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# Arthroscopic Excision of Medial Knee Plica: A Meta-Analysis of Outcomes

Adam Daniel Gerrard, MRCS<sup>1</sup> and Charalambos P. Charalambous, FRCS<sup>1,2</sup><sup>1</sup>Department of Orthopaedics, Blackpool Victoria Hospital, Blackpool; <sup>2</sup>School of Medicine, University of Central Lancashire, Preston, UK**Purpose:** A meta-analysis was performed to assess the outcomes following surgical intervention for medial knee plica.**Materials and Methods:** A literature search of Medline, EMBASE, CINAHL and Cochrane CENTRAL was performed using relevant key words. The primary outcome was patient-reported postoperative scores of “good” and “excellent”. Meta-analyses were performed using a random effects model.**Results:** The literature search identified 731 articles. After removing duplicates and those not meeting the inclusion criteria, 12 articles reporting on a total of 643 knees were included for analysis, and of these, 7 articles including 235 knees were used for meta-analysis. The overall rate of good and excellent outcomes following surgery was estimated at 84.2% (95% confidence interval [CI], 72.8–91.4). In those cases that had non-surgical therapy prior to surgery, the rate of good and excellent outcomes of surgery was estimated at 76.1% (95% CI, 60.1–87).**Conclusions:** Arthroscopic surgical management of symptomatic medial knee plica results in favourable outcomes. Our results suggest that arthroscopic surgical excision should be considered as a treatment modality in patients with pathological medial plica disease of the knee either as a first-line treatment or when symptoms have not responded to non-surgical interventions.**Level of Evidence:** IV**Keywords:** Knee, Plica, Medial, Arthroscopy, Excision

## Introduction

The reported incidence of medial plica of the knee found during arthroscopy varies from 22% to almost 80%<sup>1,2</sup>. The healthy medial plica has smooth elastic properties and slides freely over the femoral condyle with knee movement. However, a pathological medial plica can develop when inflammation and fibrosis occur. Patients suffer anterior knee pain more often on the medial aspect<sup>3-5</sup>. The pain is often made worse through activities involving flexion of the knee and may be associated with symptom of knee clicking or locking<sup>6</sup>. Often there is a history of injury or

reparative sporting activity<sup>4,7</sup>.

The diagnosis of symptomatic medial plica is challenging, as the medial plica is a common incidental finding<sup>8</sup> and the symptoms experienced by the patient with a pathological medial knee plica are indistinguishable on clinical examination to other pathologies of the knee including torn menisci, inflammation, and osteochondral defects<sup>9</sup>. Similarly, the management of pathological medial plica is controversial<sup>10</sup>, with beneficial effects reported for both non-surgical<sup>11,12</sup> and surgical treatment<sup>13</sup>. Non-surgical management uses analgesia and anti-inflammatory medications along with physiotherapy. However, when this has not improved the patient's symptoms, surgical arthroscopic intervention may be employed. At arthroscopy the pathological medial plica may be excised or divided, with studies advocating complete excision to be a superior treatment<sup>7</sup>. Surgical intervention is not without its risks as a patient is subject to the inherent dangers of surgery including anaesthetic risks and thromboembolic events, combined with the possibility of the surgery not improving symptoms<sup>14</sup> or causing local complications such as haemarthrosis and swelling, increasing the patient's morbidity<sup>15-17</sup>.

A previous meta-analysis performed for all types of knee plica

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and including children found arthroscopic resection resulted in patients being asymptomatic in 64% of cases and 26% only experiencing intermittent symptoms<sup>18</sup>. We hypothesise that within adult patients with only pathological medial plica, arthroscopic excision will yield similar positive postoperative outcomes. This will give surgeons, patients, and health care commissioners information to guide best care.

## Materials and Methods

A literature search of MEDLINE (1946 to present), EMBASE (1974 to present), CINAHL (1961 to present), and Cochrane CENTRAL (1988 to present) databases was conducted using any combination of the key words, “plica” and “knee” in December 2016 for articles published in English with no publication year limit.

