Review Article

Do meniscal repairs with meniscus cyst do better than meniscectomy?—a systematic review of meniscal cyst treatment

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Background: This systematic review aims to determine the best modality for the management of meniscal cysts and its associated meniscus tear; whether the meniscal cyst treated via arthroscopy or open methods and whether meniscal debridement or repair achieves better results.

Methods: This systematic review was performed using PRISMA guidelines. A literature search of PubMed, EMBASE and Cochrane was carried out in July 2020 using the search terms 'meniscal cyst' and 'treatment'. All clinic studies that included filters for papers in the last 20 years, English language, and meniscal cysts found in humans were included. Studies that contained case reports, were in any language other than English, and with subjects that were not humans were excluded. The methodology quality assessment was performed through the modified Coleman methodology score (CMS).

Results: A total of 166 results were obtained from PubMed, Cochrane library and EMBASE. Of them, 12 duplicates were identified across the databases and removed from consideration. Six papers were found relevant from EMBASE in which 1 was eventually included in this paper. In total, 12 papers were used in this study. The weighted mean age of the patients was 35.1 years, with total of 523 meniscal cysts, of which 488 of these cysts are associated with meniscal tears (93.31%). The studies included performed cystectomies and/or decompression of meniscal cysts while some left the meniscal cyst alone and dealt with the meniscal lesion instead. All clinical scores showed significant improvement following surgical procedures.

Conclusions: Both arthroscopic and open methods can be used for meniscal cysts treatment. Open cystectomy rather than decompression seemed to confer lower risk of cyst recurrences and complications. It is inconclusive to whether meniscal repair or meniscus debridement influenced recurrence and outcome scores. A recommendation for meniscus repair cannot be made due to insufficient high-quality level I or II trials.

Keywords: Meniscectomy; repair; cyst; meniscal

Received: 17 July 2022; Accepted: 22 November 2022; Published online: 21 December 2022.

doi: 10.21037/aoj-22-29

View this article at: https://dx.doi.org/10.21037/aoj-22-29

Introduction

Meniscal cysts have gained attention due to the complexity of surgical management, especially with the additional component of the corresponding meniscal tear. Most commonly, horizontal meniscal tears have been implicated in the formation of meniscal cysts (1), with varying rates of incidence reported. Wroblewski reported 50% (2)

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incidence of meniscal tears while Reagan et al had 84% (3) and some others were even able to show 100% association with meniscal tears (1,4,5). Various theories have been put forth to account for the development of meniscal cysts, attributing it to myxoid degeneration of collagen (6), while others have also postulated that they develop from an inflow of synovial fluid resulting from a meniscal tear instead. The meniscal cysts may result from the dual pathways of synovial fluid inflow and myxoid degeneration (6).

The recent advent of horizontal meniscus tear repair and the improved techniques to repair them have also increased the interest in repairs of this tear pattern (7). Previously what was considered as a meniscus tear pattern not amenable to repair, there is now data to show that such tears when repaired can achieve good clinical outcomes on par with other tear patterns (8).

Lateral meniscal cysts have been found to be more common than that on the medial side and predominantly affecting men. Seger *et al.* reported a ratio of 10:1 (4) favouring the lateral meniscus as compared the medial side. However, newer studies using MRI as a main modality of investigation (9-11), as compared to previous arthroscopic or surgical methods, have shown that medial meniscal cysts are more common than previously thought (10,11). Campbell *et al.* showed a 2:1 ratio of medial meniscal as compared to lateral meniscal cysts (10).

Previously, most meniscal cysts were treated surgically with open cystectomy and total meniscectomy (12). However, that led to inevitable degenerative changes in the long term. Flynn and Kelly (13) were able to achieve good results with local excision of meniscal cyst with an attempt to preserve the meniscus as far as possible if no meniscal tears were found intraoperatively. They reported no recurrences and showed earlier return to work (13). As arthroscopy and surgical techniques improved, treatment now involves arthroscopic management of the meniscal lesion with decompression of the cyst (14) or open cystectomy. Co-existing meniscal tears, if found, were mostly debrided until a stable rim was achieved (4,15-17). A recent systematic review by Haratian *et al.* (18) showed that arthroscopic management of cysts can provide satisfactory outcomes for patients with good return to sport. However, it is not clear whether the treatment of the co-existing meniscal tears can affect the outcomes achieved.

