Effectiveness and safety of the posterior approach with soft tissue repair for primary total hip arthroplasty: A meta-analysis

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ABSTRACT
Background: Repair of soft tissue in favour of the posterior approach for total hip arthroplasty is still under discussion and few studies are assessing this issue. Therefore, we performed a meta-analysis to compare the effectiveness and safety of the posterior approach for total hip arthroplasty with and without soft tissue repair. We focused on these questions as follows: does primary posterior approach for total hip arthroplasty with soft tissue repair have better result regarding dislocation rate, Harris hip score and the sciatic nerve palsy rate compared with posterior approach without soft tissue repair.

Patients and methods: We conducted electronic literature searches using CENTRAL (Issue 1 of 12, Jan 2014), PUBMED (1980 to Jan 2014), and EMBASE (1980 to Jan 2014). Clinical studies evaluating the posterior approach for total hip arthroplasty with and without soft tissue repair were collected. After independent study selection by 2 authors, data were collected and extracted independently. The methodological quality of the studies was assessed by the Cochrane Collaboration’s tool for assessing risk of bias and the Newcastle–Ottawa Scale.

Result: Seven clinical trials with 4594 hips using the posterior approach for total hip arthroplasty were included. The pooled data indicated a lower rate of dislocation (OR: 0.14, 95% CI: 0.08–0.26, P < 0.00001) and higher Harris hip score (1.75, 95% CI: 1.19 to 2.32, P < 0.00001, I² = 26%) after the posterior approach to total hip arthroplasty using soft tissue repair than without using soft tissue repair. There was no statistical difference in sciatic nerve palsy between the use of soft tissue repair and without it in posterior approach to total hip arthroplasty (OR: 5.34, 95% CI: 0.25–112.25, P = 0.28).

Discussion: Our meta-analysis included data from more studies than were previously available and demonstrated that the use of soft tissue repair and without it in posterior approach to total hip arthroplasty are similar in safety. Using repair resulted in a lower dislocation rate and higher Harris hip score than without repair.

Levels of evidence: Level 2 meta-analysis of low-powered prospective randomised trial.

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1. Introduction

In the U.S., osteoarthritis (OA) of the hip affects 2.5% of people between the ages of 40 and 84 years and has no cure and may ultimately require a total hip arthroplasty (THA) [1]. The posterior approach is one of the most commonly techniques used in THA because of its excellent exposure, less extensive tissue dissection, lower incidence of heterotopic bone formation and preservation of the abductor mechanism [2,3] compared with other approaches.

However, many early studies [4–6] have reported that the posterior approach is associated with an increased risk of postoperative dislocation compared to other approaches, with a dislocation rate of almost 4–8% [7]. That may be caused by the disruption of the posterior capsule and the short external rotators. To reduce the incidence of dislocation following the posterior approach, some authors [8,9] performed a soft tissue repair (the posterior capsule and the short external rotators) after the posterior approach of THA, and the results indicated statistically significant differences in dislocation rates with and without posterior soft tissue repair. A meta-analysis comparing the dislocation rate of THA with or without soft tissue repair was published several years ago [10], but several high quality clinical trials have since been reported, and the previous meta-analysis did not address Harris hip score and safety.

The purpose of the current study was to compare the effectiveness and safety of the posterior approach for THA with and without soft tissue repair. We focus on these questions as follows: does primary posterior approach for total hip arthroplasty with soft tissue repair has better result in dislocation rate, Harris hip score and the...
sciatic nerve palsy rate compared with posterior approach without soft tissue repair.

2. Patients and methods

2.1. Eligibility criteria and literature search

We searched the Cochrane Register of Controlled Trials (CENTRAL, Issue 1 of 12, Jan 2014), PUBMED (1980 to Jan 2014), and EMBASE (1980 to Jan 2014) databases to identify all studies that discussed the dislocation rate of the posterior approach of THA with and without soft tissue repair based on the following criteria: soft tissue repair and posterior approach and primary total hip arthroplasty and (dislocation or complications or adverse effect); “Arthroplasty, Replacement, Hip/adverse effects” [Mesh] or “Arthroplasty, Replacement, Hip/methods”[Mesh] or “Arthroplasty, Replacement, Hip/therapy” [Mesh]. The inclusion and exclusion criteria used in selecting the procedures were:

- target population: included people under treatment of posterior approach to THA;
- intervention: posterior approach to THA with or without posterior soft tissue repair;
- methodological criteria: clinical trials and randomised controlled trials comparing the effectiveness and safety of posterior approach to THA using posterior soft tissue repair with the posterior approach to THA not using posterior soft tissue repair.