The study inclusion criteria were as follows: studies including patients over the age of 15 years, published in the English language, reporting cases having arthroscopic intervention in medial plica disease with no other co-existing knee pathology, and reporting outcomes per knee rather than per patient. Studies that reported their outcomes as excellent, good, fair, or poor were included. Randomised control trials and retrospective and prospective study designs were included, with case series of less than ten patients and case reports excluded.

The title and abstract of the articles were reviewed by both authors against the inclusion criteria. Where no decision about inclusion could be made from the publication title and abstract alone, the full texts were reviewed by the first author. The lists of references for all included articles were searched for any further articles for inclusion not identified in the database search.

An electronic standardised proforma for data extraction was created and utilized. The first author performed data collection, and where there was uncertainty, this was checked by the second author. Where articles included other types of pathology or other types of plica, the data for patients with only medial plica were included.

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) methodology was used<sup>19</sup>. The articles were appraised using the methodological index for nonrandomized studies<sup>20</sup>.

### 1. Statistical Analysis

The primary outcome was patient-reported postoperative scores of “good” and “excellent”. Meta-analyses were performed using random-effects model<sup>20</sup>, 95% confidence intervals (CIs)

were calculated, and the heterogeneity was assessed using tau<sup>2</sup>, I<sup>2</sup>, Q, and p-values. Funnel plots were created, with no formal asymmetrical tests performed. Data were analyzed with CMA ver. 2 (Biostat, Englewood, NJ, USA).

## Results

The search of the databases produced 731 results. Duplicated articles were removed, and the remaining articles were assessed. Those of no relevance were eliminated, leaving 41 articles whose full texts were examined (Fig. 1). Twelve articles were identified that reported outcomes of arthroscopic medial plica excision (Table 1). In the study by Yilmaz et al.<sup>16</sup>, one patient was under the age of 15 years, and the outcomes of that single case were removed from analysis. These studies reported a total of 643 knees which had arthroscopic surgery for symptomatic medial plica. Follow-up ranged between four and 87 months, with the mean age across the studies of between 25 years and 45 years. Six studies were prospective in their design<sup>15,16,21-24</sup> and six were retrospective<sup>17,25-29</sup>.

In five of these 12 studies, all participants had undergone a course of physiotherapy and conservative management prior to arthroscopic surgery<sup>15-17,22-27</sup>. One contained patients whose symptoms persisted despite prior operations<sup>21</sup> whilst six did not state what measures had been tried pre-arthroscopic surgical intervention<sup>23-26,28,29</sup>. Of these 12 studies, three reported no complications from arthroscopic management of medial knee plicae<sup>25,22,28</sup>, two reported cases of effusion within the knee joint postoperatively with all settling without further operative intervention<sup>16,17</sup>. One study reported four cases of haemarthrosis which required aspiration at one week<sup>28</sup>. Of these 12 studies, one described their improvement in outcomes in terms of presence or change in symptoms<sup>21</sup>, one with regards to presence or absence of knee complaints<sup>26</sup>, one in terms of influence upon daily activities<sup>15</sup>, and one in terms of satisfaction<sup>24</sup>. Two studies used mean functional Lysholm scores pre- and postoperatively. Both of these found improvements with surgery. Yilmaz et al.<sup>16</sup> reported a mean preoperative scores of 38.5 and a mean postoperative score of 82. Uysal et al.<sup>17</sup> reported a mean preoperative scores of 67.19±8.05 and a mean postoperative score of 90.57±9.80. A third study by Guney et al.<sup>29</sup> used Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores and published mean preoperative and postoperative scores of 1.4±0.7/1.3 (0–3.04) and 0.2±0.5/0 (0–2.42), respectively, again showing an improvement with surgery. In the studies by Maffulli et al.<sup>15</sup> and Uysal et al.<sup>17</sup>, the included cases had undergone a course of phys-

