for continuous outcomes. Meta-analyses were conducted with a fixed effects model. Where there was statistical evidence of heterogeneity a random effects model was used.

GRADING THE STRENGTH OF THE EVIDENCE
The common system of grading the strength of scientific evidence for a therapeutic agent that is described in the CMSG module scope and in the Evidence-based Rheumatology BMJ book (Tugwell 2003) was used to rank the evidence included in this systematic review. Four categories are used to rank the evidence from research studies from highest to lowest quality: Platinum, Gold, Silver, and Bronze. The ranking is included in the synopsis of this review.

RESULTS

Description of studies

In total, 44 studies were identified (from the literature search). Only 11 studies were found relevant and 4 met the eligibility criteria and were included. The 4 included studies were prospective cohort studies.

Baker 1989 evaluated 79 hips in a trial involving 69 participants, grouped according to the operative approach used by their surgeon: 21 total hip arthroplasties (THA) were done by the posterior approach, 29 by the direct lateral approach and 29 by the Dall's modified direct lateral approach. Only data related to the posterior and direct lateral approaches (evidence of Trendelenburg gait, denervation and trochanteric pain) were extracted .

Barber 1996 compared the clinical outcome of the direct lateral and posterior surgical approaches, in terms of Trendelenburg gait and dislocation in particular, in a consecutive series of 49 participants who had a primary THA for osteoarthritis.

Weale 1996 evaluated 42 participants undergoing primary total hip replacement. According to the surgeon's normal practice, 22 participants were operated on by the posterior approach and 20 participants by the direct lateral approach. The sciatic, obturator and femoral nerves were assessed clinically and electrophysiologically four weeks after surgery.

Downing 2001 evaluated 100 participants undergoing primary THA for osteoarthritis. The first consecutive suitable people, who were willing to participate, were separated in two groups according to their surgeon's usual surgical approach. All the 49 posterior approaches received Exeter stems and Charnley stems were used for all the 51 lateral Hardinge approaches. Trendelenburg gait and dislocation were recorded.

A summary of the details of these trials is given in the Characteristics of Included Studies Table.

Characteristics of the excluded studies are reported in the Table of Characteristics of Excluded Studies.

Risk of bias in included studies

The methodology of the identified studies was generally poor. All four of the included studies scored less than 12 out of a possible maximum quality score of 17 (70%).

None used an appropriate method of randomisation. All groups of participants were formed according to the usual practice of the surgeon who was performing the posterior or the direct lateral approach and therefore inadequately concealed.

For studies comparing different approaches, ideally, implants used and rehabilitation programs should be well described. No provided sufficient details on these important factors.
Only one study (Downing 2001) had the outcome assessor blinded to the intervention.
None of the studies described the justification and calculations for the sample size.

Table 1. Assessment of methodology.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	Internal validity	Descriptive Criteria	Statistical criteria	Total	Study name
0	0	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	6	2	0	8	Baker 1989
1	0	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	6	5	1	12	Barber 1996
1	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	0	5	4	0	9	Weale 1996
1	0	0	1	1	0	0	1	1	1	0	1	1	0	0	0	1	4	4	1	9	Downing 2001
Maximum of points																	10	5	2	17	

Effects of interventions

Posterior and direct lateral approaches were compared in all four studies. The outcome measures reported by each study are listed in the Characteristics of Included Studies table.

ADVERSE OUTCOMES
DISLOCATION
The primary outcome, dislocation, was studied only by Barber 1996 and Downing 2001. Summation of the data available from these studies is given in the analysis tables. These indicate no significant difference between posterior versus direct lateral surgical approach [1/77 (1.3%) versus 3/72 (4.2%); relative risk (RR) 0.35; 95% confidence intervals (CI) 0.04 to 3.22].

TRENDELENBURG GAIT
The presence of a postoperative Trendelenburg gait was studied by Baker 1989, Barber 1996 and Downing 2001. Summation of the data available from these studies is given in the analysis tables. These indicate no significant difference between posterior versus direct lateral surgical approach [7/88 (8.0%) versus 13/78 (16.7%); RR 0.52; 95% CI 0.21 to 1.27]. This outcome measure seems to favour slightly the posterior surgical approach as having less participants with postoperative Trendelenburg gait. However, the pooled results

should be taken with care as all the studies did not compare the patient gait at the same follow-up times.

NERVE PALSY OR INJURY

Nerve palsy or injury was studied by Baker 1989 and Weale 1996. Weale observed sciatic, femoral and obturator nerve palsies. Baker observed only superior gluteal nerve palsies. A significant difference between posterior versus direct lateral surgical approach was found in favour of less nerve injuries with the posterior approach [1/43 (2%) versus 10/49 (20%); RR 0.16; 95% CI 0.03 to 0.83]. However, when looking at each type of nerve palsy separately, no significant difference was found between each type of surgical approach.

PAIN

The last adverse outcome selected, pain, was studied only by Baker 1989. No significant difference was observed between the posterior and direct lateral surgical approaches [3/21 (14%) versus 7/29 (24%); RR 0.59; 95% CI 0.17 to 2.03].

FUNCTIONAL OUTCOMES

HARRIS HIP SCORE and WOMAC SCORE

Harris hip scores were recorded only by Barber 1996. Patients of both groups improved their score to obtain the same mean score of 94 two years after surgery.

