

Systematic Review

Systematic Review of the Long-term Surgical Outcomes of Discoid Lateral Meniscus

Yong Seuk Lee, M.D., Ph.D., Seow Hui Teo, M.B.B.S., Jin Hwan Ahn, M.D., Ph.D.,
O-Sung Lee, M.D., Seung Hoon Lee, M.D., and Je Ho Lee, M.D.

Purpose: To evaluate the surgical treatment of the discoid lateral meniscus (DLM) with long-term follow-up and to search which factors are related to good clinical or radiological outcomes. **Methods:** Search was performed using a MEDLINE, EMBASE, and Cochrane database, and each of the selected studies was evaluated for methodological quality using a risk of bias (ROB) covering 7 criteria. Clinical and radiological outcomes with more than 5 years of follow-up were evaluated after surgical treatment of DLM. They were analyzed according to the age, follow-up period, kind of surgery, DLM type, and alignment. **Results:** Eleven articles (422 DLM cases) were included in the final analysis. Among 7 criteria, 3 criteria showed little ROB in all studies. However, 4 criteria showed some ROB ("Yes" in 63.6% to 81.8%). The minimal follow-up period was 5.5 years (weighted mean follow-up: 9.1 years). Surgical procedures were performed with open or arthroscopic partial central meniscectomy, subtotal meniscectomy, total meniscectomy, or partial meniscectomy with repair. The majority of the studies showed good clinical results. Mild joint space narrowing was reported in the lateral compartment, but none of the knees demonstrated moderate or advanced degenerative changes. Increased age at surgery, longer follow-up period, and subtotal or total meniscectomy could be related to degenerative change. The majority of the complications was osteochondritis dissecans at the lateral femoral condyle (13 cases) and reoperation was performed by osteochondritis dissecans (4 cases), recurrent swelling (2 cases), residual symptom (1 case), stiffness (1 case), and popliteal stenosis (1 case). **Conclusions:** Good clinical results were obtained with surgical treatment of symptomatic DLM. The progression of degenerative change was minimal and none of the knees demonstrated moderate or advanced degenerative changes. Increased age at surgery, longer follow-up period, and subtotal or total meniscectomy were possible risk factors for degenerative changes. **Level of Evidence:** Level IV, systematic review of Level IV studies.

Discoid lateral meniscus (DLM) is an anatomic variation, and it may be susceptible to degeneration and tears.^{1,2} It has been reported that degeneration and tears of the DLM are associated with the unique

features of this condition, such as abnormal shape, tissue thickness, abnormal collagen arrangement, flimsy attachment to the joint capsule, and poor vascularization.^{1,3,4} Therefore, tearing in the DLM can occur at an earlier period than in the normal meniscus, and it may cause symptoms such as pain, clicking, or limitation of extension during childhood or the early adolescent period.

The appropriate treatment for symptomatic DLM tears has been a controversial issue.^{5,6} Traditionally, total meniscectomy was recommended according to the belief that the collagen structure is inherently different from that of the normal meniscus.^{7,8} Morphologically, the lack of a meniscotibial ligament in the setting of a DLM (Wrisberg variant) results in meniscal hypermobility.³ Total meniscectomy has been preferred if the DLM is unstable (Wrisberg type).⁹ However, in recent years, total meniscectomy of the lateral meniscus has no longer been performed because it leads to the development of premature degenerative osteoarthritis in the lateral compartment.¹⁰ The gold-standard treatment is now arthroscopic meniscal reshaping or

From the Department of Orthopaedic Surgery, Seoul National University College of Medicine, Seoul National University Bundang Hospital (Y.S.L., O-S.L., S.H.L., J.H.L.), Seongnam, Republic of Korea; the Department of Orthopaedic Surgery, Sungkyunkwan University College of Medicine, Kangbuk Samsung Hospital (J.H.A.), Jongno, Seoul, Republic of Korea; and the Department of Orthopaedic Surgery, National Orthopaedic Centre of Excellence in Research and Learning (NOCERAL), Faculty of Medicine, University of Malaya (S.H.T.), Kuala Lumpur, Malaysia.