This paper aims to review current literature available to compare the outcomes between arthroscopic and open surgeries for treatment of the meniscal cyst, as well as the clinical outcomes for meniscal repair in contrast to meniscal debridement, focusing on literature in the last 10 years and only studies of Level IV evidence and above. We present the following article in accordance with the PRISMA reporting checklist (available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-29/rc). This systematic review is not registered.

Highlight box

Key findings

- Both arthroscopic decompression and open cystectomy are viable options for dealing with a meniscal cyst.
- Open cystectomy appears to be associated with lower cyst recurrences and complications.
- There is inconclusive evidence to determine if treatment of the meniscal tear, repair or debridement, affects the outcomes of the meniscal cyst.

What is known and what is new?

- Meniscal tears have been found to be commonly associated with a meniscal cyst, especially in horizontal meniscal tears.
- This systematic review looks at the various types of treatment of the meniscal tear and how it affects outcomes and recurrence of the meniscal cyst.

What is the implication, and what should change now?

- More high-quality studies should be done to determine how repairs or debridements of the associated meniscal tears affect the outcomes and recurrence of meniscal cysts.

Methods

Literature search

A literature search of PubMed, Embase and Cochrane was carried out by a single reviewer using the following keywords in combination: *meniscal*, *meniscus*, *cyst*, *treatment*. If the abstract matched the topic, the full article was assessed by a single reviewer. Of which, the studies were then shortlisted and evaluated for the following: (I) journal of publication; (II) year of publication; (III) country and language; (IV) level of evidence; (V) whether arthroscopic treatment or open treatment was adopted; (VI) number of cases of meniscal cysts that are associated with meniscal tears; (VII) treatment of meniscal cyst.

Thereafter, the articles were screened based on their titles and abstract for relevance. The full texts of the remaining articles were retrieved and assessed for inclusion into this systematic review. All articles were reviewed by a senior author.

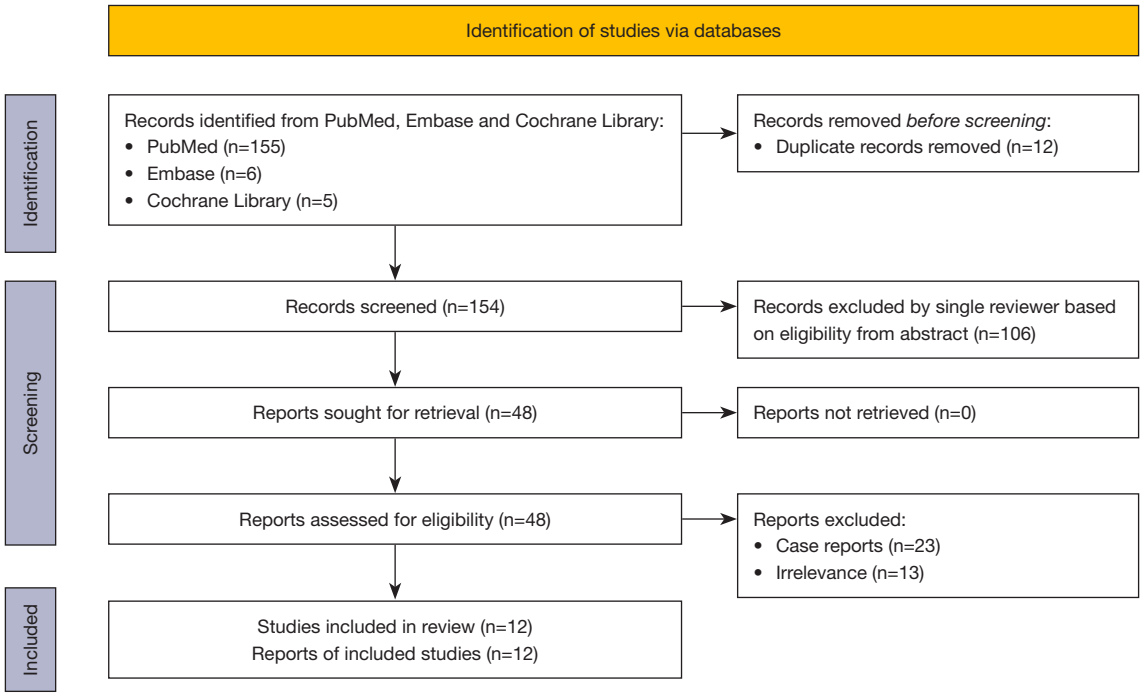

Figure 1 PRISMA diagram of studies included in this systematic review.