2.2. Outcome assessment

The primary outcomes measured were the rate of dislocation. The secondary outcomes measured included the Harris hip score and the sciatric nerve palsy.

2.3. Data extraction and quality assessments

For each trial, we gathered data on the study type, sample size, interventions, length of follow-up, dislocation rate, Harris hip score and sciatric nerve palsy. We also collected data on the randomisation process, allocation concealment process, binding, and selective reporting in randomised controlled trials. For the controlled clinical trials, we gathered data on representativeness of the cases, selection of controls, definition of controls, comparability of cases and controls, ascertainment of exposure, and equivalent methods of diagnosis and determination of response rate for cases and controls. Two authors extracted data independently according to the pre-specified selection criteria. Disagreement was resolved through discussion.

Two authors independently assessed the quality of the included studies and disagreement was resolved through discussion. We used the quality of reporting of meta-analyses (QUORUM) to improve the quality of reports of meta-analyses [11]. In this study, the Cochrane Collaboration’s tool for assessing risk of bias [11] was used for assessing the quality of the randomised controlled trials and the Newcastle-Ottawa Scale (NOS) [12] was used for assessing the quality of case control trials. For the Cochrane Collaboration’s tool for assessing risk of bias in randomised controlled trials, the quality of the studies was assessed using the following criteria:

- randomisation sequence generation: assessment for selection bias;
- allocation concealment: assessment of selection bias;
- level of blinding (blinding of participants and blinding of outcome assessment): assessment for performance bias and detection bias;
- incomplete outcome data: assessment for attrition bias; and;
- selective reporting: assessment for reporting bias. For case control studies, we calculated a total Newcastle-Ottawa Scale score from a maximum of 9 points for case control studies, using criteria listed in Table 1.

2.4. Statistical analyses

The statistical analysis was conducted using Review Manager (Computer program. Version 5.2. Copenhagen: The Nordic Cochrane Centre, the Cochrane Collaboration, 2012). For each study, the odd ratio (OR) was calculated for dichotomous outcomes, and treatment effects for continuous outcomes used the mean differences (MD), both used a 95% confidence interval (CI). Heterogeneity was assessed by visual inspection of the forest plot (analysis) along with the Chi² test and I² test, and a significance level of less than 0.10 for the Chi² test was interpreted as evidence of heterogeneity. I² was used to estimate total variation across studies. When there was no statistical evidence of heterogeneity, a fixed effect model was applied, otherwise a random effect model was chosen [11].

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The Newcastle-Ottawa Scale (NOS) for assessing the quality of non randomised case control studies in meta-analyses [12].</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection</td>
<td>Comparability</td>
</tr>
<tr>
<td>1) Is the case definition adequate?</td>
<td>1) Comorability of cases and controls on the basis of the design or analysis</td>
</tr>
<tr>
<td>a) Yes, with independent validation*</td>
<td>a) Study controls for „(select the most important factor)”</td>
</tr>
<tr>
<td>b) Yes, e.g. record linkage or based on self reports</td>
<td>b) Study controls for any additional factor (this criteria could be modified to indicate specific control for a second important factor)”</td>
</tr>
<tr>
<td>c) No description</td>
<td>c) Interview not blinded to case/control status</td>
</tr>
<tr>
<td>2) Representativeness of the cases</td>
<td>d) Written self report or medical record only</td>
</tr>
<tr>
<td>a) Consecutive or obviously representative series of cases*</td>
<td>e) No description</td>
</tr>
<tr>
<td>b) Potential for selection biases or not stated</td>
<td>2) Same method of ascertainment for cases and controls</td>
</tr>
<tr>
<td>3) Selection of controls</td>
<td>a) No*</td>
</tr>
<tr>
<td>a) Community controls*</td>
<td>3) Non-response rate</td>
</tr>
<tr>
<td>b) Hospital controls</td>
<td>a) Same rate for both groups*</td>
</tr>
<tr>
<td>c) No description</td>
<td>b) No</td>
</tr>
<tr>
<td>4) Definition of controls</td>
<td>4) No history of disease (endpoint)*</td>
</tr>
<tr>
<td>a) No history of disease (endpoint)*</td>
<td>b) No description</td>
</tr>
<tr>
<td>b) No description of source</td>
<td></td>
</tr>
</tbody>
</table>

