Review article

A systematic review of preoperative determinants of patient-reported pain and physical function up to 2 years following primary unilateral total hip arthroplasty

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A B S T R A C T

Although generally considered successful, total hip arthroplasty (THA) can yield suboptimal results in terms of pain and function in up to one forth of patients suffering from hip osteoarthritis (OA). A thorough understanding of the determinants of patient-reported pain and function following THA can help plan interventions directed at improving surgical results. Previously published systematic reviews do not permit to confidently identify the determinants of THA outcomes because of unsatisfactory methodological designs. Therefore, we aimed to answer: (1) which preoperative factors are most consistently associated with postoperative patient-reported pain and function up to 2 years following primary unilateral THA for hip OA. Medline, Pubmed, Embase and CINAHL were screened from their respective inception dates until April 2015 using a combination of keywords and MESH terms. Criteria for inclusion were: (1) participants with primary unilateral THA for hip OA followed for at least 3 months with a maximal follow-up of 2 years; (2) validated disease-specific patient-reported outcome measures assessing pain and/or disability; (3) identification of determinants obtained via multivariate analyses. Methodological quality was assessed using a modified version of the methodology checklist for prognostic studies. Twenty-two manuscripts were included. Mean score of the methodological quality was 81.0 ± 10.3% (66.7% to 100%). Among socioeconomic determinants, a lower educational level was significantly related to worse pain and function (3 out of 3 studies evaluating the relationship). Clinical determinants of poor outcomes included preoperative levels of pain and physical function (9 out of 12 studies), higher body mass index (6 out of 10 studies), presence/greater level of comorbidities (7 out of 8), worse general health (4 out of 4 studies) and lower radiographic OA severity (3 out of 4 studies). Study heterogeneity limited the pooled assessment of the strength of associations between the preoperative variables and THA outcomes. Studies with moderate-to-high methodological quality allowed to identify 6 preoperative variables consistently associated with medium term pain and function following THA. This knowledge may assist the management of patients at risk of poor results. Further research is required to clarify the force of associations between determinants and THA outcomes.

Level of evidence: Level II. Systematic review of cohort studies.

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1. Introduction

Hip osteoarthritis (OA) is a chronic debilitating condition, limiting the affected individuals in terms of function and causing important levels of physical pain [1,2]. Numerous pharmacological and non-pharmacological approaches aimed at relieving the ailments accompanying hip OA have been advocated. Total hip arthroplasty (THA) is currently the mainstay treatment in candidates experiencing important levels of pain and physical limitations who are unresponsive to other treatments [3]. Although generally effective in reducing pain and disability, THA may yield suboptimal results in up to 25% of patients [4]. A sound knowledge of determinants of THA results can ultimately provide an estimate of the likelihood of surgical success.
Hence, there is a clear necessity of comprehensively summarizing the determinants of pain and function levels after THA with the greatest amount of high-quality evidence. Previously published systematic reviews on the topic have several shortcomings, such as focus on only one type of determinant, inclusion of studies with poor methodological quality (MQ), a large range of follow-up and presentation of results based on combined cohorts of patients undergoing THA and total knee arthroplasty [5,6]. Moreover, an increasing amount of evidence published in the recent years on the topic, including the identification of novel determinants, motivates a systematic assessment of the literature. An appropriate knowledge of determinants of THA outcomes can be achieved by reviewing studies employing validated and disease-specific patient-reported outcome measures (PROMs) of pain and function evaluating the independent effect of THA determinants by using multivariate analysis [7]. Identification of determinants up to 2 years following THA is particularly relevant, as patients are thoroughly monitored by their surgeons, and any outcome considered unsatisfactory can potentially be addressed promptly.

We aimed to answer which preoperative variables have the highest quality and amount of evidence linking them to postoperative patient-reported pain and disability 3 months to 2 years following primary unilateral THA for hip OA.