Eligibility criteria

All clinical studies investigating treatment of meniscal cysts were considered for inclusion. Only articles with the following are included:

(I) Papers published from year 2000–2020;
(II) Level of evidence IV and above according to the *Journal of Bone and Joint Surgery* were included (19);
(III) Papers that were in English and involving human studies;
(IV) Minimum duration of follow-up of at least 12 months.

Outcomes of interest

Study generalities (author, year, journal), surgical technique and related patient baseline data (type of procedures, mean age, gender proportion, duration of follow-up, complications) were recorded. Data concerning the satisfaction and different clinical scores were collected. For example, the Lysholm Knee Scoring Scale, Visual Analogue Scale (VAS) and the categorical scores.

Methodological quality assessment

The Coleman methodology score (CMS) was used to assess the quality of the studies, accounting for chance, biases, and confounding factors. Even though the CMS was initially developed for use in patella tendinopathy, modifications have been allowed for other trial designs due to the similarities in the subsections of the CMS as well as the Consolidated Standards of Reporting Trials (CONSORT) statement. The CMS comprises of a score ranging from 0 to 100, a higher score indicates a lower probability of various biases, confounding factors, and chance (20).

Results

Search result

The initial literature search produced a total of 166 articles across PubMed, EMBASE and Cochrane with 12 duplicates. The literature search from EMBASE resulted in 6 papers, and that of the Cochrane library resulted in 5 papers. Of these 6 papers from EMBASE, 1 was included in this study after assessing relevance of the abstract. Finally, there were a total of 12 studies included in this review (*Figure 1*). We have included Tudisco *et al.* (21) and Haklar *et al.* (22) in our review for further analysis; where the number of meniscal tears in their cohort was not documented, but they recorded

details of meniscal tear treatment.

Patient demographics

From the 12 studies (6,21-31) included in this systematic review, the weighted mean follow-up duration was 41.4 months, and the weighted mean age of the patients was 35.1 years. Meniscal cysts mostly affected men, with 334 male patients (63.74%) and 190 female patients (36.26%), agreeing with a generally male predominant population as compared to other studies.

The details and characteristics of all 12 studies included in this systematic review have been summarised in *Table 1* and *Table 2*.

Despite variations in techniques as described by the different authors in the studies above, it can be broadly classified into open or arthroscopic/percutaneous decompression of the meniscal cyst (cyst decompression) versus open cystectomy. This is matched against the management of the meniscus tear i.e., meniscus repair versus partial meniscectomy/meniscal debridement and is represented in *Table 3*.

A total of 523 cases of meniscal cysts were included in this systematic review, amongst 524 patients. Three hundred seventy-eight cysts (72.28%) involved the lateral and 145 cysts (27.72%) involved the medial meniscus.

One hundred and seventy-six patients underwent open cystectomy, 14 patients underwent arthroscopic partial meniscectomy alone without any cyst manipulation, 18 had percutaneous decompression of the cyst and 315 underwent arthroscopic decompression of the meniscal cyst.

While some studies did not mention the prevalence and/or types of meniscal tears in their patient population, there were at least 488 meniscal tears recorded, with the following broadly classified proportion of the different meniscal tear patterns: 90 complex tears, 301 horizontal tears, 44 radial tears, 7 transverse tears, 17 vertical tears, 7 flap tears, 2 discoid associated, 2 meniscocapsular tears and 12 bucket handle tears. Of the meniscal tears, 2 were left alone, 439 arthroscopic partial meniscectomies or debridement were performed, 1 repair (not specified if open or arthroscopic method used), and 14 arthroscopic repairs and 32 open repairs were done. This data is represented in *Table 4* and *Table 5* below.

Complications

Hulet *et al.* (25) reported 3 post-operative complications: 1 patient who developed knee septic arthritis, 1 patient who developed reflex sympathetic dystrophy, and 1 patient with recurrent effusions. No major complications were reported from the other 11 remaining studies.