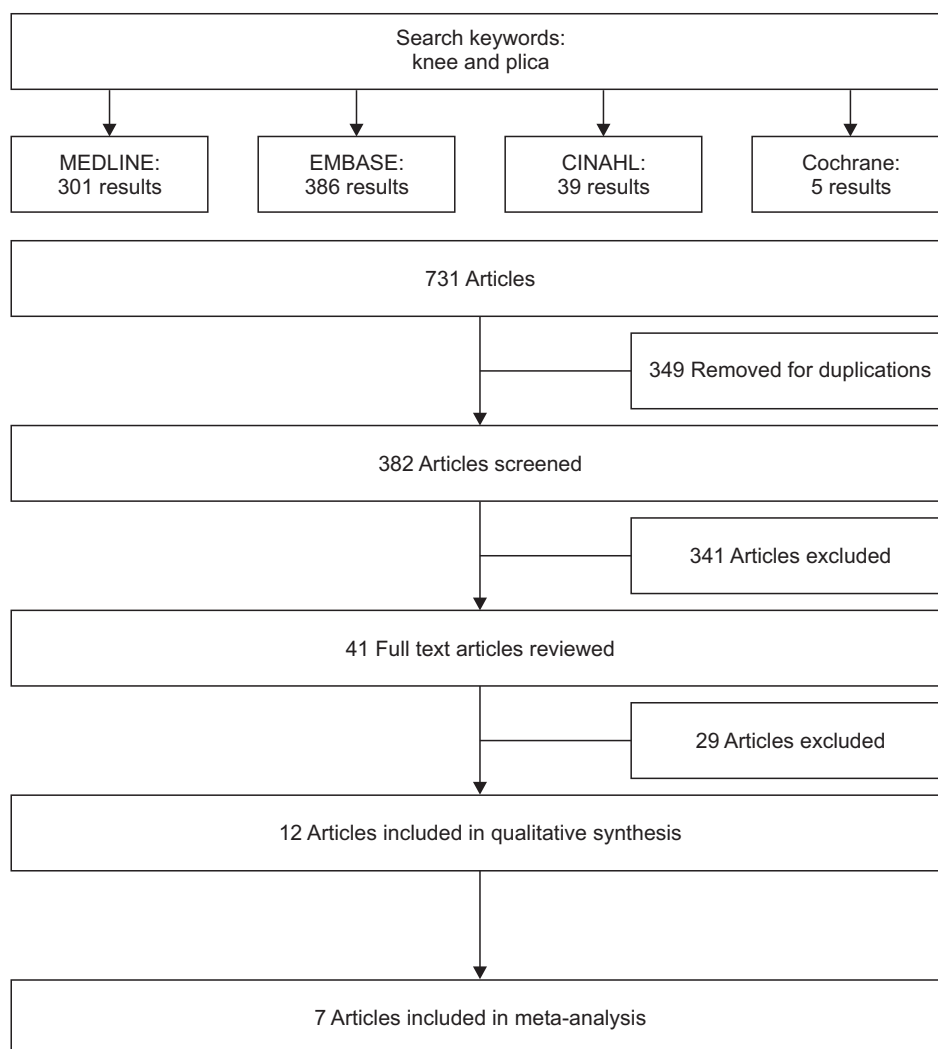


Fig. 1. Study flow diagram.

iotherapy and conservative management prior to arthroscopic surgery.

Seven studies including 235 knees reported their outcomes as either excellent, good, fair, or poor<sup>16,22,23,25,27-29</sup> and were thus used for meta-analysis (Table 1). Of these, 3 studies reported cases that had undergone a course of physiotherapy and conservative management prior to arthroscopic surgery<sup>16,22,27</sup>, and a further meta-analysis was performed for these studies in isolation. Meta-analysis of all seven included studies showed that arthroscopic excision of medial knee plica resulted in favorable outcomes in most cases (Fig. 2). An outcome of good or excellent was seen in 84.2% (95% CI, 72.8–91.4) of knees following arthroscopic resection of pathological medial plica (21 knees; heterogeneity:  $\tau^2=0.52$ ;  $I^2=64.7\%$ ;  $Q=17$ ;  $df=6$ ;  $p=0.009$ ). Funnel plot visual analysis did not show an obvious small study effect. Meta-analysis of the three studies where the participants had non-surgical interventions prior to arthroscopic surgery showed that arthroscopic excision of medial

knee plica resulted in favorable outcomes in most cases; an outcome of good or excellent was seen in 76.1% (95% CI, 60.1–87) following arthroscopic resection of pathological medial plica (Fig. 3) (heterogeneity:  $\tau^2=0.22$ ;  $I^2=50.2\%$ ;  $Q=4$ ;  $df=2$ ;  $p=0.134$ ).