2. Methods

2.1. Literature search and study identification

Four databases (Medline, Pubmed, Embase and CINAHL) were reviewed from their respective inception dates until April 2015 using a combination of keywords and MESH terms (see Appendix 1 for detailed search strategy). References of previously published reviews and relevant articles were scanned manually. In order to evaluate the eligibility, two authors independently reviewed the titles, abstracts and full texts of the articles.

2.2. Study selection

The eligibility of the studies was evaluated by considering the following criteria:

- participants underwent primary unilateral THA for hip OA;
- results are presented for a follow-up ranging between 3 and 24 months;
- the outcome measure was a disease-specific validated PROM assessing pain and/or function;
- identification of determinants was obtained using multivariate analyses;
- full-text article was published in English or French.

2.3. Data extraction

The following characteristics were recorded using a standardized form: participants’ age and gender proportion of the sample, number of patients, follow-up period, outcome measure, statistical methods used and adjustments, as well as statistically significant and non-significant determinants reported by the study. Data from each article was recorded by one of the raters and verified by another.

2.4. Methodological quality appraisal

Two trained evaluators (first author and a research assistant otherwise uninvolved in the project) independently appraised the MQ of the studies. Subsequently, results were discussed to facilitate consensus. A third evaluator intervened in case of differences. The appraisal of the risk of bias was undertaken with a modified version of the Methodology checklist for prognostic studies [8]. This tool evaluates the following characteristics: “Study participation”, “Study attrition”, “Prognostic factor measurement”, “Outcome measurement”, “Confounding measurement and account” and “Analysis”. Each item assesses the risk of potential bias: low (0), unclear or unknown given the information available in the article (1) and high (2), with a maximal total score of 12, a higher score indicating a better MQ. If the included study was retrospective and no information regarding patients excluded from the study was provided, a score of 1 was automatically attributed to the “Study participation” item. A follow-up percentage inferior to 80% prompted the attribution of a score of 0 to the “Study attrition” item. Studies not accounting for either age, gender or body mass index (BMI) in their multivariate analysis received a score of 0 for the “Confounding measurement and account” item. Total MQ was subsequently standardized.

2.5. Data synthesis and statistical analysis

In their multivariate analyses, studies employed two approaches when defining the dependent variables: either pain and function were evaluated separately (such as the pain and the function subscale of the Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]) or as part of a combined construct (total WOMAC score). Therefore, data on determinants was summarized according to both approaches. Solely a qualitative analysis was performed due to the heterogeneity of included studies in terms of study designs, variables’ constructs and definitions as well as statistical analyses.

3. Results

3.1. Description of the included studies

After exclusion of titles and abstracts, 129 full-text articles were further evaluated. One hundred and seven full-text articles were subsequently excluded for reasons presented in Fig. 1, leaving 22 manuscripts published from 1997 to 2015 for inclusion. Details of study characteristics can be found in Appendix 2. Data from two studies are shown conjointly because of results based on the same cohort [8,9]. The WOMAC was the most frequently employed validated tool (14 studies), followed by the Harris hip score (HHS), the Oxford hip score (OHS) and the Lower extremity functional scale (LEFS) (2 studies each) and the Hip disability and osteoarthritis outcome score (HOOS) used in 1 study. Thirteen (13) studies were conducted in European countries, 8 in the United States or Canada and 1 in Australia.

3.2. Methodological quality

Details of the MQ of the included studies can be found in Table 1. Mean total score was 81.0% ± 10.3% (min = 66.7%, max = 100%), representing moderate-to-high quality of evidence. No study received a score lower than 66.7% and four studies were graded above 90% [1,13,16,21]. The “Study attrition” domain received the lowest mean score of 35.7% ± 42.3%, with 11 studies having a follow-up proportion under 80%.

3.3. Preoperative determinants of pain and function levels following THA

Table 2 shows all the preoperative variables that were identified as significantly associated with THA results among the included studies, and are classified according to their types (demographic,
socioeconomic, psychosocial, clinical or healthcare-related) and to the measures of the dependent variables that were employed in the statistical analyses (pain and function separately or as a combined construct). Table 3 shows 6 preoperative variables with the highest amount of moderate to high quality of evidence linking them to THA outcomes. In the following paragraphs of this section, we summarize each type of determinant according to the amount and quality of evidence, and we detail pertinent studies.