Outcomes of interest

The outcomes of interest in this paper are measured via the following means: (I) Recurrences of meniscal cysts looking at—(i) treatment of meniscal cyst; (ii) treatment of meniscal tear and (II) Outcome scores: categorical or Lysholm score.

Recurrences

Treatment of meniscal cyst

Forty-six meniscal cysts recurred (8.63%), with at least 34 recurrences after decompression (10.2%) and 6 recurrences (3.41%) after open cystectomy. This is illustrated in *Table 6* below. However, both Bombaci *et al.* (29) and El-Assal *et al.* (24) did not report recurrences separately in the groups of patients who underwent different index surgeries, whether it was via the arthroscopic decompression, using the extra-articular portal, or open cystectomy. This brings about ambiguity to the recurrence rates for either surgical technique in their cohort, and their recurrence rates were included in the total numbers but excluded from the treatment specific results.

Four cysts recurred following arthroscopic decompression in the study by El-Assal *et al.* (24), while 1 cyst recurred following open cystectomy in the study by Sarimo *et al.* (23). Chang *et al.* (28) had 5 out of 112 (4.46%) meniscal cysts that underwent open cystectomy recurred, while 27 out of 129 (20.93%) meniscal cysts that underwent arthroscopic decompression recurred.

Treatment of meniscal tears

There were a total of 47 meniscal repairs across these 12 studies, with 14 all-inside repairs and 32 open repairs. However, in these studies, clinical outcomes, and recurrences of cysts in the patients who underwent meniscal repair were not reported separately to allow for further scrutiny as to whether the management of the meniscal tear had any impact on the recurrence of the meniscal cyst.

Kumar *et al.* (27) did not report any manipulation of the cyst and yet was able to achieve good pre and post-operative Lysholm scores with partial meniscectomy alone.

Outcome scores

Of all the 12 studies included, there were mainly 2 predominant clinical outcome measures used, the Lysholm score (32) as well as the categorical scale. The Lysholm

Table 1 Details of all the papers included in this systematic review

Author	Year	Journal published	Level of evidence	Modified CMS	Surgical method(s)	Number of patients	Number of meniscal cysts	Number of meniscal tears	Mean age, in years [range]	Mean follow-up in months [range]	Clinical outcome scoring system	Number of cyst recurrences	Complications
Tudisco *et al.* (21)	2000	*American Journal of sports medicine*	IV	39	Arthroscopy	19	19	–	33.5 [20–53]	39.6 [24–60]	Cerullo evaluation scale	0	–
Sarimo *et al.* (23)	2002	*American journal of sports medicine*	III	42	Arthroscopy: 19; Open: 16	35	35	33	33 [16–83]	33 [6–120]	Categorical	1	–
El-Assal *et al.* (24)	2003	*KSSTA*	IV	29	Arthroscopy: 22; Open: 5	26	27	27	29 [12–40]	58 [9–110]	Categorical	4	1 revision arthroscopic excision and debridement of cyst due to incomplete removal
Hulet *et al.* (25)	2004	*Arthroscopy*	IV	40	Arthroscopy	103	105	105	33 [12–69]	60 [12–144]	Categorical	7	1 septic arthritis; 1 recurrent hydrarthrosis; 1 reflex dystrophy
Howe and Koh (6)	2007	*The Knee*	IV	32	Arthroscopy	8	8	6	37.2 [18–49]	39.1 [12-94]	Lysholm and Tegner	0	–
Pujol *et al.* (26)	2013	*KSSTA*	IV	27	Open	19	15	21	25 [16–44]*	40 [24–101]*	KOOS 86.1; IKDC 84.0	0	4 secondary meniscectomies for recurrence of symptoms
Kumar *et al.* (27)	2014	*The Knee*	IV	39	Arthroscopy	14	14	14	40 [21–56]	61.2 [38–94]	Lysholm	0	–
Haklar *et al.* (22)	2014	*The Knee*	IV	52	Arthroscopy	20	20	–	41 [17–68]	37.5 [12–70]	Lysholm and modified Dorfmann clinical outcome scale	0	–
Chang *et al.* (28)	2015	*KSSTA*	III	58	Arthroscopy	241	241	241	36.8	26 [7–36]	Lysholm and VAS	32	–
Bombaci, *et al.* (29)	2016	*SICOT-J*	IV	46	Arthroscopy	8	8	7	36.13 [19–63]	27.3 [12–47]	Lysholm and VAS	2	–
Iorio *et al.* (30)	2020	*International orthopaedics*	IV	53	Arthroscopy	18	18	21	40 [15–60]	139.2 [84–180]	Lysholm, IKDC and Tegner	0	–
Orsini *et al.* (31)	2020	*International Orthopaedics*	IV	44	Open	13	13	13	33 [18–56]	32 [24–27]	Lysholm and VAS	0	–