Note: a study can be awarded a maximum of one star for each numbered item within the selection and exposure categories. A maximum of two stars can be given for comparability.
3.3.3.2. [8, 9, 13–17] about with the tool. The total rate of dislocation was significantly lower with the use of soft tissue repair than without it in posterior approach to THA (OR: 0.14, 95% CI: 0.08–0.26, P < 0.00001) (Fig. 3).

3.4. Does posterior approach with soft tissue repair has better result of Harris hip score compared with posterior approach without soft tissue repair?

Data pooled from two studies [9, 13] involving 526 hips indicated that the use of soft tissue repair resulted in significantly higher Harris hip score than without it in posterior approach to THA (1.75, 95% CI: 1.19 to 2.32, P < 0.0001, I² = 26%) (Fig. 4).

3.5. Does posterior approach with soft tissue repair has better result of sciatic nerve palsy rate compared with posterior approach without soft tissue repair?

A fixed effects model meta-analysis of one trial [15] including 275 hips yielded a pooled risk ratio that indicated that there was no statistical difference in sciatic nerve palsy between the use of soft tissue repair and without it in posterior approach to THA (OR: 5.34, 95% CI: 0.25–112.25, P = 0.28) (e-component 1).

4. Discussion

This meta-analysis included 7 clinical trials involving 4594 hips treated with the posterior approach to THA. Our results demonstrated a lower dislocation rate and higher Harris hip score when using soft tissue repair compared to not using the soft tissue repair during the posterior approach to THA. Our meta-analysis also indicated that there were no statistical differences between the two procedures in sciatic nerve palsy. This meta-analysis focused on the dislocation rate, Harris hip score and the rate of sciatic nerve palsy with or without posterior soft tissue repair during the posterior approach to THA. The approach to THA was restricted to the posterior approach and did not include other approaches. In this study, both unilateral and bilateral THA patients were selected.

This study has limitations:

- we only included 2 randomised controlled trials, the other 5 studies were case control studies, which may have reduced the quality of the evidence for this meta-analysis. The meta-analysis was conducted with a common method and design to allow for reproducible research selection and inclusion. The electronic search was conducted using CENTRAL, PUBMED and EMBASE, and full papers without restriction of language were selected;
- although the search strategy was broad and extensive, not all related clinical trials were included mainly because of publication

Fig. 1. Flow diagram depicting selection of studies for inclusion in meta-analysis.

3. Results

3.1. Search and selection of studies

The search strategy retrieved the following 324 studies: 105 from CENTRAL, 110 from PUBMED, and 109 from EMBASE. After examination of the titles and abstracts of these references, 8 studies were identified. A reading of the full text of 1 study revealed that the intervention was unclear. Thus, the remaining 7 clinical trials [8, 9, 13–17] seemed to be the primary relevant studies and were included in this meta-analysis (Fig. 1). Of which 2 studies [13, 15] were randomised controlled trials and 5 studies [8, 9, 14, 16, 17] were case control trials.

3.2. Characteristics and quality of included studies

In this meta-analysis, hips were the units of analysis. The sample sizes of the included studies ranged from 180 to 1515. Seven trials with 4594 hips treated with the posterior approach were included in the analysis. Table 2 presents the study characteristics (study type, sample size, interventions, length of follow-up and dislocation rate). All included studies were of a parallel design and had a positive control group. According to the Cochrane Collaboration’s tool for assessing risk of bias, the 2 randomised controlled trials [13, 15] were of moderate quality (Table 3). All 5 case control studies [8, 9, 14, 16, 17] were of high quality according to the NOS score (Table 4). Fig. 2 shows the quality of reporting of meta-analyses about our study.

