The role for arthroscopic partial meniscectomy in knees with degenerative changes

A SYSTEMATIC REVIEW

Aims
Patients with osteoarthritis of the knee commonly have degenerative meniscal tears. Arthroscopic meniscectomy is frequently performed, although the benefits are debatable. Recent studies have concluded that there is no role for arthroscopic washout in osteoarthritis of the knee. Our aim was to perform a systematic review to assess the evidence for the efficacy of arthroscopic meniscectomy in patients with meniscal tears and degenerative changes in the knee.

Patients and Methods
A literature search was performed, using the PubMed/MEDLINE database, for relevant articles published between 1975 and 2015. A total of six studies, including five randomised controlled trials and one cross-sectional study of a prospective cohort, met the inclusion criteria. Relevant information including study design, operations, the characteristics of the patients, outcomes, adverse events and further operations were extracted.

Results
The degree of osteoarthritis in the patients who were included and the rate of crossover from one form of treatment to another varied in the studies. Two randomised controlled trials showed a benefit of arthroscopic surgery in patients with limited degenerative joint disease, compared with conservative treatment. One cross-sectional study showed that patients with less severe degenerative changes had better outcomes.

Conclusion
Patients with symptomatic meniscal tears and degenerative changes in the knee can benefit from arthroscopic meniscectomy, particularly if the osteoarthritis is mild. A trial of conservative management may be effective and should be considered, especially in patients with moderate osteoarthritis.
optimise the indications for surgery and selection of patients for this procedure.

Materials and Methods
An initial literature search was performed in September 2015 using PubMed (1975 to present).

The same strategy was used to perform additional secondary searches using the MEDLINE database on EBSCOhost and the EMBASE database. The references of the studies to be included were also reviewed to ensure that no relevant publications were excluded.

Inclusion criteria. Studies were considered for inclusion if they were published in English, were a randomised controlled trial (RCT) or prospective cohort study published in a peer-reviewed journal with a minimum of level II evidence, assessed the efficacy of arthroscopic partial meniscectomy or conservative management of patients with pain, meniscal tears and degenerative changes in the knee.

Studies were excluded if they: contained < 50% of patients with degenerative changes in the knee, as based on either imaging prior to surgery or findings at arthroscopy, contained > 50% of patients with Kellgren-Lawrence grade 4 OA, did not report the incidence of meniscal tears, did not report the number of patients with baseline degenerative changes by severity, lacked pre-defined inclusion and exclusion criteria or pre-specified primary outcomes or any case series or pilot studies.

The authors (JL and RHB) independently screened the studies which were retrieved. Screening was initially performed on the title and abstract. If a study appeared to meet the inclusion criteria, the full-length article was reviewed.

### Table I. Characteristics of the studies which were included

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients (n)</th>
<th>Study design</th>
<th>Primary outcome measure</th>
<th>Outcome measures</th>
<th>Patient demographics</th>
<th>Follow-up (%)</th>
<th>Minimum follow-up (mths)</th>
<th>Overall LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauffin et al 2014</td>
<td>150</td>
<td>RCT</td>
<td>KOOS (pain) at 12 months postop</td>
<td>KOOS, EQ-5D, PAS, symptom satisfaction scale</td>
<td>Age 54 yrs ± 5.5; Gender 73% (109)M/ 27% (41)F</td>
<td>870</td>
<td>12</td>
<td>I</td>
</tr>
<tr>
<td>Katz et al 2013</td>
<td>351</td>
<td>RCT</td>
<td>WOMAC (physical) at 6 months postop</td>
<td>WOMAC (physical) at 12 months, KOOS pain, SF-36 physical</td>
<td>Age 58.4 yrs ± 7.4; Gender 94.0</td>
<td>6</td>
<td>I</td>
<td></td>
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<tr>
<td>Silvonen et al 2013</td>
<td>146</td>
<td>RCT</td>
<td>Lyshon and WOMET at 12 months postop, knee pain after exercise</td>
<td>NRS, Lysholm, WOMET</td>
<td>Age 52 yrs ± 7; Gender 61% (89) M/ 39% (57) F; BMI 27.4 ± 4.0</td>
<td>100.0</td>
<td>12</td>
<td>I</td>
</tr>
<tr>
<td>Kirkley et al 2008</td>
<td>188</td>
<td>RCT</td>
<td>WOMAC (total) at 24 months postop</td>
<td>WOMAC (total), SF-36 physical, MACTAR, ASES, standard-gamble utility score</td>
<td>Age 59.6 yrs ± 10.1; Gender 37% (68)M/ 63% (112)F; BMI 30.9 ± 6.5</td>
<td>89.4</td>
<td>24</td>
<td>I</td>
</tr>
<tr>
<td>Aaron et al 2006</td>
<td>122</td>
<td>Cross sectional prospective cohort</td>
<td>KSS pain (no time specified)</td>
<td>Dichotomized KSS (pain) (0-20 indicates failure, ≥ 30 indicate success), Noyes and Stabler joint severity score</td>
<td>Age 61.7 yrs; Gender 33% (36) M/ 67% (74) F; BMI 31.8</td>
<td>90.0</td>
<td>24</td>
<td>II</td>
</tr>
<tr>
<td>Merchant and Galindo 1993</td>
<td>80</td>
<td>RCT</td>
<td>Modified HSS Knee Rating Score (no time specified)</td>
<td>Modified HSS Knee Rating Score</td>
<td>Age 56.5 yrs ± 7; Gender 27% (20) M/ 73% (53)</td>
<td>91.3</td>
<td>12</td>
<td>II</td>
</tr>
</tbody>
</table>

