

Risk Factors for Articular Cartilage Lesions in Symptomatic Discoid Lateral Meniscus

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Purpose: To investigate risk factors related to articular cartilage lesions in discoid lateral meniscus (DLM) and to analyze the possible mechanisms associated with articular cartilage lesions. **Methods:** From October 2004 to April 2008, 103 knees in 97 patients with DLM confirmed by arthroscopy were operated on at our clinical center. Among them, 16 knees were accompanied by articular cartilage injury. Data on risk factors, including patient age, traumatic history, DLM type, presence or absence of tear, symptomatic duration, and meniscal shape, were analyzed to investigate the relation with articular cartilage lesion by logistic regression analysis. **Results:** Only symptomatic duration and meniscal shape had a significant relation with articular cartilage lesion. Symptomatic duration and meniscal shape can be regarded as risk factors, and their odds ratios were 4.983 ($P < .01$) and 5.356 ($P < .05$), respectively. **Conclusions:** Long symptomatic duration (>6 months) and asymmetrical shape of DLM were more frequently related to articular cartilage lesions than other factors. **Level of Evidence:** Level IV, therapeutic case series. **Key Words:** Discoid meniscus—Arthroscopy—Articular cartilage.

Discoid lateral meniscus (DLM) in the knee is a common morphologic variant, which has a lower incidence (0.4% to 5%) in Europe and a relatively higher incidence in Asia (9.1% to 10.5%).^{1,2} Degeneration or a defect of the articular cartilage can present concomitantly with DLM.^{3,4} Because of meniscal function, articular cartilage may be vulnerable and degeneration may be

unavoidable without normal meniscal protection.⁵ The most common injuries associated with articular cartilage lesions are medial meniscus injury and anterior cruciate ligament injury, whereas the patellar articular surface and the medial femoral condyle represent the most frequent localization of articular cartilage lesions.⁶ However, Deie et al.³ reported a high incidence of osteochondritis dissecans in DLM. Contrary to the location of the articular cartilage lesion in traumatic knees, osteochondritis dissecans was located on the lateral femoral condyle in almost all cases. Such information has provided the impetus to investigate the relation between articular cartilage lesions and DLM. Because of unique features in DLM, the etiology and epidemiology of articular cartilage lesion may be different with traumatic cartilage lesions and osteoarthritis (OA). The purpose of our study was to evaluate as many factors as possible in patients with DLM to discover any common relation to articular cartilage lesions. We hypothesized that there are some risk factors of DLM that represent different conditions of DLM and influence the consequences of articular cartilage.

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METHODS

From October 2004 to February 2008, 103 knees in 97 Chinese patients with DLM confirmed by arthroscopy and magnetic resonance imaging were enrolled in this study. There were 42 female and 55 male patients, aged 6 to 34 years (mean, 15.9 years). Symptomatic duration, which was the time interval from the onset of symptoms to arthroscopic treatment, averaged 5.8 months (range, 2 weeks to >5 years). Thirteen patients were considered overweight or obese according to Chinese body mass index. Pain combined with mechanical symptoms or limited motion represented the indication for surgery. Snapping, popping, or giving way alone was not regarded as an indication but was recorded upon symptomatic duration. Patients who reported 1 or more injuries related to the knee were recorded as having a positive traumatic history, whereas patients with a vague history or no history of injury to the knee were recorded as having a negative traumatic history. To exclude age-related chondral disease, such as OA, patients aged over 35 years were excluded from this study. Patients who had a previous operation with ligamentous injury or fracture of the knee were also excluded.

All arthroscopies were performed with a pneumatic tourniquet by the arthroscopic team including 4 surgeons. Intra-articular findings of arthroscopic examination were noted on the operative record, according to the surgeons' observations and description, including classification and shape of DLM, as well as the presence or absence of meniscal tear and articular cartilage lesions (Videos 1 and 2, available at www.arthroscopyjournal.org). Other data including gender, age at the time of surgery, and symptomatic duration were also collected by the team to be recorded in the patient history. Articular cartilage lesions were labeled by use of an arthroscopic classification that subdivided lesions into 5 grades, ranging from normal cartilage to ulceration and bone exposure.⁷ Functional zonation of the articular cartilage lesion was also recorded according to the International Cartilage Repair Society articular cartilage injury mapping system.⁸ DLM types were based on the Watanabe classification, and classification of DLM shape including symmetry and asymmetry was performed according to the classification of Stark et al.^{9,10}

Six variables were considered as possible factors associated with articular cartilage injury: patient age, traumatic history, symptomatic duration, DLM type (complete or incomplete), presence or absence of meniscal tear, and DLM shape. All data were trans-

formed into binary logistic data (recorded as 0 or 1) according to the following criteria: (1) patient age (0, mean age ≤ 16 years; 1, mean age > 16 years); (2) symptomatic duration (0, ≤ 6 months [mean time of symptomatic duration]; 1, > 6 months); (3) traumatic history (0, no; 1, yes); (4) DLM type (0, incomplete; 1, complete); (5) meniscal tear (0, no tear; 1, tear); and (6) DLM shape (0, symmetrical shape [concave mirror shape or slab shape]; 1, asymmetrical shape [wedge shape]).

The relation between such variables and articular cartilage lesions was evaluated by regression analysis of grouped data. Calculations were performed with SPSS software, version 11.0 (SPSS, Chicago, IL). In all instances $P < .05$ was considered statistically significant.