WOMAC scores were not computed in any of the studies

RANGE OF MOTION

Only the mobility in internal rotation while the hip joint lies in extension was recorded by Barber 1996. A significant difference was observed between posterior and direct lateral surgical approach in favour of the posterior approach [35° (SD 13) versus 19° (SD 13); WMD 16; 95% CI 8.64 to 23.36].

LEG LENGTH DISCREPANCY

The last functional outcome selected was studied only by Weale 1996. Limb length discrepancies of more than 1cm were recorded and no significant difference was found between posterior and direct lateral surgical approaches [4/22 (18%) versus 6/20 (30%); RR 0.61; 95% CI 0.20 to 1.84].

Baker 1989 compared 21 participants operated on by the posterior approach to 29 operated on by the direct lateral one. There were no loss to follow-up. However, the type of implants used as well as the rehabilitation procedure were not stated.

Trendelenburg gait was reported 3 months after surgery with a trend of less positive tests among the posterior approach group but no significant difference between groups [2/20 (10.0%) versus 9/24 (37.5%); RR 0.27; 95% CI 0.06 to 1.10].

Evidence of superior gluteal nerve denervation was reported at 2 weeks and 3 months without significant difference between groups. Trochanteric pain was assessed on a visual analogue scale (number of participants who had a score of 3 or greater, out of ten), without significant difference between groups.

Barber 1996 compared 28 total hip prostheses operated on using the posterior approach versus 21 hips using the direct lateral approach. Cemented and un cemented implants were used in both approaches in different proportions. The rehabilitation program included protected weight bearing, starting on postoperative day 2 for both approaches.

At 2-years follow-up, no dislocations were recorded in either group. The risk difference (RD) was 0.00 with a 95% CI -0.08 to 0.08 (RR not estimable).

A Trendelenburg test score as well as a limp score and an abductor power score were recorded without significant differences between groups.

There were no significant difference in postoperative heterotopic ossifications and no evidence of implant loosening in either group.

The average range of internal rotation in extension of the hip was significantly higher in the posterior approach group [mean (m) 35°, standard deviation (sd) 13°] compared to the direct lateral approach [m 19°, sd 13°; mean weighted difference 16.0; 95% CI 8.64 to 23.36]. The average Harris hip scores were the same at 1-year follow-up for both groups.

Weale 1996 compared 22 participants operated on by the posterior approach to 20 operated on by the direct lateral one. There were no loss to follow-up. However, the type of implants used as well as the rehabilitation procedure were not stated. Mean operative time and operative blood loss were evaluated without mention of standard deviation, making difficult any meaningful comparison (78 min and 599 ml for posterior approach vs 107 min and 768 ml for direct lateral approach).

Incidence of nerve injury (sciatic, obturator, femoral nerves) was reported at 4 weeks from operation with no difference between groups.

Post-operative limb-length discrepancy of more than 1 cm was reported also with no difference between groups.

Downing 2001 compared 49 total hip arthroplasties done by the posterior approach versus 51 hips by the direct lateral approach for 100 participants. All participants had cemented stems, but the type was different in each group; Exeter prostheses for the posterior approach and Charnley ones for the direct lateral approach. Follow-up was done at 3 and 12 months. Twenty seven participants were lost to follow-up, but the number of lost to follow-up per group was not stated.

Four participants had a hip dislocation, 1/49 (2.0%) in the posterior approach group versus 3/51 (5.9%) in the direct lateral approach group. The difference was not statistically significant between the groups (RR 0.35; 95% CI 0.04 to 3.22).

Trendelenburg tests were reported at 12 months from surgery without difference between groups [2/40 (5.0%) versus 2/33 (6.1%); RR 0.82; 95% CI 0.12 to 5.54]. Hip abductor strength of the operated leg improved in both groups at 3 months and 12 months without any difference between groups.

Two complications were noted: one periprosthetic fracture and one death (approach used for these 2 participants was not stated).

DISCUSSION

Many of the trial reports indicated a poor level of methodological rigour, in particular regarding concealment of allocation and assessor blinding. Furthermore, many of the studies involved small numbers of participants with limited reporting of outcome measures. The low methodology scoring for these studies may reflect firstly poor reporting and secondly poor trial methodology.

The four identified studies investigating the comparison between posterior and direct lateral surgical approach involved a total of 241 participants. All studies were inadequately concealed: groups were made up according to surgeon's approach and usual referral practice to get consecutive participants.

The largest study, Downing 2001 with 100 participants, was of poor methodological quality, with limited reporting of baseline groups characteristics and outcomes, inadequate follow-up of participants and 27% of participants lost to follow-up without knowing to which group they belonged. There were less than 30 participants in each groups of the other included studies. The limited number of participants in these trials prevents firm conclusions being made. This is especially true for low rate events as hip dislocation, currently reported in the literature to be often less than 5%.