NRS, Numerical Rating Scale; WOMET, Western Ontario Meniscal Evaluation Tool; K-L, Kellgren-Lawrence grade; MACTAR, McMaster-Toronto Arthritis Patient Preference Disability Questionnaire; ASES, Arthritis Self-Efficacy Scale; SF-36, Short Form-36 Physical Component Summary; HSS, Modified Hospital for Special Surgery Knee Rating Scale; KOOS, Knee Injury and Osteoarthritis Outcome Score; EQ5D, EuroQol EQ-5D; PAS, Physical Activity Scale; KSS, Knee Society Scoring System; WOMAC, Western Ontario and McMaster University Osteoarthritis Index; LOE, level of evidence; BMI, body mass index; RCT, randomised controlled trial; sd, standard deviation

### Risk of bias assessment.
The authors also assessed the methodological quality of the studies using criteria previously described, and independently assessed the randomisation and allocation concealment, blinding, attrition bias, sample size calculation, selective outcome reporting and other bias.

### Data extraction.
A standardised data sheet was prepared, and the authors extracted all relevant information and reported outcome data from the included studies. When necessary, means and measures of dispersion (standard deviation based on error bars from figures) were estimated. All information about adverse events and re-operations was extracted. We excluded data extracted on patients with Kellgren-Lawrence grade 4 OA, as arthroscopic meniscectomy is known to be ineffective in these patients.

### After screening 1025 studies from the initial search (PubMed), 18 studies were identified for full-text review and consideration of inclusion. The additional searches (EBSCO-MEDLINE 827, EMBASE 803) did not reveal any more studies. A total of 12 studies were excluded, leaving six studies; five RCTs and one cross-sectional study of a prospective cohort for inclusion.

### Results.
The six studies meeting the inclusion criteria ranged in size from 80 to 351 patients and from a single site to seven (Table I). Baseline pain in the knee and function scores were similar in most studies. Primary and secondary outcome measures varied. The minimum follow-up ranged from six to 24 months and numbers lost to follow-up ranged from 0% to 13%. Participation varied from 26% to 97%.
The inclusion and exclusion criteria varied between studies. The minimum age for inclusion ranged from 18 to 50 years. Four studies specified that patients, to be considered for inclusion, must have already failed conservative treatment. Regarding the minimum duration of symptoms, one study required a duration of more than four weeks, two required a duration of longer than three months and one required that the patient had symptoms for less than six months before randomisation. The other two studies did not specify a duration of symptoms. Five studies excluded patients with a history of trauma to the affected knee or a locked knee on examination. Kirkley et al excluded large meniscal tears ("bucket-handle tears") as detected by clinical examination or pre-operative MRI. In two studies, all patients had meniscal tears. In the others, the incidence of meniscal tears in patients undergoing arthroscopy ranged from 71.8% to 89%. In the paper by Sihvonen et al, all patients had medial meniscal tears. Merchan and Galindo described a ratio of medial to lateral meniscal tears of four to one. In the four other studies, the laterality of the meniscal tear was not described.

When possible, data stratified by Kellgren-Lawrence grade was extracted. In four studies, all patients had degenerative changes within the knee. In two studies, we excluded the data of patients with Kellgren-Lawrence grade 4 OA. Kirkley et al and Aaron et al required at least grade 2 OA, while Gauffin et al and Sihvonen et al excluded such patients.

In five studies, all treatment groups underwent arthroscopic surgery. In Sihvonen et al's study, arthroscopic surgery was limited to arthroscopic partial medial meniscectomy. If any additional pathology was seen during diagnostic arthroscopy, those patients were excluded from the study. In the other studies, additional pathology seen during diagnostic arthroscopy, such as loose chondral flaps or loose bodies, were addressed surgically and patients were not excluded from the respective study. Katz et al randomised patients to arthroscopic meniscectomy versus physiotherapy but allowed crossover. Of the five RCTs which were included, four had a control group that received conservative treatment. The only double-blinded study used arthroscopic lavage as a control group, which the authors described as sham surgery.