Table 2

<table>
<thead>
<tr>
<th>Author group</th>
<th>Study type</th>
<th>Experimental intervention</th>
<th>Controlled intervention</th>
<th>Sample size (hips)</th>
<th>Length of follow-up (months)</th>
<th>Dislocation</th>
<th>Rate Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellicci et al. [8]</td>
<td>Case control study</td>
<td>Posterior repair</td>
<td>Without repairing</td>
<td>1074</td>
<td>6; 12</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>Suh et al. [9]</td>
<td>Case control study</td>
<td>Soft tissue repair</td>
<td>Without repairing</td>
<td>346</td>
<td>12</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Chiu et al. [13]</td>
<td>RCT</td>
<td>Capsulorhaphy</td>
<td>No capsulorhaphy</td>
<td>180</td>
<td>38</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Goldstein et al. [14]</td>
<td>Case control study</td>
<td>Capsulotomy</td>
<td>Partial</td>
<td>1000</td>
<td>12</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Tarasevicius et al. [15]</td>
<td>RCT</td>
<td>Soft tissue repair</td>
<td>Without repairing</td>
<td>275</td>
<td>12</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Tsai et al. [16]</td>
<td>Case control study</td>
<td>Capsular repair</td>
<td>Without repairing</td>
<td>204</td>
<td>12</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>White et al. [17]</td>
<td>Case control study</td>
<td>Capsular repair</td>
<td>Capsulotomy</td>
<td>1515</td>
<td>6</td>
<td>3</td>
<td>52</td>
</tr>
</tbody>
</table>

bias, which may exclude obvious outcome differences of the two treatment methods [18];

- of the 2 randomised controlled trials, only 1 study [13] reported the adequate allocation concealment and one study [15] reported the clear loss to follow-up reporting. Both studies were free of selecting report. The 5 case control studies had more than 7 points according to NOS score (maximum 9 points). While considering the overall evidence supplied by these trials instead of individual outcomes, we concluded that the evidence was of moderate quality for this meta-analysis.
The dislocation rate of soft tissue repair during the posterior approach to THA has been reported by several studies [3,5,19]. Robinson et al. [5] first reported that reattaching the short external rotators to the greater trochanter could reduce the incidence of postoperative dislocation from 7.5% to 1% in patients who had a posterior approach for THA. Weeden et al. [3] also reported a large series of patients who had been treated with a posterior approach and repair of the posterior capsule and short external rotators to the greater trochanter with nonabsorbable suture. Out of 945 patients operated on between 1994 and 2000, only 8 patients experienced a postoperative dislocation. This indicated that the posterior surgical approach could result in an extremely low dislocation rate with soft tissue repair. However, Kao and Woolson [19] did not report the same results after repairing the piriiformis tendon. Of the 10 consecutive total hip replacement cases, 8 of the 10 repairs failed during the early postoperative period, and 1 of the 2 repairs that did not fail was in the only patient who sustained a posterior dislocation. Kwon et al. [10] previously reported a lower dislocation rate when using soft tissue repair compared to not using the soft tissue repair during the posterior approach to THA. In our study, which included more high-quality studies, there was a lower dislocation rate with soft tissue repair than without soft tissue repair during the posterior approach to THA.

Harris hip score is frequently used to assess the outcome and effectiveness of total hip replacement, in our meta-analysis, the Harris hip score was higher when using soft tissue repair. While significant difference was observed, we recognize the mean difference in Harris hip score between groups was almost 2 points, which may have limited clinical significance. Sciatic nerve palsy is a common complication in posterior approach to THA, only one study [15] reported the result of sciatic nerve palsy, and we found that there were no statistical differences between the two procedures in sciatic nerve palsy. In contrast, one may consider the reasons for the occurrence of the sciatic palsy after THA are multiple and mainly not related to the surgical approach.

In summary, our meta-analysis included data from more studies than were previously available and demonstrated that the use of soft tissue repair and without in posterior approach to THA are similar in safety. Using repair resulted in a lower dislocation rate and higher Harris hip score than without repair.

**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

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**Appendix A. Supplementary data**

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.otsr.2014.10.015.

**References**