Details of surgery and rehabilitation were not well described in any of the included studies. This might prevent meaningful pooling of results. In a recent review of more than 50'000 primary total hip arthroplasty, Furnes 2001 reported that the type of implant and fixation were major confounding factors in the study of hip replacement. Pellicci 1998 showed in 2 series of 395 total hip replacement that capsular repair in a posterior approach reduced the dislocation rate (from 4% to 0% in his study) enhancing the need for a detailed description of the surgical technique. As well, early mobilisation is recognized as mandatory for a good functional recovery after total hip arthroplasty, and should be part of the details given in the method section of a study, separated from any other rehabilitation interventions for which the value is not yet proven as recently mentioned by Roos 2003. Baker 1989 and Weale 1996 did not report which type of implants and rehabilitation programs were used and if they were the same for all participants in both groups. Barber 1996 described the type of prostheses that were used for participants in both groups, but the proportion of each type were different between approaches: 86% fully cemented for the posterior approach group and 91% hybrid procedure for the direct lateral approach group. Downing 2001 used Exeter cemented stems for the posterior approach group and Charnley cemented stems for the direct lateral approach group, without mention of the type of cups that were used. Co-interventions should be well described and similar between groups. Surgeon experience in both procedures should also be well described. Hedlundh 1996 observed twice the number of dislocations among inexperienced surgeons, with an important change as soon as the surgeon has done 30 primary total hip arthroplasty and at least 10 times a year. In these trials, neither is done, therefore preventing meaningful conclusions to be made.

Two studies reported the dislocation rate (Barber 1996; Downing 2001), three studies reported postoperative Trendelenburg gait (Baker 1989; Barber 1996; Downing 2001), and two reported postoperative nerve palsy (Weale 1996). No significant differences were found between the posterior and direct lateral approaches dislocation rate and the postoperative Trendelenburg gait, in each study or in the meta-analysis. A significant difference was found for the presence of a nerve palsy or injury when using the direct lateral approach. However, when looking at each nerve injury separately (sciatic, gluteal, obturator, or femoral), no significant difference was found with the posterior approach. In addition, this result should be taken cautiously as it represents only the situation in a collective of less than 100 patients, which is small for hip arthroplasty surgery, and in which the details of surgery and rehabilitation procedure were not stated by the authors. Among the other outcomes, the only significant result found was an increased range of motion in internal rotation of the hip in extension for participants operated on by posterior approach (Barber 1996). However, the limited number of studies found as well as the limited reporting of their outcome measures prevent definite conclusions being drawn.

Finally, only one study had a blinded outcome assessor (Downing 2001). It is clear that blinding of the surgeon is impossible. Patient blinding is almost impossible because of the obvious scar on the upper thigh. But the outcome assessor should have been blinded in all studies in order to decrease the number of possible study biases.

AUTHORS' CONCLUSIONS

Implications for practice

The quality of the information extracted from the trials performed to date is poor, which prevents any firm conclusion on the optimum choice of surgical approach in adult patients undergoing primary total hip arthroplasty for osteoarthritis to be drawn.

Implications for research

Further well conducted randomised trials with full reporting of outcomes, blinding of outcome assessors and correct methodology are required to determine the optimum surgical approach for the insertion of a total hip arthroplasty. Reporting should conform to the CONSORT statement (Moher 2001).

A sample size calculation revealed that about 1500 participants will be required in each arm of the study (alpha = 0.05, power = 0.80, probability of event among controls = 1.5%, RR = 2, case sample size = 1534, PS software version 2.1.30, February, 2003) to determine if there is an increased or decreased risk of dislocation with one or the other surgical approach. A multi-centre prospective randomised controlled study is recommended.

This Cochrane review should be updated as further studies become available. The authors of this review will be pleased to receive information about any other prospective studies or RCT comparing the lateral and posterior approaches in primary total hip arthroplasty.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. Arne Ohlsson for his helpful comments, Jessie McGowan and Louise Falzon for help with literature search as well as Maria Judd and Lara Maxwell for help with preparation of the review.
We would also like to thank the following for useful feedback at editorial review Ann Scott and Jason Werle.

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CHARACTERISTICS OF STUDIES

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Baker 1989

Methods	Trial: groups according to surgeon's approach - prospective cohort study
Participants	50 patients 21 posterior approach 29 direct lateral approach Bristol Royal Infirmary, Bristol, UK Mean age not stated Male/Female repartition not stated Follow-up: all patients 3 months post surgery. None lost to follow-up
Interventions	Implants used not stated Rehabilitation procedure not stated
Outcomes	- Trendelenburg gait - Gluteal denervation - Trochanteric pain
Notes	Quality score: Internal validity 6/10, descriptive criteria 2/5, statistical criteria 0/2, total 8/17 Pre-operative diagnosis not well stated

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Barber 1996

Methods	Trial: consecutive patients grouped according to surgeon's approach - prospective cohort study
Participants	49 patients 28 posterior approach 21 direct lateral approach Division of Orthopaedic Surgery, Standford, CA, USA Mean age 70 y (post) 72 y (lat) 50% female (post) 72% female (lat) Follow-up of at least 2 years None lost to follow-up
Interventions	Mixed cemented and uncemented implants for both approaches Rehabilitation with protected weight bearing started on day 2 for both approaches
Outcomes	- Trendelenburg gait - Abductor power - Limp - Dislocations - Harris hip scores - Range of motion - Heterotopic ossification - Loosening
Notes	Quality score: Internal validity 6/10, descriptive criteria 5/5, statistical criteria 1/2, total 12/17