*, median value. CMS, Coleman methodology score; IKDC score, International Knee Documentation Committee score; KOOS, The Knee injury and Osteoarthritis Outcome Score; KSSTA, Knee Surgery, Sports Traumatology, Arthroscopy; SICOT-J, journal of the Société Internationale de Chirurgie Orthopédique et de Traumatologie; VAS, visual analogue scale.

Table 2 Number of meniscal tears associated with meniscal cysts and surgical technique

Author	Year	Method	Gender	Number of meniscus tears	Meniscal tear patterns	Treatment of meniscal tear	Number of meniscal cysts	Distribution of meniscal cysts	Treatment of meniscal cyst
Tudisco *et al.* (21)	2000	Arthroscopy	Males: 10; Females: 9	–	Horizontal or radial lesion (or both)	Arthroscopic partial meniscectomy	19	19 lateral	Arthroscopic decompression
Sarimo *et al.* (23)	2002	Arthroscopy: 19; Open: 16	Males: 23; Females: 12	33	Radial: 8; Flap: 7; Complex: 11; Bucket handle: 5; Meniscocapsular tears: 2	Arthroscopic partial meniscectomy	35	17 lateral; 18 medial	Arthroscopic decompression: 19; Open cystectomy: 16
El-Assal *et al.* (24)	2003	Arthroscopy: 22; Open: 5	Males: 21; Females: 5	27	Horizontal: 12; Complex with peripheral horizontal component: 8; Transverse: 7	Arthroscopic partial meniscectomy: 24; Open repair: 3	27	27 lateral	Arthroscopic decompression: 22; Open cystectomy: 5
Hulet *et al.* (25)	2004	Arthroscopy	Males: 80; Females: 23	105	Horizontal: 30; Horizontal with radial split: 30; Radial: 31; Complex: 10; Vertical: 4	Arthroscopic partial meniscectomy: 104; Repair: 1	105	105 lateral	Arthroscopic decompression: 91; Additional percutaneous drainage: 14
Howe and Koh (6)	2007	Arthroscopy	Males: 4; Females: 4	6	–	Arthroscopic partial meniscectomy: 4; Left alone: 2	8	6 lateral; 2 medial	Arthroscopic decompression
Pujol *et al.* (26)	2013	Open	Males: 13; Females: 6	21	Horizontal: 21	Arthroscopic partial meniscectomy: 5; Open repair with vertical sutures: 16	15	6 lateral; 9 medial	Open cystectomy
Kumar *et al.* (27)	2013	Arthroscopy	Males: 7; Females: 7	14	Horizontal: 8; Complex with horizontal component: 6	Arthroscopic partial meniscectomy	14	8 lateral; 6 medial	Arthroscopic partial meniscectomy without cyst decompression
Haklar *et al.* (22)	2014	Arthroscopy	Males: 13; Female: 7	–	–	Arthroscopic partial meniscectomy	20	20 lateral	Arthroscopic decompression
Chang *et al.* (28)	2015	Arthroscopy	Males: 135; Females: 106	241	Horizontal: 167; Complex: 51; Vertical: 13; Bucket handle: 7; Radial: 3	Arthroscopic repair (inside out): 14; Arthroscopic partial meniscectomy: 227	241	136 lateral; 105 medial	Arthroscopic treatment of meniscal lesion with open cystectomy: 112 (6 repair); Arthroscopic decompression: 129 (8 repair)
Bombaci *et al.* (29)	2016	Arthroscopy	Males: 6; Females: 2	7	Horizontal: 7	Arthroscopic partial meniscectomy: 7	8	7 lateral; 1 medial	Mini-open decompression: 1; Arthroscopic decompression: 7 (3 with extra-articular portal)
Iorio *et al.* (30)	2020	Arthroscopy	Males: 13; Females: 5	21	Horizontal: 13; Radial: 2; Complex: 4; Discoid associated: 2	Arthroscopic partial meniscectomy	18	18 lateral	Percutaneous decompression with needle: 18
Orsini *et al.* (31)	2020	Open	Males: 9; Females: 4	13	Horizontal: 13	Open repair: 13	13	9 lateral; 4 medial	Open cystectomy