3.3.1. Demographic determinants

Among the demographic variables that were investigated, older age was found to be associated with poor pain and functional outcomes in 4 out of 11 studies (MQ: 66.7–100%) [1,2,11,16,22,23]. Dowsey et al. [1] showed that in a cohort of 382 patients, higher age was associated with worse function at 1 and 2 years postoperatively as measured with the function subscale of the HHS. Stevens et al. [26] showed that being older than 70 years old was associated to worse function at 1 year as per the function subscale of the WOMAC score. Nevertheless, seven studies (MQ: 66.7–91.7%) did not identify a significant association between age and THA outcomes [8,9,11,16,18–20,24].

Only 2 out of 9 studies showed a significant relationship between gender and postoperative pain and function, and their findings are contradictory. Being female was associated with a higher change in the WOMAC pain score 6 months following THA in the first study [16] (MQ: 91.7%) but to a lower total WOMAC score 1 year postoperatively in the other (MQ: 83.3%) [26]. Seven studies (MQ: 66.7–100%) were unable to establish such a significant association [8,9,16–18,21,23,24].

The living arrangements was the sole other demographic determinant investigated in one study. Jones et al. [16] (MQ: 91.7%) showed that living alone was significantly associated with a lower change in the function subscale of the WOMAC score 6 months postoperatively (1 out of 1 study).

3.3.2. Socioeconomic determinants

Among socioeconomic determinants of THA outcomes, a higher educational level was shown to be associated to lower levels of postoperative pain and to better functional status in 3 out of 3 studies (MQ: 66.7–83.3%). Fortin et al. [8,9] report that a greater number of years of education was associated to lower levels of pain and better function 6 and 12 months after THA, Judge et al. [17,18] showed that patients with more education had a higher chance of being responders according to the OMERACT-OARSI criteria (see Appendix 2 for detailed definition), in addition to the greater likelihood of returning to a normal state (decrease in the total WOMAC score by 2 standard deviations compared to baseline) 1 year after THA.

Fig. 1. Flowchart of the literature search.
Table 1
Methodological appraisal of the included studies according to a modified version of the Methodology checklist for prognostic studies [10].

<table>
<thead>
<tr>
<th>Included studies (n = 22)</th>
<th>Study participation</th>
<th>Study attrition</th>
<th>Prognostic factor measurement</th>
<th>Outcome measurement</th>
<th>Confounding measurement and account</th>
<th>Analysis</th>
<th>Total score (/12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braeken et al. [11]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Caracciolo et Giaquinto  [12]</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Dowsey et al. [1]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Fortin et al. [8,9]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Gandhi et al. [13]</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Garbuz et al. [14]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Holstege et al. [2]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Jenkins et al. [15]</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Jones et al. [16]</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Judge et al. [17]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Judge et al. [18]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Judge et al. [19]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Kennedy et al. [20]</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>9</td>
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<tr>
<td>Kessler et al. [21]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Peter et al. [22]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Quintana et al. [23]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Ramaesh et al. [24]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Slaven [25]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Stevens et al. [26]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Vergara et al. [27]</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Wykle et al. [28]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Total (mean ± SD)/12 1.95 ± 0.22 0.71 ± 0.85 2.00 ± 0.0 2.00 ± 0.0 1.05 ± 1.02 2.00 ± 0.0 9.71 ± 1.23
Total (mean ± SD)/100 97.6 ± 10.9 35.7 ± 42.3 100 ± 0.0 100 ± 0.0 52.4 ± 51.2 100 ± 0.0 81.0 ± 10.3

Study participation: the study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results; study attrition: loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias; prognostic factor measurement: the prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias; outcome measurement: the outcome of interest is adequately measured in study participants, sufficient to limit bias; confounding measurement and account: important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest; analysis: the statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results; SD: standard deviation.