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Address correspondence to Yong Seuk Lee, M.D., Ph.D., Department of Orthopaedic Surgery, Seoul National University College of Medicine, Bundang Hospital, 166 Gumi-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 463-707, Republic of Korea. E-mail: smcos1@daum.net or smcos1@snu.ac.kr

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meniscopeplasty, by which the central part of the meniscus is removed to restore its normal crescent shape. Meniscal repair or peripheral reattachment can be performed at the same time if there is an associated instability.¹¹⁻¹⁵

General consensus has not been achieved on how long-term results differ according to the different kinds of surgical treatment and other factors such as age at surgery, type of DLM, and follow-up period. If these can be known, such knowledge may be helpful as a guide for the management of DLM. However, general consensus could be difficult to reach on the basis of the current literature, because there has been no randomized controlled trial or case-control study in this field. Only cases series have been reported. Furthermore, some published studies reported limited short-term follow-up results. Nevertheless, it is necessary to review the existing reports, because they could give some guidance in the future despite the lack of high-quality studies.

This systematic review was conducted to evaluate the surgical treatment of the DLM with long-term follow-up and to search which factors are related to good clinical or radiological outcomes. The hypotheses were as follow: (1) good clinical outcomes would be maintained with long-term follow-up, and (2) degenerative change would occur and it would be related to the extent of the meniscal removal and follow-up period.

Methods

Search Strategy

A rigorous and systematic approach conforming to the preferred reporting items for systematic review and meta-analysis guidelines was used.¹⁶ In phase 1 of the preferred reporting items for systematic review and meta-analysis search process, selected databases were searched, including the MEDLINE, EMBASE, and Cochrane database (October 2016). A Boolean strategy was used, and all field search terms included the following: Search (Discoid meniscus) AND (((((((((results) OR outcome) OR clinical results) OR clinical outcome) OR radiological results) OR radiological outcome) OR MRI results) OR MRI outcome) OR follow up MRI). The citations in the included studies were screened, and unpolished articles were also checked with hand searches. The bibliographies of the relevant articles were subsequently cross-checked for articles not identified in the search. In phase 2, abstracts and titles were screened for relevance. In phase 3, the full text of the selected studies was reviewed to assess for the inclusion criteria and methodological appropriateness with a predetermined question. In phase 4, the studies were subjected to a systematic review process, if appropriate.

Eligible Criteria

Studies meeting the following criteria were included: (1) studies on DLM, (2) articles written in English, (3) articles with full text available, (4) human in vivo studies, and (5) article including clinical and/or radiological outcome with more than 5 years of follow-up. The exclusion criteria were as follows: (1) non-English articles, (2) articles with full text not available, (3) experimental studies, (4) articles reporting only on the surgical technique, (5) clinical studies not reporting clinical and/or radiological outcomes, and (6) studies less than 5 years of follow-up (Fig 1).

Data Extraction

Data were extracted by using the following standardized protocol: first author, publication year, publication journal, study type, number of cases, age at the surgery, follow-up period, symptom duration before the surgery, DLM type, main symptom, kind of surgery, clinical results, radiological results, and others. The extracted data were then cross-checked for accuracy (Y.S.L. and S.H.L., experience of more than 10 and 5 years as a knee specialist, respectively), and any disagreement were settled by a third review author (O-S.L., experience of more than 5 years as a knee specialist).

Quality Assessment

Each of the selected studies was evaluated for methodological quality by 2 independent authors (Y.S.L. and S.H.L.). To assess the methodological quality of the case series, the risk of bias (ROB) for interrupted time series studies as suggested by the Effective Practice and Organization of Care was used.¹⁷ Seven standard criteria covering independency, prespecification of the intervention effect, effect of the intervention to data collection, knowledge of the allocated intervention, address of the incomplete outcome data, selective outcome reporting, and other ROB were assessed. The criteria were scored as "Yes (low ROB)," "No (high ROB)," or "Unclear."

Results

Search

Among 347 articles, 11 articles were included in the final analysis. The detailed characteristics of the included studies are summarized in Table 1. All articles were retrospective case series.^{5,9-11,18-24} A total of 422 DLM cases were included in the final analysis. The mean patient age at surgery ranged from 9 years to 31.2 years (weighted mean age: 18.9 years), and the mean follow-up period ranged from 5.5 years to 19.8 years (weighted mean follow-up: 9.1 years). The symptom duration before surgery varied from 2 weeks to 12 years, and the main symptom was pain (in 5 of 7 studies that reported the main symptoms). Surgical

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