Allocation was adequately concealed in five studies. Patients and outcome assessors were only blinded in one study. A total of four of the six studies clearly explained sample size calculations. The rate of crossover from one treatment arm to the other varied in the studies from approximately 6% to > 30%. Gauffin et al included 150 patients in the study and reported that 21% crossed over from conservative treatment to arthroscopy and 12% crossed over from arthroscopy to conservative treatment. Katz et al included 351 patients and reported a 30.2% rate of crossover from conservative treatment to arthroscopy at six months, while 5.6% of patients assigned to the arthroscopic meniscectomy group had not undergone surgery. An additional 4.7% crossed over from the conservative treatment group to the arthroscopic meniscectomy group between six and 12 months after entering the trial. Sihvonen et al included 146 patients and reported a 7% rate of crossover from lavage surgery to the arthroscopic meniscectomy group. Kirkley et al included 188 patients and reported that 6.4% of patients crossed over from the arthroscopic meniscectomy group to the conservative group. Overall, two studies were assessed to have a moderate risk of bias and four a high risk of bias.

Primary outcome measures in the six studies included: the Knee Injury and Osteoarthritis Outcome Score (KOOS) pain subscale, the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) physical subscale and total score, the Lysholm Knee Scoring Scale, Western Ontario Meniscal Evaluation Tool (WOMET), the Knee Society Score (KSS) pain subscale and the modified Hospital for Special Surgery (HSS) knee rating score.

In all, four studies stratified outcome by the Kellgren-Lawrence grade of OA, while two others, which only included patients with minimal OA, did not stratify by the Kellgren-Lawrence grade. No significant improvement was shown in the primary outcome for the operative group compared to the control group in three studies. A significant improvement was shown in three other studies. Gauffin et al showed a higher between-group difference in KOOS (pain) score at 12 months in favour of the operative group. Using a ten point increase from baseline as a priori-defined indication of clinical improvement, Merchan and Galindo showed an increased mean difference in the modified HSS knee rating score, in favour of the operative group, at all time points. Aaron et al separated the KSS (pain), into two categories, with 0 to 20 points indicating failure of treatment and > 30 points indicating successful treatment. Comparing patients with grade 2 and grade 3 degenerative changes, Aaron et al showed that those with grade 2 changes had a significantly higher rate of treatment success at all follow-up times.

In the study by Gauffin et al, age, either classified as < 55 years or > 55 years, had a significant effect on KOOS (pain) after controlling for intervention. Although the authors anticipated that younger patients would be more likely to benefit from arthroscopic debridement, older age was actually found to be the only factor associated with a significantly improved outcome.

The incidence of adverse events was relatively balanced between operative and conservative treatment groups in all the studies.

**Discussion**

This systematic review of arthroscopic intervention for symptomatic meniscal tears in patients with OA of the knee included six studies; five RCTs and a cross-sectional study of a prospective cohort. Analysis of these studies suggests that these patients can benefit from arthroscopic meniscectomy, particularly if the OA is mild.
Higher rates of crossover from conservative to arthroscopic management may be contributed to by a failure of conservative measures prior to randomisation, as was observed in the studies by Katz et al.13 and Gauffin et al.34 Patient selection criteria may have played a significant role in the results of some of the studies. Sihvonen et al.17 excluded patients with an “obvious traumatic onset of symptoms” or with “arthroscopic assessment showing anything other than a degenerative tear of the medial meniscus requiring surgical intervention”; criteria which are difficult to define. Another vague, unquantified exclusion criterion is “decreased range of motion of the knee.” This may limit the clinical impact of this study, as there may be relatively few patients with no history of trauma, symptomatic, isolated “degenerative” medial meniscal tears, “full” range of movement and no other intra-articular pathology to address at arthroscopy. Furthermore, the patients excluded from this study may be the most likely to benefit from arthroscopic meniscectomy. These strict exclusion criteria probably contributed to this multi-centre study’s prolonged five-year period of enrolment.17 Sihvonen et al.17 also did not control for the presence of chondrosis, with a higher prevalence and severity of chondrosis seen in patients undergoing arthroscopic meniscectomy compared with the control group (arthroscopic lavage).8 There may have been a relevant difference in patients requiring additional surgery between the partial meniscectomy group and the sham group, after two and five patients in each group (respectively) underwent additional surgery due to persistent symptoms (although no statistical analysis was performed).17 Finally, when not stratified by Kellgren-Lawrence grade, their graphs show significant differences in WOMET score and pain in the knee after exercise at two and six months, but no analysis was reported. While Kirkley et al.35 excluded patients suspected of having large meniscal tears, patients did not require a meniscal tear for inclusion and instead were included on the basis of Kellgren-Lawrence grade 2, 3 or 4 OA. Kirkley et al.35 and Aaron et al.33 included patients with grade 4 OA, a group known not to benefit from arthroscopic surgery of the knee.21,22 However, in patients with Kellgren-Lawrence grade 2 to 3 OA, Aaron et al.33 showed that the severity of OA had a profound effect on the outcome, suggesting that patients with grade 3 OA are less ideal candidates for arthroscopic surgery than those with limited degenerative changes. This is further supported by the finding that 5% of patients with grade 2 OA underwent TKA at a mean of 24 months, while 22% of those with grade 3 OA underwent TKA at a mean of ten months after arthroscopic meniscectomy (p = 0.016).