Risk of bias

Barber 1996 *(Continued)*

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Downing 2001

Methods	Trial: consecutive patients grouped according to surgeon's approach (usual referral practice) - prospective cohort study
Participants	100 patients 49 posterior approach 51 direct lateral approach Queen's Medical Centre, University Hospital, Nottingham, UK Mean age 67y [41-83] (post), 65y [42-83] (lat) 51% female (post) 59% female (lat) Follow-up at 3 and 12 months Losses to follow-up not described per group (27 lost/100)
Interventions	Cemented stems: Exeter (post) Charnley (lat). Cup used not stated. Standard rehabilitation program for both approaches but not described
Outcomes	- Trendelenburg gait - Abductor strength - Dislocation - Periprosthetic fracture - Mortality
Notes	Quality score: Internal validity 4/10, descriptive criteria 4/5, statistical criteria 1/2, total 9/17 Benefits from commercial part

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Weale 1996

Methods	Trial: consecutive patients grouped according to surgeon's practice (usual referral practice) - prospective cohort study
Participants	42 patients 22 posterior approach 20 direct lateral approach Southmead Hospital, Bristol, UK Mean age 69.4y (post) 68.5y (lat) 68% female (post) 45% female (lat) Follow-up: all patients 4 weeks post surgery. None lost to follow-up
Interventions	Implants used not stated Rehabilitation procedure not stated
Outcomes	- Sciatic nerve injury

Weale 1996 *(Continued)*

	- Obturator nerve injury - Femoral nerve injury - Operative time - Operative blood loss - Limb length discrepancy
Notes	Quality score: Internal validity 5/10, descriptive criteria 4/5, statistical criteria 0/2, total 9/17 Pre-operative diagnosis not well stated

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Byström 2003	This study analyzed the Norwegian Arthroplasty Register to find risk factors for prosthesis dislocation leading to revision. Seven prosthesis brand combinations were used in 42897 primary hip arthroplasty in 68 hospitals. The study was excluded because we had no idea if groups of surgical approach are similar as for age, comorbidities, and types of prosthesis (shape, fixation,head sizes). In addition, the lateral approach included a mixed of Hardinge, antero-lateral and trochanterotomy approaches.
Grossmann 1994	This study compared 45 dislocations in 1734 patients with a randomized control group of 61 patients. Factors causing an increasing number of dislocation as surgical approaches were analysed. The study was excluded as it was retrospective and without mention of the clinical diagnosis before total hip replacement.
Kohn 1997	This study reviewed 1238 primary total hip arthroplasties for arthritis. The influence of surgical approaches on dislocation was studied. The study was excluded as it was retrospective.
Moreschini 1996	This study reviewed 19 patients operated on for osteoarthritis (primary and secondary) or femoral neck fractures with clinical and electromyographic assessments. This study was excluded as it was retrospective and without specific data for primary osteoarthritis and adults results.
Moroni 2000	This study reviewed intraoperative femoral fractures after 3566 total hip replacements. Potential risk factors as surgical approaches were reviewed. The study was excluded as it was retrospective and there was not a comparison per surgical approaches.
Pascarel 1989	This randomized study compared 63 hip prostheses implanted with the direct lateral approach with 63 total hip arthroplasties implanted with the posterior approach to assess the functional impact. The study was excluded as the hip replacements were not done for osteoarthritis only (fractures, osteonecrosis, dysplasia,...) and no specific data were available for patients with osteoarthritis.
Zimmerman 2002	The study reviewed 271 patients aged 65 years and older, operated on for osteoarthritis, from numerous surgeons in different hospitals. The study was excluded as lateral and antero-lateral approaches were mixed in one group, as well as posterior and postero-lateral approaches in the other group. In addition, it was unrandomized and the groups were different in terms of age and comorbidities.

DATA AND ANALYSES

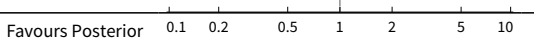
Comparison 1. Posterior vs Direct Lateral approach for THA