Table 2
Significant determinants of poor outcome 3 months to 2 years following THA.

<table>
<thead>
<tr>
<th>Determinant type</th>
<th>Pain Studies</th>
<th>Function Studies</th>
<th>Pain Studies</th>
<th>Pain and function combined Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Old age [23]</td>
<td>Old age [16]</td>
<td>Lower education [8,9]</td>
<td>Lower age [8,9]</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>None [18]</td>
<td>Fewer surgery expectations [18]</td>
<td>Lower educational level [17,18]</td>
<td>Lower educational level [17,18]</td>
</tr>
<tr>
<td></td>
<td>More comorbidity [12,26]</td>
<td>Better mental health [23]</td>
<td>Lower radiographic OA severity [17,18]</td>
<td>Lower radiographic OA severity [17,18]</td>
</tr>
<tr>
<td></td>
<td>Worse physical health [1]</td>
<td>Higher BMI [1,11,16]</td>
<td>None [None]</td>
<td>None [None]</td>
</tr>
<tr>
<td></td>
<td>Presence of back pain [1,23]</td>
<td>More comorbidity [16,22]</td>
<td>None [None]</td>
<td>None [None]</td>
</tr>
<tr>
<td></td>
<td>Greater widespread pain sensitivity [23]</td>
<td>Presence of back pain [1,23]</td>
<td>None [None]</td>
<td>None [None]</td>
</tr>
<tr>
<td></td>
<td>Medical concenctic disease [1]</td>
<td>Lower knee extensors strength [2]</td>
<td>None [None]</td>
<td>None [None]</td>
</tr>
</tbody>
</table>

BMI: body mass index; OA: osteoarthritis.
the outcomes. In studies where outcomes were measured as a function of postoperative state, worse levels of preoperative pain and function were associated with worse levels in the respective domains [16,23,27]. In contrast, studies that employed a change in status as a dependent variable showed that better preoperative levels of pain and function were associated with smaller changes [1,8,9,12,14,24]. Only two studies showed no significant association between preoperative and postoperative pain and function [11,20] (MQ: 83.3% and 75% respectively).

A greater BMI at the time of surgery was associated with worse THA results in terms of pain and function with high quality of evidence (6 out of 10 studies, MQ: 83.3–100%). In a cohort of 707 THA patients, a BMI superior to 30 was associated with lower total WOMAC scores at 1 year [13]. Similar results were found for subjects having a BMI greater than 25 in another study [26] and comparable results have been observed by four other studies [1,11,16,19], while two studies report a non-significant association between BMI and THA outcomes [20,21] (MQ: 100% and 75% respectively).

Regardless of the method of measurement of comorbidity, i.e. either the presence of a specific medical condition or the number of concomitant disorders, preoperative comorbidities were significantly associated with worse pain and function following THA in a consistent manner (7 out of 8 studies, MQ: 66.7–90.7%). Peter et al. [22] showed that a greater number of preoperative comorbidities were associated with worse HOOS pain and physical functioning scores up to 22 months after THA. Moreover, the same study showed that arteriosclerosis, cardiac disorders, dizziness in combination with episodes of falling, asthma, chronic obstructive pulmonary disease and cancer were all associated with worse pain and functioning. Four other studies concluded to similar findings regarding the association between greater comorbidity and worse THA pain and functional outcomes [13,16,24,26], while two others found no association between comorbidity and THA results [12,23] (MQ: 66.7% and 75% respectively). Presence of preoperative back pain was associated with a smaller change on the pain subscale of the 2-year WOMAC score, and to a smaller change in function at 6 months and 2 years postoperatively [23]. Similarly, severe back pain was associated to poor HOOS pain and functional scores 7 to 22 months postoperatively [22]. Regarding contralateral hip involvement, two studies found it to be associated to poor pain and function outcomes after THA [16,23].

A worse general health level, as measured by the SF-36 and the SF-12 questionnaires, was associated with poor outcomes after THA in 4 out of 4 studies that evaluated such an association [1,16,17,23] (MQ: 66.7–100%). According to Dowsey et al. [1], better physical and mental health are both independent determinants of hip pain and function, and were associated with better Harris Hip pain and function scores at 1- and 2-year follow-ups.