Three systematic reviews have recently investigated the role of arthroscopy for the treatment of OA of the knee.43-45 These studies did not limit inclusion to studies in which arthroscopic meniscectomy was specifically performed. Thordlund et al.43 performed a meta-analysis investigating arthroscopic surgery of the knee for patients with degenerative changes, concluding that this procedure is ineffective in middle aged or older patients with pain in the knee and is associated with harm.10,13,17,25,27,28,32,34,35,43 A significant question about this study is why the authors drew conclusions of associated harm from a series of mainly registry studies rather than those used to analyse the benefits of surgery. Laupattaraksem et al.45 investigated arthroscopic debridement for OA of the knee, concluding that arthroscopic debridement has no benefit.25-27,45 Khan et al.44 investigated arthroscopic surgery for degenerative meniscal tears, concluding that there is no benefit from arthroscopic meniscectomy in middle-aged patients with mild or no OA.10,11,14,17,28,30,32 Both Thordlund et al.44 and Laupattaraksem et al.45 included studies in which most patients had moderate to severe OA.25,27 Thordlund et al.43 and Khan et al.44 included a pilot study28 which favoured conservative treatment more than any other study. All three reviews contained studies in which arthroscopic meniscectomy was not specifically performed.25,27,30 Interestingly, in a study excluded from the present systematic review, due to a lack of baseline changes of OA of the knee, but included in all three recent systematic reviews, Herrlin et al.11 reached a different conclusion at the five-year follow-up than the original two-year follow-up study, which had concluded that arthroscopic medial meniscectomy followed by physiotherapy was not superior to physiotherapy alone.10,11 At five years, one third of patients randomised to physiotherapy had disabling symptoms in the knee, which improved to the same level as the other patients in the study after crossing over and undergoing arthroscopic meniscectomy. While these systematic reviews fail to show a benefit for arthroscopic surgery in OA, they do not specifically investigate arthroscopic meniscectomy and also include many studies not meeting our inclusion criteria.

There are several limitations to this review. We initially sought to include studies containing only patients with symptomatic meniscal tears and OA of the knee. However, only two studies13,17 exclusively contained patients with meniscal tears; the prevalence of tears in the other four studies ranged from 71.8% to 89%.33-36 Nonetheless, the authors of the study with the lowest prevalence of tears commented that, with the numbers available, the prevalence of meniscal tears had no influence on the outcome.33 We had initially considered performing a meta-analysis on the data extracted from the included studies. However, due to the heterogeneity of primary outcomes and heterogeneous cohorts of patients, we were unable to perform a meaningful meta-analysis. Despite these limitations, this systematic review shows that patients with symptomatic meniscal tears and degenerative changes in the knee can benefit from arthroscopic meniscectomy, particularly those with mild OA. Because most patients undergoing conservative treatments within the included studies had clinically significant improvements, physical and medical forms of treatment should be used for most patients prior to operative intervention, particularly in those with moderate OA. More research is needed to better define prognostic factors and long-term outcomes in these patients.
Take home message:
Arthroscopic partial meniscectomy may benefit patients with symptomatic meniscus tears in knees with degenerative changes, with better results generally associated with less severe joint degeneration. A trial of conservative treatment should be considered in most cases prior to operative intervention.

Supplementary material
Tables showing the search strategy, reasons for exclusions and outcomes are available alongside the online version of this article at www.bjjskeletaljoint.org.uk

Authors contributions:
J. D. Lamplot: Responsible for literature search and review, Manuscript preparation, Creation of tables.
R. H. Brophy: Responsible for literature search and review, Manuscript preparation, Manuscript review, Correspondence.

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References