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dislocation	2	149	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.04, 3.22]
2 Trendelenburg gait	3	166	Risk Ratio (M-H, Fixed, 95% CI)	0.52 [0.21, 1.27]
3 Nerve palsy or injury	2	92	Risk Ratio (M-H, Fixed, 95% CI)	0.16 [0.03, 0.83]
4 Pain	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.59 [0.17, 2.03]
4.1 Trochanteric pain (>3/10)	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.59 [0.17, 2.03]
5 Trendelenburg score [0-2]	1	49	Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.25, 0.31]
6 Limp score [0-4]	1	49	Mean Difference (IV, Fixed, 95% CI)	-0.14 [-0.61, 0.33]
7 Abductor power score [0-5]	1	49	Mean Difference (IV, Fixed, 95% CI)	0.20 [-0.24, 0.64]
8 Sciatic nerve palsy	1	42	Risk Ratio (M-H, Fixed, 95% CI)	0.18 [0.01, 3.59]
9 Sup. gluteal nerve palsy	1	50	Risk Ratio (M-H, Fixed, 95% CI)	0.28 [0.03, 2.19]
10 Obturator nerve palsy	1	42	Risk Ratio (M-H, Fixed, 95% CI)	0.18 [0.01, 3.59]
11 Femoral nerve palsy	1	42	Risk Ratio (M-H, Fixed, 95% CI)	0.30 [0.01, 7.07]
12 Harris hip score	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
12.1 Pre-operative	1	49	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.2 Postoperative	1	49	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.3 Change post-preop at folllow-up	1	49	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 WOMAC score	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
14 Range of motion	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
14.1 Internal rotation	1	49	Mean Difference (IV, Fixed, 95% CI)	16.0 [8.64, 23.36]
15 Limb-length discrepancy	1	42	Risk Ratio (M-H, Fixed, 95% CI)	0.61 [0.20, 1.84]
15.1 LLD > 1cm	1	42	Risk Ratio (M-H, Fixed, 95% CI)	0.61 [0.20, 1.84]
16 Stem loosening	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
17 Cup loosening	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
18 Reoperation	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
19 Periprosthetic fracture	0	0	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
20 Heterotopic ossification [Brooker 1-4]	1	245	Risk Ratio (M-H, Fixed, 95% CI)	0.57 [0.30, 1.09]
20.1 Brooker I	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.16, 1.55]
20.2 Brooker II	1	49	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.15, 15.46]
20.3 Brooker III	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.25 [0.01, 5.91]
20.4 Brooker IV	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
20.5 Total	1	49	Risk Ratio (M-H, Fixed, 95% CI)	0.56 [0.23, 1.38]

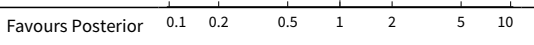
Analysis 1.1. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 1 Dislocation.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Downing 2001	1/49	3/51		100%	0.35[0.04,3.22]
Barber 1996	0/28	0/21			Not estimable
Total (95% CI)	**77**	**72**		**100%**	**0.35[0.04,3.22]**
Total events: 1 (Posterior app.), 3 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.93(P=0.35)					

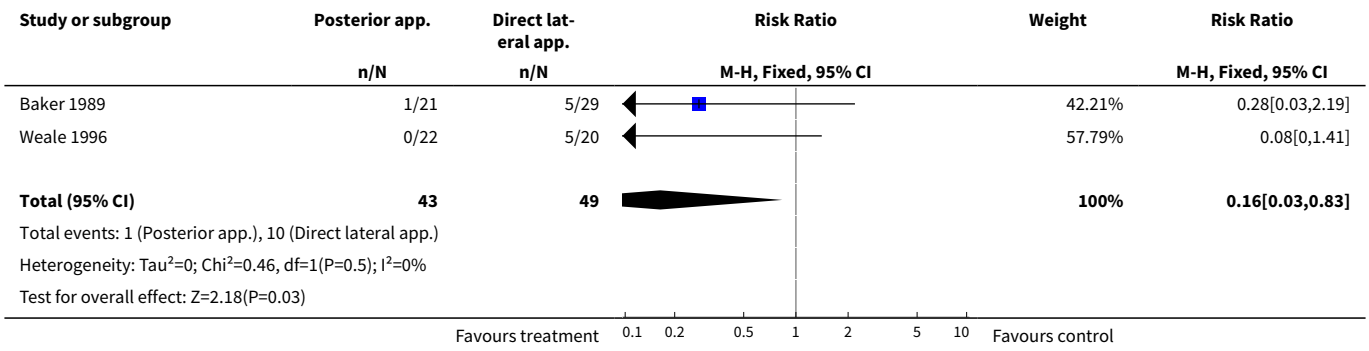


Analysis 1.2. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 2 Trendelenburg gait.

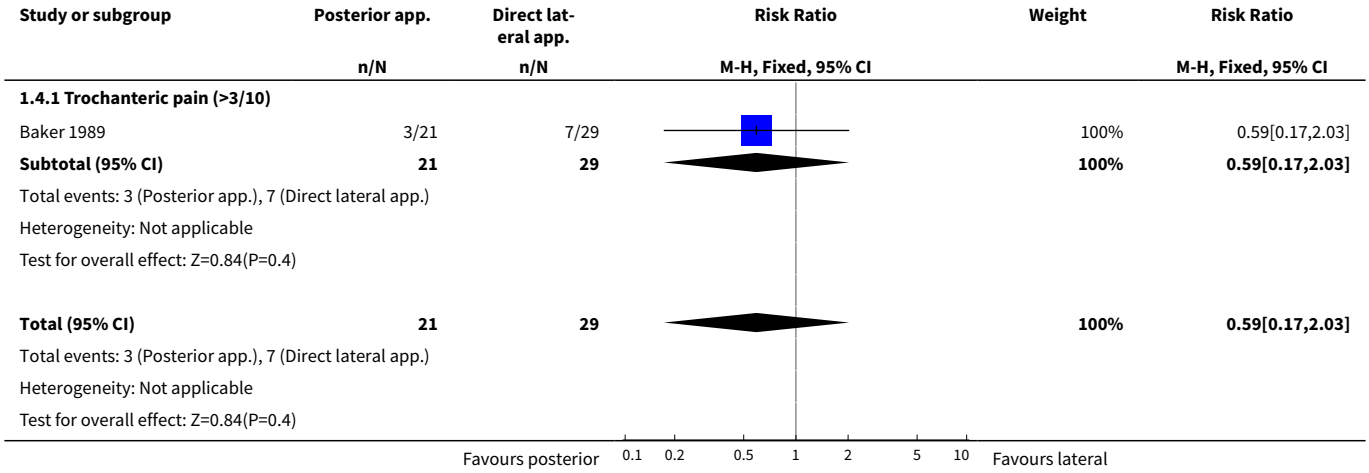
Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Baker 1989	2/20	9/24		64.63%	0.27[0.06,1.1]
Barber 1996	3/28	2/21		18.06%	1.13[0.21,6.14]
Downing 2001	2/40	2/33		17.31%	0.83[0.12,5.54]
Total (95% CI)	**88**	**78**		**100%**	**0.52[0.21,1.27]**
Total events: 7 (Posterior app.), 13 (Direct lateral app.)					
Heterogeneity: Tau^2=0; Chi^2=1.88, df=2(P=0.39); I^2=0%					
Test for overall effect: Z=1.43(P=0.15)					