A lower radiographic OA severity was associated to poor outcomes in 3 out of 4 studies [1,17,18] (MQ: 83.3–100%). Judge et al. [17] found that a Kellgren-Lawrence grade of 1, 2 or 3 was associated with a lower odds of being a responder according to the OMERACT-OARSI responder criteria (Appendix 2) 1 year postoperatively when compared to a grade of 4.

Table 2 presents other clinical variables that were found significantly associated with pain and function after THA, including greater widespread pain sensitivity [28], radiographical medial concentric disease [1] and lower knee extensor muscle strength [2] (all 1 out of 1 study).

3.3.5. Healthcare-related determinants

One study investigated the relationship between waiting time and THA outcomes. Vergara et al. [27] showed that waiting longer than 6 months for THA was associated to lower gains in function 1 year after the surgery when compared to waiting less than 3 months (1 out 1 study).

4. Discussion

4.1. Main findings

A proper understanding of the determinants of THA outcomes could lead to improved results in terms of pain and functional status outcomes in the significant proportion of patients experiencing suboptimal results following this intervention. We aimed to answer which preoperative variables are the most consistently associated with patient-reported, disease-specific pain and functional limitations following primary unilateral THA in patients with hip OA. A systematic review of the literature identified 22 prognostic studies concluding that a lower educational status, worse or better preoperative levels of pain and function, greater BMI, more comorbidity, worse general health and a lower radiographical OA severity are significant preoperative determinants of THA pain and function outcomes (Table 3). According to the available evidence, age and gender are not significant determinants of THA pain and functional outcomes.

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**Table 3** Determinants of worse pain and function 3 months to 2 years following THA with the highest level of evidence.

<table>
<thead>
<tr>
<th>Determinant type</th>
<th>Pain and/or function</th>
<th>Number of studies with significant results</th>
<th>Number of studies investigating the determinant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socioeconomic</td>
<td>Lower educational status</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Clinical</td>
<td>Better/worse preoperative pain/function*</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Higher body mass index</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Presence or greater level of comorbidity</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Lower general health</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Lower radiographic OA severity</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

* Better preoperative status (pain/function) associated with worse change in status; worse preoperative status associated with worse postoperative status.

Regarding the socioeconomic status, in their cohort of 1744 subjects followed for 18 months, Jenkins et al. [15] found that a greater level of social deprivation predicted a poorer HHS 18 months after THA (MQ 66.7%) (1 out of 1 study).

3.3.3. Psychosocial determinants

Only one study investigated psychosocial determinants of THA outcomes. Judge et al. [18] (MQ: 83.3%) found that having a greater number of expectations regarding functional, activity and pain levels following surgery was associated with higher odds of achieving the OMERACT-OARSI responder criteria and the minimal clinically important difference on the 1-year function domain of the WOMAC score (Appendix 2), but not associated to the pain domain (1 out of 1 study).

3.3.4. Clinical determinants

The associations between clinical variables and THA outcomes were the most studied relationships, with the greatest amount of moderate to high evidence present for the preoperative levels of hip-related pain and function (9 out of 12 studies, MQ: 66.7–100%). In the case where outcomes were measured as a function of postoperative state, worse levels of preoperative pain and function were associated with worse levels in the respective domains [16,23,27]. In contrast, studies that employed a change in status as a dependent variable showed that better preoperative levels of pain and function were associated with smaller changes [1,8,9,12,14,24]. Only two studies showed no significant association between preoperative and postoperative pain and function [11,20] (MQ: 83.3% and 75% respectively).