Table 3 Studies included in systematic review, sorted according to different treatment combinations

Different combinations of meniscal cyst and tear management	Partial meniscectomy/meniscal debridement	Meniscal repair
Cystectomy	Chang *et al.* (28); Pujol *et al.* (26); Sarimo *et al.* (23)	Orsini *et al.* (31); Chang *et al.* (28); Pujol *et al.* (26); El-Assal *et al.* (24)
Cyst Decompression	Iorio *et al.* (30); Bombaci *et al.* (29); Chang *et al.* (28); Haklar *et al.* (22); Howe *et al.* (6); Tudisco *et al.* (21); Sarimo *et al.* (23); El-Assal *et al.* (24)	Chang *et al.* (28); Hulet *et al.* (23)

Table 4 Distribution of meniscal tear patterns

Meniscal tear patterns	Number (%)
Complex	90 (18.4)
Horizontal	301 (61.7)
Radial	44 (9.0)
Transverse	7 (1.4)
Vertical	17 (3.5)
Flap	7 (1.4)
Discoid associated	2 (0.4)
Bucket handle	12 (2.5)
Meniscocapsular	2 (0.4)
Not described	6 (1.2)

Table 5 Treatment of meniscal tears

Treatment of meniscal tears	Number (%)
Arthroscopic partial meniscectomy/debridement	439 (90.0)
Repairs, total	47 (9.6)
Arthroscopic repair	14 (2.9)
Open repairs	32 (6.7)
Unclear method	1 (0.2)
Left alone	2 (0.4)

score is a 100-point patient reported score initially used to assess outcomes after knee ligament surgery, first published in 1982. A higher score is indicative of a better outcome with fewer symptoms or disability.

The categorical scale adopted by most of the papers used excellent/good/fair/poor, with fairly similar clinical endpoints across the board. The "excellent/good/fair/poor" score was adopted from the Raegan scoring system (3) and is defined below:

Table 6 Treatment of meniscal cysts and recurrences

Meniscal cyst treatment	Total number	Recurrence after treatment
Decompression	333 (18 percutaneous decompression, 315 arthroscopic decompression)	34 (10.21%)
Cystectomy	176	6 (3.41%)

(I) Excellent: no pain, no swelling, full range of motion, full return to athletics of choice;
(II) Good: occasional discomfort, no swelling, full range of motion, return to athletics of choice but not at same level;
(III) Fair: pain with strenuous activity with or without occasional swelling and return to modified athletics;
(IV) Poor: pain with activities of daily living, locking, painful catching, cessation of athletics/interference with activities of daily living.

To allow for comparison between outcomes, papers that adopted the Lysholm Scoring system will be assessed together, while papers that adopted the "excellent/good/fair/poor" scoring system will be assessed together. The other papers were not considered for outcomes.

Comparing outcomes with Lysholm score

Seven of the 12 included studies used the Lysholm score to quantify clinical outcomes. These studies and the various scores have been included in *Figure 2*.

Despite having incomplete data regarding the preoperative Lysholm scores, a good outcome was achieved across these studies, with an average score of 92.1 regardless of surgical method. Post operatively, arthroscopic, mini-open and percutaneous meniscal decompression averaged a Lysholm score of 91.9 as compared to 93.8 in open cystectomy.

When considering the outcome scores in relation to meniscal tear management, only Orsini *et al.* (31) and Chang

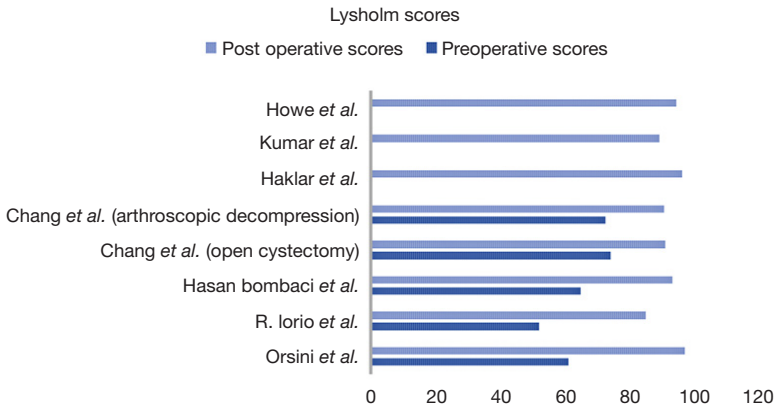

Figure 2 Lysholm scores of the 7 studies.