Critical appraisal of the included studies using MINORS criteria<sup>20</sup> are summarised in Table 2. A clearly stated aim could be observed in all. Unbiased assessment of outcomes was not seen in any of the studies, as they did not use independent evaluators to assess the postoperative outcomes.

## Discussion

The results of this meta-analysis demonstrate that arthroscopic excision of symptomatic medial knee plica leads to favourable clinical outcomes in most cases. Hence, based on our results, we recommend that arthroscopic excision of symptomatic medial knee plica is considered as a treatment modality in those patients

Table 1. Summary of Study Demographics, Outcomes, and Complications

Author	Year	Journal	Study type	No. of knees (n=643)	Age (yr)	Sex (M:F)	Non-operative management prior to surgery	Operation performed	Follow-up time (mo)	Outcome	Complication	Included in meta-analysis
Moller <sup>21)</sup>	1981	<i>Acta Orthopaedica Scandinavica</i>	Prospective	78	31.2	51:28	-	Excision of the medial plicat+Z-plasty	11	Without symptoms: 66 Slight symptoms: 8 Unchanged: 1 Worse: 1 Chronic synovitis: 2	-	No
Klein <sup>25)</sup>	1983	<i>Archives of Orthopaedic and Traumatic Surgery</i>	Retrospective	17	-	-	-	Excision of the medial plica	Apr-42	Excellent: 7 Good: 6 Fair: 1 Poor: 3	-	Yes
Bough and Regan <sup>22)</sup>	1985	<i>Irish Medical Journal</i>	Prospective	23	23 (15-56)	3:1	Yes	Excision or division of plica	18 (12-48)	Excellent: 16 Good: 5 Fair: 0 Poor: 2	No complications	Yes
Andersen and Poulsen <sup>23)</sup>	1986	<i>Archives of Orthopaedic and Traumatic Surgery</i>	Prospective	31	31 (15-44)	20:8	-	Excision of the medial plica	15 (7-29)	Excellent: 12 Good: 14 Fair: 4 Poor: 0	No complications	Yes
Brabants et al. <sup>26)</sup>	1988	<i>Acta Orthopaedica Belgica</i>	Retrospective	161	-	-	-	Release of the plica	-	Complaint free: 128 Not complaint free: 33	-	No
Dorchak et al. <sup>27)</sup>	1991	<i>The American Journal of Sports Medicine</i>	Retrospective	51	24.9 (17-40)	-	Yes	Excision of the medial plica	46.8 (15-77)	Excellent: 22 Good: 16 Fair: 0 Poor: 13	-	Yes
Maifulli et al. <sup>15)</sup>	1993	<i>Medicine and Science in Sports and Exercise</i>	Prospective	102	26.5 (18-40)	-	Yes	Excision of the medial plica	43 (9-87)	No complaints: 67 Not able to perform best at sport, work & social life not affected: 11 Sport affected, able to work: 14 Limited daily activities of living: 10	6 Haematomas	No

Table 1. Continued

Author	Year	Journal	Study type	No. of knees (n=643)	Age (yr)	Sex (M:F)	Non-operative management prior to surgery	Operation performed	Follow-up time (mo)	Outcome	Complication	Included in meta-analysis
Farkas et al. <sup>28)</sup>	1997	<i>Acta Chirurgica Hungarica</i>	Retrospective	14	23.6 (15–43)	1:1	–	Excision of the medial plica	18 (7–35) Excellent: 4 Good: 9 Fair: 0 Poor: 1	4	No complications	Yes
Yilmaz et al. <sup>16)</sup>	2005	<i>International Orthopaedics</i>	RCT between different plica excisions	23	45.1	1:2	Yes	Excision of the medial plica	30 (24–36) Excellent: 5 Good: 10 Fair: 2 Poor: 6	5	20/23 Self resolving effusions	Yes
Shetty et al. <sup>24)</sup>	2007	<i>Journal of Knee Surgery</i>	Prospective	44	45 (15–65)	–	–	Resection of the plica	3	Satisfactory: 39 Unsatisfactory: 5	–	No
Uysal et al. <sup>17)</sup>	2008	<i>International Orthopaedics</i>	Retrospective	23	42.4 (23–60)	14:8	Yes	Plica resected with punch and then shaved	21 (13–24)	All patients regained full range of movement Average Lysholm knee scale score: preoperative, 67.19±8.05, postoperative, 90.57±9.80	2/23 Self resolving effusions	No
Guney et al. <sup>29)</sup>	2010	<i>Knee Surgery, Sports Traumatology, Arthroscopy</i>	Retrospective	76	37.2 (15–61)	44:32	–	Excision of the medial plica	6	Excellent: 72 Good: 2 Fair: 2 Poor: 0 Mean WOMAC score: preoperative, 1.4±0.7/1.3 (0–3.04) postoperative, 0.2±0.5/0 (0–2.42)	–	Yes