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4.2. Strengths and limitations of the review

The eligibility criteria allowed for the inclusion of studies with the highest MQ from four important databases. Focus on all variables investigated for a possible association with THA outcomes permitted the elaboration of a comprehensive list of determinants with the highest level of evidence to date. Study heterogeneity reduces the ability to pool results in order to evaluate the strength of association between significant determinants and THA outcomes. Study findings do not apply to patients undergoing bilateral and revision THA, nor can be extended to determinants of long-term outcomes. Moreover, regardless of the sound statistical methods employed to identify determinants of THA results in the included studies, the extent of the clinical importance of the determinants remains to be fully established.

4.3. Educational level

A lower educational level is associated with poor outcomes following THA in all the 4 studies where it was investigated. Although the reasons for such an association are not directly discussed by the included studies, it is likely that the level of education is related to the patients’ socioeconomic status, which has been consistently associated with outcomes of other musculoskeletal conditions and related interventions [29,30].

4.4. Preoperative pain and function

The preoperative levels of pain and function are the determinants with the highest amount of evidence in the current review. The direction of the association depends on the approach employed for the evaluation of surgical results. Indeed, a lower preoperative status of pain and function is associated with a lower postoperative status, but with a higher change in these domains. Because the amount of pain and the extent of disability are often indications of proceeding with THA, this finding highlights the paradigm where patients with worse preoperative status have larger gains, but generally do not achieve the same levels as their counterparts who underwent THA earlier in the disease process. Unfortunately, there does not seem to be a clinical consensus regarding the necessity and timing for performing the surgery in patients with worse or better preoperative state [31].

4.5. Body Mass Index

BMI was significantly associated with worse THA outcomes in 6 out of 10 studies in our review. Some of these studies emphasize that the clinical significance of such a relationship may however be limited, as the individual weight of other variables such as preoperative levels of pain, function or comorbidities is more substantial [19,26]. For example, Stevens et al. [26] report that when compared to a BMI smaller than 25, a BMI greater than 25 was significantly associated with a poorer 1-year total WOMAC score with a multivariate regression coefficient of −0.63, P < 0.001, whereas having more than two comorbidities had a coefficient of −14.5, P < 0.001.

4.6. Preoperative comorbidities

A greater level of comorbidity and worse general health are somewhat related clinical factors that were found to have sizeable evidence. Traditionally, the level of comorbidity is evaluated preoperatively using the American Society for Anaesthesiology Scale in order to assess the risk of complications associated with the surgery [22]. The link between other medical conditions as well as general health with THA outcomes is increasingly recognized, and some authors suggest that addressing these before undergoing the surgery may be indicated [26].

4.7. Radiographic osteoarthritis severity

A lower radiographic OA severity has been associated with worse changes in pain and function in 3 out of 3 studies. Although the relationship between radiographic severity with preoperative hip pain and function is inconsistent, this finding may parallel the association between higher preoperative levels of pain and disability with lower changes in status after the surgery [32].

4.8. Determinants of pain compared to determinants of function

Some studies focused on evaluating determinants of THA for either pain or function independently, whereas others assessed the associations between preoperative variables and pain and function as part of a combined measure, such as in the case of the total WOMAC score. We attempted to compare whether the two approaches yielded different results in terms of the identity of the determinants. On occasion, individual studies report different determinants according to the method of outcome assessment; however, the results are ultimately similar when viewing the overall picture (Table 2).

4.9. Negative findings

In contrast with previously published systematic reviews on the same subject [5,6], the current study does not suggest a significant association between demographic variables such as age and gender with THA outcomes. Although some evidence indicates that older age may be associated with worse pain and function, a non-negligible number of included studies point to no significant association, prompting us to conclude that age is most likely unrelated to THA pain and function outcomes. Regarding gender, the two studies that found a significant association with THA outcomes have contradictory results for males and females.

5. Conclusion

Studies with a moderate-to-high MQ identified 6 preoperative determinants of pain and function 3 months to 2 years following primary unilateral THA. Knowledge of these determinants could improve the management of patients considering or undergoing the procedure. More standardized approaches of future studies could diminish the heterogeneity associated with the results and allow the pooling of the strength of association between determinants and outcomes. Evaluating the clinical applicability of the relationship between determinants and THA outcomes should also be targeted in future studies.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

References