RESULTS

General Data

Most patients (64 of 97) had no precise traumatic history. Complete and incomplete types of DLM accounted for 54.4% and 45.6% of total knees, respectively; 50 of 103 knees displayed torn menisci in 49 patients. According to evaluation by arthroscopic examination, 30 cases of DLM were regarded as having an asymmetrical shape, whereas 73 cases were a symmetrical shape.

Articular Cartilage Lesions

Articular cartilage lesions were found in 16 of 103 knees in 15 patients (Table 1), varying from grade III to IV. Among them, lesions on the lateral femoral condyle were present in 12 knees and lesions on the lateral tibial plateau were present in 7 knees. Three knees had cartilage lesions on both the lateral femoral condyle and the lateral tibial plateau. All lesions on the lateral tibial plateau were located in the central or posterior zone of the sagittal plane and the lateral and central zones of the frontal plane. Lesions on the femoral condyle were located in the central or posterior zone of the sagittal plane and the lateral and central zones of the frontal plane.

Statistical Analysis

Two variables (patient age and traumatic history), which were the least related to articular cartilage lesions, were excluded after preliminary statistical analysis (odds ratio [OR] of 1.260 and $P = .712$ for age, OR of 0.772 and $P = .692$ for traumatic history).

TABLE 1. Distribution of Cases With Cartilage Lesions

Factor	Patient Age		Symptomatic Duration		Traumatic History		DLM Type		Tear		Meniscal Shape	
	≤16 y	>16 y	≤6 mo	>6 mo	Yes	No	Incomplete	Complete	Yes	No	Symmetrical	Asymmetrical
Cartilage lesion	7/58	9/39	6/67	10/30	6/33	10/64	6/47	10/56	7/50	9/53	7/73	9/30
No cartilage lesion	51/58	30/39	61/67	20/30	27/33	54/64	41/47	46/56	43/50	44/53	66/73	21/30
OR	1.260		4.983		0.772		1.566		1.940		5.356	
P value	.712		.008		.692		.486		.320		.010	

When the 4 remaining variables were entered into the equation for logistic analysis again, symptomatic duration and DLM shape were still risk factors for articular cartilage lesions, whereas DLM type (OR, 1.566; $P > .05$) and torn DLM (OR, 1.940; $P > .05$) had no relation with the lesion. Thus articular cartilage lesions occurred more frequently when symptomatic duration was more than 6 months (OR, 4.983; $P < .01$) and DLM shape was asymmetrical (OR, 5.356; $P < .05$).

DISCUSSION

Articular cartilage lesions are a common pathology in the arthroscopic population. On the basis of broad data analysis, articular cartilage lesions exhibit a 60% incidence among arthroscopic patients, whereas most cases exhibit a traumatic noncontact onset.⁶ Compared with other knee injuries, DLM has unique risk factors that were associated in this study with an increased incidence of articular cartilage damage.

Symptomatic duration of more than 6 months will markedly increase the incidence of articular cartilage damage. This time dependence is similar to aging, which is an important risk factor for OA.¹¹ In general, mechanical stress is considered as a primary inductor and risk factor for articular destruction.^{12,13} The lateral meniscus plays an important role in the transmission of load across the knee joint. Even lateral meniscectomy would cause worse radiologic changes than medial meniscectomy.¹⁴ Asymmetry in DLM is also a risk factor for articular cartilage damage. A wedge-shaped meniscus can produce an abnormal loading distribution just like malalignment, which will lead to joint degeneration.¹⁵ A similar phenomenon was also observed in tears of the posterior root of the medial meniscus, which led to a significant increase in contact pressure and changes in knee joint kinematics.¹⁶ The impact caused by snapping may be insidious if the meniscal shape is symmetrical and the patient's meniscal kinematics are nearly normal.¹⁷ Information

regarding DLM shape may be helpful in selecting the therapeutic regimen.

Meniscectomy or meniscal degenerative change, such as horizontal cleavage or a complex tear, may lead to degeneration of articular cartilage.^{14,18} However, we observed no relation between tear of DLM and articular cartilage lesions in this study. The reason may be that the mechanism of articular cartilage damage in DLM is different with evolvement of OA, which is obviously related to aging and requires a procedure that will adjust to long-term changes.¹⁸ Whether meniscal tear is the cause or result of cartilage damage in OA is still controversial.⁵ Some menisci have unstable features without meniscal tears. Moreover, the incidence of meniscal tear was relatively low in our series, as compared with that previously reported.¹⁹

There is no statistical significance in the relation between the different types of DLM and articular cartilage lesions. Most articular cartilage lesions were found in the complete type of DLM, and the distribution of lesions was similar to that published in another report; different indications and race may account for the more serious articular cartilage lesions found in this study.⁴ The Watanabe classification of DLM may provide little accurate information regarding DLM. In our clinical practice we could not identify 1 case as the Wrisberg type, whose incidence has been reported as 0% to 33% of all cases of DLM.¹⁰ The Wrisberg type may emerge from a normal lateral meniscus that has been detached from the posterior tibia because of stress or injury.¹⁰ Subclassification of stable and unstable types from 2 primary types (complete and incomplete) may be more reasonable.⁴

The limitation of this study is that we did not analyze stability as an independent factor. If stability correlated with other risk factors, then determining whether and how such risk factors are related to zonation and grading of the articular cartilage lesion would require further research. Furthermore, being overweight may also be a risk factor,²⁰ but the limited

sample used for this study did not allow statistical analysis of this variable.

CONCLUSIONS

Long symptomatic duration (>6 months) and asymmetrical shape of DLM were more frequently related to articular cartilage lesions than other factors.

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