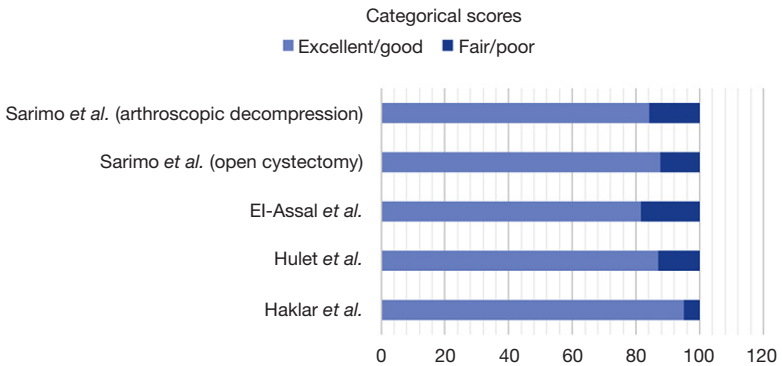

Figure 3 Categorical outcomes of the 4 studies.

et al. (28) performed meniscal repairs. Orsini *et al.* (31) showed improvement in Lysholm scores with the open meniscal repair method, from 61 to 97. However, Chang *et al.* (28) did not report results for patients who underwent meniscal repair separately, rendering further analysis impossible. In addition, only 27 of patients underwent meniscal repair while 286 underwent meniscal debridement/partial meniscectomy, with an evidently large disparity in proportion. The average post-operative Lysholm score following meniscal debridement or partial meniscectomy, excluding data from Chang *et al.* due to lack of separate reporting, is 91.6.

Kumar *et al.* (27) studied the clinical outcomes in patients with meniscal cysts simply by debriding the concomitant meniscal tear instead of decompressing or excising the meniscal cyst. He reported a mean post-operative Lysholm score of 89.1, which is lower than both the decompression and cystectomy group.

Comparing outcomes with categorical scores

4 studies were included for comparison using the categorical outcome scales, including that of Haklar *et al.* (22), due to the similarity in the modified Dorfmann clinical outcome score. This data is represented in *Figure 3*.

Arthroscopic cyst decompression showed an average of 86.9% with excellent/good outcomes, and 13.1% with fair/poor outcomes. The only study with open cystectomy done was that by Sarimo *et al.* (23), with 87.5% excellent/good and 12.5% fair/poor.

The outcomes from both the Lysholm score and the categorical scale showed significant improvement. In addition, the data from the included studies appear to be encouraging, with good Lysholm scores and at least 80% of patients having excellent/good outcomes with either arthroscopic decompression or open cystectomy.

Only 1 of the 4 studies included meniscal repair, with Hulet *et al.* (25) reporting 1 case of meniscal repair. There was no separate reporting of the data and more information regarding meniscal treatment outcomes cannot be obtained.

Discussion

In 2016, Chang *et al.* (28) did a comparison of arthroscopic cyst decompression compared to arthroscopic cyst excision, where it was found that open cystectomy showed significantly better results with lower recurrence risk than arthroscopic decompression. There was an increased risk of cyst recurrence associated with decompression compared with excision for patients with symptomatic meniscal cysts during an average 26-month follow-up period. 20.9% of meniscus cysts (27/129) that were decompressed recurred, only 4% (5/112) of excised meniscus cysts recurred They suggested that cyst volume and meniscal tear circumference were associated with disease recurrence. This opinion is echoed in the study by El-Assal *et al.* (24) who described 3 of 4 recurrences secondary to a large cyst which could not be properly addressed arthroscopically. Similarly, Bombaci *et al.* (29) also reported an increased risk of recurrence in the event of a large meniscal cyst.