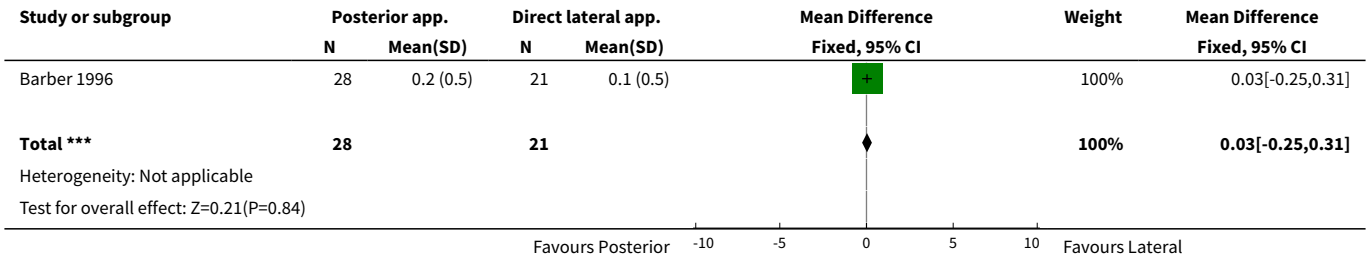
Analysis 1.3. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 3 Nerve palsy or injury.



Analysis 1.4. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 4 Pain.



Analysis 1.5. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 5 Trendelenburg score [0-2].



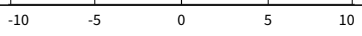
Analysis 1.6. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 6 Limp score [0-4].

Study or subgroup	Posterior app. N	Posterior app. Mean(SD)	Direct lateral app. N	Direct lateral app. Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Barber 1996	28	0.7 (0.9)	21	0.9 (0.8)		100%	-0.14[-0.61,0.33]
Total ***	**28**		**21**			**100%**	**-0.14[-0.61,0.33]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.59(P=0.56)							

Favours Posterior — Favours Lateral

Analysis 1.7. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 7 Abductor power score [0-5].

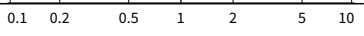
Study or subgroup	Posterior app. N	Posterior app. Mean(SD)	Direct lateral app. N	Direct lateral app. Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Barber 1996	28	4.5 (0.6)	21	4.3 (0.9)		100%	0.2[-0.24,0.64]
Total ***	**28**		**21**			**100%**	**0.2[-0.24,0.64]**
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%							
Test for overall effect: Z=0.9(P=0.37)							



Favours Lateral — Favours Posterior

Analysis 1.8. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 8 Sciatic nerve palsy.

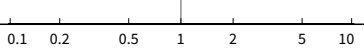
Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Weale 1996	0/22	2/20		100%	0.18[0.01,3.59]
Total (95% CI)	**22**	**20**		**100%**	**0.18[0.01,3.59]**
Total events: 0 (Posterior app.), 2 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.12(P=0.26)					



Favours Posterior — Favours Lateral

Analysis 1.9. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 9 Sup. gluteal nerve palsy.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Baker 1989	1/21	5/29		100%	0.28[0.03,2.19]
Total (95% CI)	**21**	**29**		**100%**	**0.28[0.03,2.19]**
Total events: 1 (Posterior app.), 5 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.22(P=0.22)					



Favours Posterior — Favours Lateral

Analysis 1.10. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 10 Obturator nerve palsy.

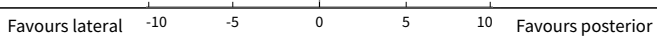
Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Weale 1996	0/22	2/20		100%	0.18[0.01,3.59]
Total (95% CI)	**22**	**20**		**100%**	**0.18[0.01,3.59]**
Total events: 0 (Posterior app.), 2 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.12(P=0.26)					

Analysis 1.11. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 11 Femoral nerve palsy.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Weale 1996	0/22	1/20		100%	0.3[0.01,7.07]
Total (95% CI)	**22**	**20**		**100%**	**0.3[0.01,7.07]**
Total events: 0 (Posterior app.), 1 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.74(P=0.46)					

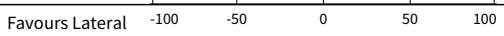
Analysis 1.12. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 12 Harris hip score.