Values are presented as mean (range).

RCT: randomized controlled trial, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

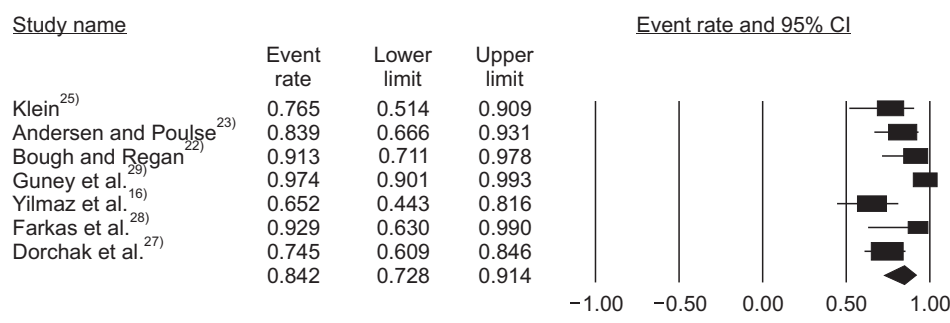


Fig. 2. Meta-analysis of outcomes rated as good and excellent following arthroscopic excision of medial knee plica. CI: confidence interval.

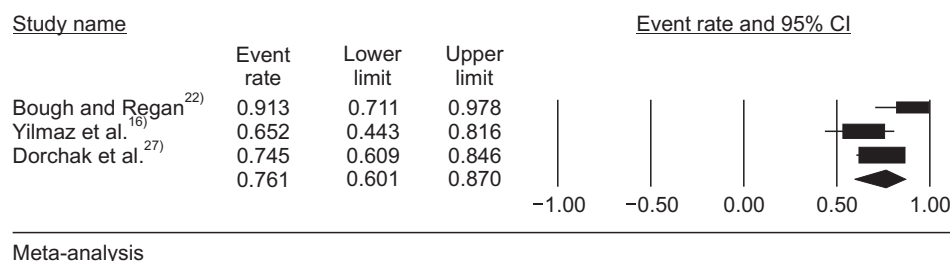


Fig. 3. Meta-analysis of outcomes rated as good and excellent following arthroscopic excision of medial knee plica in patients previously treated by conservative methods. CI: confidence interval.

Table 2. Methodological Index for Non-Randomized Studies Assessment of Included Studies

Criteria	Moller <sup>21)</sup>	Klein <sup>25)</sup>	Bough and Regan <sup>22)</sup>	Andersen and Poulsen <sup>23)</sup>	Brabants et al. <sup>26)</sup>	Dorchak et al. <sup>27)</sup>	Maffulli et al. <sup>15)</sup>	Farkas et al. <sup>28)</sup>	Yilmaz et al. <sup>16)</sup>	Shetty et al. <sup>24)</sup>	Uysal et al. <sup>17)</sup>	Guney et al. <sup>29)</sup>
A clearly stated aim	2	2	2	2	2	2	2	2	2	2	2	2
Inclusion of consecutive patients	2	2	2	2	2	2	2	2	2	2	2	2
Prospective collection of data	2	0	0	2	0	0	2	0	2	2	0	2
Endpoints appropriate to the aim of study	2	2	2	2	2	2	2	2	2	2	2	0
Unbiased assessment of study endpoint	0	0	0	0	0	0	0	0	0	0	0	2
Follow-up appropriate to the aim of study	2	2	2	2	0	2	2	2	2	1	2	0
Loss to follow-up, <5%	2	2	2	2	2	2	2	2	2	2	2	2
Prospective calculation of study size	0	0	0	0	0	0	0	0	0	0	0	0
Total	12	10	10	12	8	10	12	10	12	11	10	10