In our review, decompression of the meniscal cyst appears to have a higher rate of recurrence as compared to cystectomy. However, it may not be completely accurate to simply conclude that open cystectomy is the surgery of choice when it comes to meniscal cyst. This review suggests a relationship between size of meniscal cyst and rate of recurrence, as well as the choice to manage them with decompression or excision. This is prior to taking the meniscus tear management into consideration as well.

Barrie (1) in 1979 postulated that the horizontal meniscal tear was paramount in the development of meniscal cysts, with all 112 surgical specimens demonstrating a horizontal tear in relation with a meniscal cyst. Today, new advancements in horizontal meniscus repair may herald a new option for meniscal cysts, with the aim to preserve meniscus as far as possible. Pujol *et al.* (26) did not experience any meniscal cyst recurrences when the horizontal meniscal tears were repaired.

In this review, there were 523 meniscal cysts, associated with 488 meniscal tears. Haklar *et al.* (22) and Tudisco *et al.* (21) were excluded in the tally for the meniscal tears as they did not record the number of meniscal tears associated with the cysts. Almost all the cysts were noted to be associated with meniscal tears, some cysts even had more than 1 meniscal tear involved, as noted by Pujol *et al.* (26). The presence of meniscal tear may explain why some meniscal cysts that were decompressed without addressing the meniscus tear might have increased risk of recurrence. Kumar *et al.* (27) reported medium-term outcomes with post-operative Lysholm score of 89.1, from an initial score of 94.1. This could be attributed to perhaps the lack of meniscal cyst management and degenerative changes following meniscal debridement/meniscectomy.

Cowden *et al.* (9) proposed an algorithm suggesting for meniscectomy and cystectomy in symptomatic patients with meniscal cysts and meniscal tears not amenable to repair.

Similarly, Pedowitz *et al.* (33) previously recommended partial meniscectomy for meniscal tears associated with meniscal cysts in a surgical algorithm for treatment of meniscal cysts and associated meniscal tears. The recognition of the importance of treating horizontal meniscus tears and avoiding resection of either leaves of the horizontal tear given that the loss of meniscus leads to degenerative changes; has seen the increased repairs of such tears.

With further improvement in meniscal repair techniques, further consideration should be given to meniscal repairs in the presence of meniscal cysts. Hence these algorithms require thought now as the indications for meniscal repairs have been pushed further to include horizontal meniscus tears. Other parameters including size of meniscal cyst should also be taken into consideration when dealing with a meniscal tear with a concomitant cyst.

Due to the lack of separately reported outcomes and recurrences in the patients who underwent meniscal repair, open or arthroscopic, it is difficult to determine if the meniscal repair could have also contributed to improved outcomes or the recurrences of meniscal cyst treatment with our review cohort.

Limitations

This systematic review of the literature presents several limitations. The overall retrospective nature of the included papers means that most of the studies were non-randomised clinical trials, thus predisposing to allocation bias. The lack of high-quality level I or II studies prevents a surgical recommendation to be made in the algorithm of management of meniscal cysts. While the methods were generally the same throughout all the papers, there are minor technique variations evidenced. The papers also had different markers of clinical success—some used the Lysholm scoring system, while others used the "excellent/good/fair/poor" system which then made it difficult to accurately assess the level of improvement for all the patients involved. Further studies should improve these limitations, providing prospective analyses involving more

patients, using common yardsticks of measures of success or common scoring systems, including general health measures as well. Recurrence of cysts should also be stated clearly, especially if there are none involved.

The points of strength of this paper included comprehensive nature of the literature search, the strict eligibility criteria and adequate follow up duration.

Conclusions

According to the main findings of this systemic review, both arthroscopic and open methods can be used for meniscal cysts treatment. Open cystectomy, rather than decompression of the meniscal cyst appear to confer lower recurrence rates, with reasonable clinical outcomes. However, a recommendation for surgical repair of meniscus tears associated with meniscus cysts cannot be made at this time due to insufficient high-quality level I or II trials and separate outcome reporting. Previously proposed algorithms may require reconsideration as the boundaries of meniscal tear repairs are pushed further today.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-29/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-29/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/aoj-22-29
Cite this article as: Thor JEH, Lim GYC, Hui JHP, Lee DYH. Do meniscal repairs with meniscus cyst do better than meniscectomy?—a systematic review of meniscal cyst treatment. Ann Joint 2023;8:8.