Study or subgroup	Posterior app. N	Posterior app. Mean(SD)	Direct lateral app. N	Direct lateral app. Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
1.12.1 Pre-operative							
Barber 1996	28	54 (0)	21	62 (0)			Not estimable
Subtotal ***	**28**		**21**				**Not estimable**
Heterogeneity: Not applicable							
Test for overall effect: Not applicable							
1.12.2 Postoperative							
Barber 1996	28	94 (0)	21	94 (0)			Not estimable
Subtotal ***	**28**		**21**				**Not estimable**
Heterogeneity: Not applicable							
Test for overall effect: Not applicable							
1.12.3 Change post-preop at folllow-up							
Barber 1996	28	40 (0)	21	32 (0)			Not estimable
Subtotal ***	**28**		**21**				**Not estimable**
Heterogeneity: Not applicable							
Test for overall effect: Not applicable							
Test for subgroup differences: Not applicable							



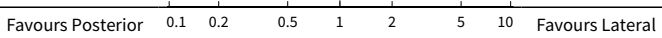
Analysis 1.14. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 14 Range of motion.

Study or subgroup	Posterior app. N	Posterior app. Mean(SD)	Direct lateral app. N	Direct lateral app. Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
1.14.1 Internal rotation							
Barber 1996	28	35 (13)	21	19 (13)		100%	16[8.64,23.36]
Subtotal ***	**28**		**21**			**100%**	**16[8.64,23.36]**
Heterogeneity: Not applicable							
Test for overall effect: Z=4.26(P<0.0001)							



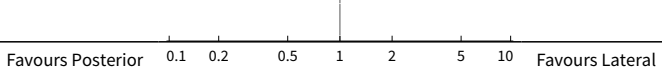
Analysis 1.15. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 15 Limb-length discrepancy.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
1.15.1 LLD > 1cm					
Weale 1996	4/22	6/20		100%	0.61[0.2,1.84]
Subtotal (95% CI)	**22**	**20**		**100%**	**0.61[0.2,1.84]**
Total events: 4 (Posterior app.), 6 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.88(P=0.38)					
Total (95% CI)	**22**	**20**		**100%**	**0.61[0.2,1.84]**
Total events: 4 (Posterior app.), 6 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.88(P=0.38)					



Analysis 1.16. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 16 Stem loosening.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Barber 1996	0/28	0/21			Not estimable
Total (95% CI)	**28**	**21**			**Not estimable**
Total events: 0 (Posterior app.), 0 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



Analysis 1.17. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 17 Cup loosening.

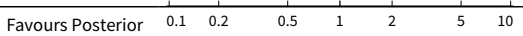
Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Barber 1996	0/28	0/21			Not estimable
Total (95% CI)	**28**	**21**			**Not estimable**
Total events: 0 (Posterior app.), 0 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

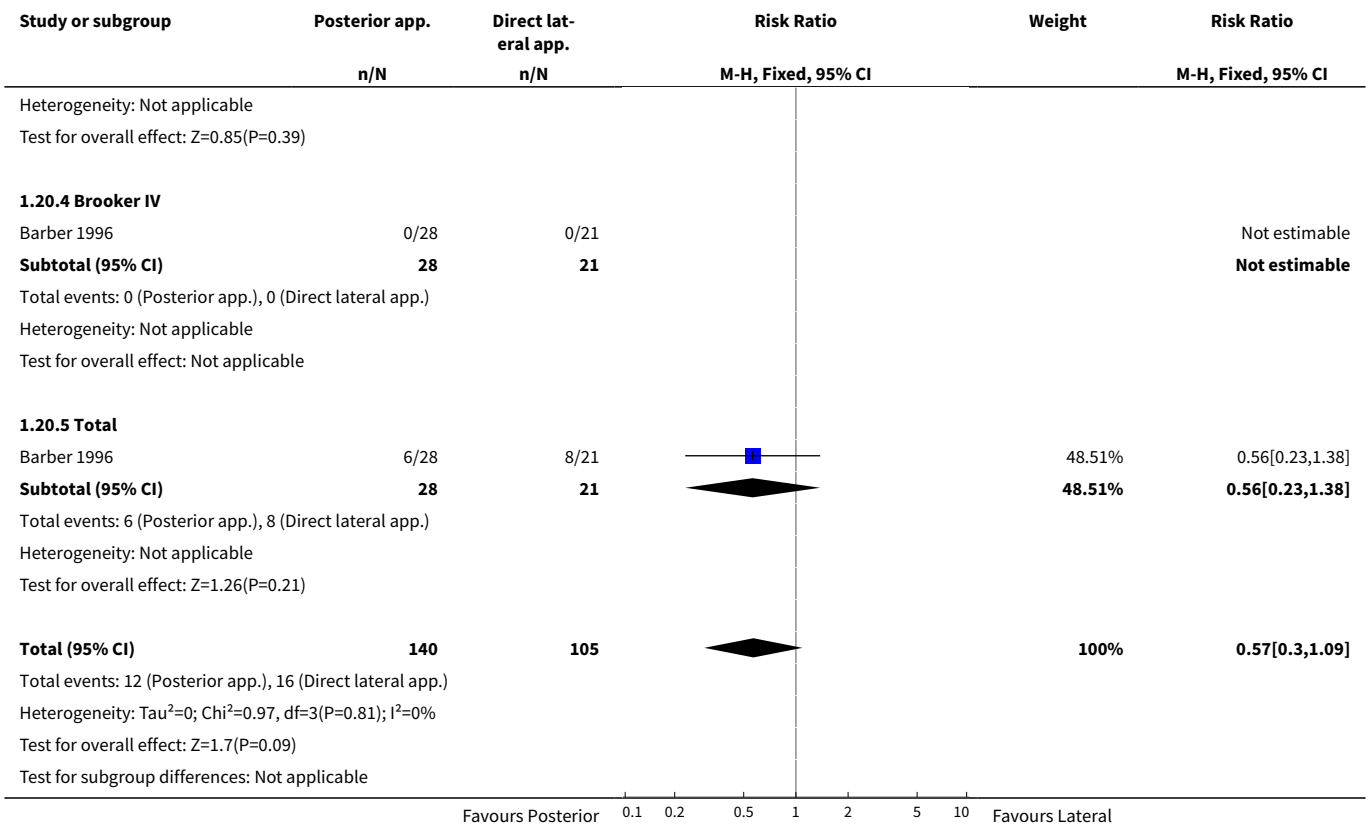
Analysis 1.18. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 18 Reoperation.