The items are scored 0 (not reported), 1 (reported but inadequate) or 2 (reported and adequate), with maximum possible score being 16.

that fail initial non-surgical management. Five of our included studies looked at patients who had a course of physiotherapy and conservative management prior to arthroscopic surgery. One of these<sup>15)</sup> showed that 67 of 102 cases had no post-surgery complaints with regards to functional activities, whilst another study<sup>17)</sup> reported an improvement in the mean Lysholm knee score from 67.19±8.05 prior to surgery to 90.57±9.80 postsurgery.

Meta-analysis of three further studies which reported their outcomes as excellent, good, fair, or poor showed that arthroscopic excision of medial knee plica resulted in a good or excellent outcome in an estimated 76.1% (95% CI, 60.1–87) of cases.

Synovial plica of the knee was first described by Mayeda in 1918. It is thought that a plica is a remnant strand of mesenchymal tissue persisting from the embryonic development of the

knee cavity between 8–12 weeks of gestation. The medial plica arises from the genu-articularis muscle proximally and passes over the medial femoral condyle to merge with the synovial lining of the joint capsule. It ranges from a cord-like appearance to that of a larger shelf structure<sup>30</sup>.

The majority of medial knee plica identified during arthroscopy are thin and asymptomatic. However, incidents of trauma or overuse result in plica becoming oedematous and fibrotic, and overtime they may tighten or bowstring<sup>4</sup>. The usual gliding effect of the medial plica over the femoral condyle between 30° and 60° of flexion is lost, and instead the plica may impinge and cause chondral injuries, resulting in pain, mechanical or other symptoms (swelling, snapping sensation, tenderness, stiffness, and locking)<sup>5</sup>. Examination of the knee may elicit an effusion, decreased range of motion, tenderness over the medial femoral condyle or joint line and on occasion synovial thickening<sup>6</sup>.

The arthroscopic surgical management for pathological plica is to either excise or divide the plica. Excision may involve the use of punch, shaver, diathermy or scissor devices to take the plica back to a level where it no longer impinges. Division of the plica is performed by breaking its continuity. Patients in whom the plica is divided may risk the two cut ends re-joining via scar tissue and a return of their symptoms; for this reason excision of the plica has been suggested to be preferential<sup>22</sup>.

Unfortunately, only three studies<sup>16,17,29</sup> reported functional score outcomes. However, although there were not enough studies using the same scoring systems to extract any combined data for analysis, all of the studies reported a mean improvement in their patients who had arthroscopic intervention.

There are a number of limitations to this study. Firstly, the preoperative management of the patients within the different studies was not uniformly described. Some patients had undergone pharmaceutical management and physiotherapy to help their symptoms prior to proceeding with surgery, but it could not be determined as to whether this altered their final surgical outcomes. Patients in studies who specified preoperative conservative management had a benefit to arthroscopic resection in 76%, compared with the 84% who had a positive response when all studies were included. Secondly, there was variation in the outcome evaluation systems employed across studies and therefore only seven could be included in the meta-analysis. Furthermore, outcomes employed were mainly categorical rather than continuous numerical. In addition, most studies were observational, with no randomised trial available comparing surgical versus non-surgical intervention. Most of the studies were produced over 20 years ago with few recent studies available to be used in the

analysis.

Despite the above limitations, our meta-analysis brings together clinical outcomes from a large number of pooled cases, from which meaningful conclusions can be reached.

## Conclusions

Given the available evidence, our results suggest that arthroscopic excision of symptomatic medial knee plica is associated with favourable patient outcomes in an estimated 76% of those cases that had non-surgical therapy prior to surgery and 84% of all patients included. Based on these findings, we recommend that arthroscopic surgical excision should be considered as a treatment modality in patients with pathological medial plica disease of the knee either as a first-line treatment or when symptoms have not responded to non-surgical interventions.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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