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Barber 1996	0/28	0/21			Not estimable
Total (95% CI)	**28**	**21**			**Not estimable**
Total events: 0 (Posterior app.), 0 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

Analysis 1.20. Comparison 1 Posterior vs Direct Lateral approach for THA, Outcome 20 Heterotopic ossification [Brooker 1-4].

Study or subgroup	Posterior app. n/N	Direct lateral app. n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
1.20.1 Brooker I					
Barber 1996	4/28	6/21		36.38%	0.5[0.16,1.55]
Subtotal (95% CI)	**28**	**21**		**36.38%**	**0.5[0.16,1.55]**
Total events: 4 (Posterior app.), 6 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.2(P=0.23)					
1.20.2 Brooker II					
Barber 1996	2/28	1/21		6.06%	1.5[0.15,15.46]
Subtotal (95% CI)	**28**	**21**		**6.06%**	**1.5[0.15,15.46]**
Total events: 2 (Posterior app.), 1 (Direct lateral app.)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.34(P=0.73)					
1.20.3 Brooker III					
Barber 1996	0/28	1/21		9.05%	0.25[0.01,5.91]
Subtotal (95% CI)	**28**	**21**		**9.05%**	**0.25[0.01,5.91]**
Total events: 0 (Posterior app.), 1 (Direct lateral app.)					





APPENDICES

Appendix 1. Full search strategy

1 arthroplasty, replacement, hip/ (6632)
2 Hip Prosthesis/ (14867)
3 or/1-2 (18638)
4 arthroplasty/ or arthroplasty, replacement/ (6923)
5 Joint Prosthesis/ (7466)
6 "Prostheses and Implants"/ (27329)
7 (arthroplasty or replacement or prosthes#s).tw. (151653)
8 or/4-7 (177019)
9 hip/ or hip joint/ or hip.tw. (59269)
10 8 and 9 (19395)
11 3 or 10 (25121)
12 (moore or austin-moore).tw. (1569)
13 posterior.tw. (113463)
14 12 or 13 (115004)
15 3 and 14 (542)
16 hardinge.tw. (27)
17 lateral.tw. (121370)
18 16 or 17 (121386)
19 3 and 18 (616)
20 15 and 19 (102)
21 (mt or su).fs. (2162624)
22 11 and 21 (13337)
23 clinical trial.pt. (431542)
24 randomized controlled trial.pt. (206880)

25 random$.tw. (352004)
26 meta-analysis.pt,sh. (21089)
27 (meta-anal: or metaanal:).tw. (16560)
28 (quantitativ: review: or quantitativ: overview:).tw. (336)
29 (methodologic: review: or methodologic: overview:).tw. (181)
30 (systematic: review: or systematic: overview).tw. (13159)
31 review.pt. and medline.tw. (12662)
32 or/23-31 (651784)
33 22 and 32 (1007)
34 33 not 20 (1004)
35 limit 20 to all adult <19 plus years> (63)
36 limit 33 to all adult <19 plus years> (798)
37 from 35 keep 1-63 (63)
38 limit 37 to yr="2002-2005" (16) (update from the end of 2002 to Oct 13, 2005)

WHAT'S NEW

Date	Event	Description
9 November 2008	Amended	Converted to new review format. CMSG ID: C069-R

CONTRIBUTIONS OF AUTHORS

Brigitte M. Jolles: developing and writing the text of this review
Earl R. Bogoch: developing and writing the text of this review

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Hôpital Orthopédique de la Suisse Romande, University of Lausanne, Lausanne, Switzerland.
- St. Michael's Hospital, University of Toronto, Toronto, Canada.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

Arthroplasty, Replacement, Hip [adverse effects] [*methods]; Osteoarthritis, Hip [*surgery]; Prosthesis Failure

MeSH check words

Adult; Humans