
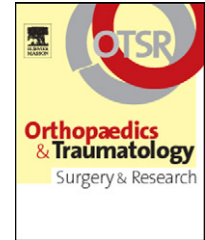




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## ORIGINAL ARTICLE

# Lateral meniscus lesions on unstable knee

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## Introduction

Meniscal lesions are frequently associated with anterior knee laxity. The percentage ranges from 16 to 82% in acute-phase anterior cruciate ligament (ACL) tear, reaching nearly 96% in chronic-phase cases [1]. Their time-course and evolution, however, vary depending on whether the meniscal damage is medial or lateral [2,3]. Lateral meniscal (LM) lesions tend to occur in the acute phase, without additional instability-related accidents, and show constant frequency over time, whereas medial meniscal (MM) lesions become more frequent over time [2–7]. The functional results of ACL reconstruction are adversely affected by lateral meniscectomy [4,8,9], quickly developing pain and swelling of the knee [10], thought to be due to lateral cartilage lesions [11]. The LM plays a major role in absorbing weight-bearing stress [12]. Meniscal lesion, even on a stabilized knee, would seem to be a long-term arthritis risk factor [13,14].

In the literature, few series have focused on the frequency and type of the various (notably lateral) meniscal lesions [4,15]. Given their frequency in case of knee instability and the adverse functional impact of lateral meniscectomy, the purpose of this study was:

- to document associated LM and cartilage lesions revealed during ACL reconstruction;
- to compare onset of LM and MM and bi-meniscal lesions in a dedicated sample of our study population;
- to explore the relationship between the various types of meniscal lesion and factors such as age, gender and the interval between accident and surgery;
- to assess current LM lesion management practices during ACL reconstruction;
- to examine how practice changes with the interval between accident and surgery.

## Material and methods

A continuous retrospective multicenter study of lateral meniscus lesions was conducted between January 2007 and July 2008 for the French Arthroscopy Society Symposium. All patients operated on for ACL reconstruction in the 11 participating centers (nine in France, one in Switzerland and one in Luxembourg: Lyon [Centre Albert-Trillat, Centre Santy], Toulouse [Cours Dillon Clinic], Paris [Ambroise-Paré Teaching Hospital], Caen Teaching Hospital, Luxembourg Hospital, Geneva Teaching Hospital, Versailles Hospital, Rennes [Saint-Grégoire Hospital]) during the study period were included. The first objective was to inventory meniscal lesions discovered during primary arthroscopic ACL reconstruction. The second was to examine the relationship between the presence of meniscal lesion and age, gender, accident-to-surgery interval and presence of cartilage

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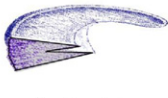

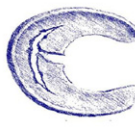
Elementary lesions			
			
vertical	Horizontal	Radial	Complex
Lesion forms			
Stable vertical tear	Stable horizontal cleavage	Radial tear	
Flap	Flap		
Bucket-handle			

Figure 1 Lateral meniscus lesion descriptions.

lesion. Patients with history of surgery to the affected knee were excluded, as were multi-ligament lesions. Epidemiological and clinical data were obtained from the patients' medical records, which showed family status, age, weight, date and circumstances of the accident, implicated mechanism and accident-to-surgery interval. Meniscus and cartilage lesions were inventoried by studying the surgical reports.

All the meniscal lesions found were classified according to:

- meniscus (lateral or medial);
- segment (anterior, body, posterior);
- type (vertical, horizontal, radial or complex: Fig. 1);
- anteroposterior extension;
- depth (zone 1 = axial, zone 2 = central, zone 3 = peripheral, zone 4 = mural).

Lesion sites were then mapped onto a 9-zone schema (Fig. 2). Presence and location of cartilage lesions were studied for each compartment and graded on the ICRS classification [16]. Finally, meniscal lesion management was classified as abstention, meniscectomy or repair.

Patient data and records were collated in a table on Excel then copied onto a StatView spreadsheet (Abacus Concept) for descriptive epidemiological analysis. Variables were compared using  $\chi^2$  test and ANOVA with Bonferroni correction. The significance threshold was set at 0.05.

Results

Analysis of records distinguished two series of patients. The first (n = 2245) comprised all files and concerned only LM lesions. In the second (n = 1068), MM lesions and the consequences of the surgeon's choice of management could also be studied.

1st series

This series comprised 2245 ACL reconstructions under arthroscopy. 435 patients presented an LM lesion: 342 males (78.6%), 93 females (sex-ratio = 3.7). Incidence of LM lesion was thus 20%. Mean age at accident was 27.2 years (range: 12 to 63 years) and mean accident-to-surgery interval was 22 weeks (range: 11 to 58 weeks). The accident was

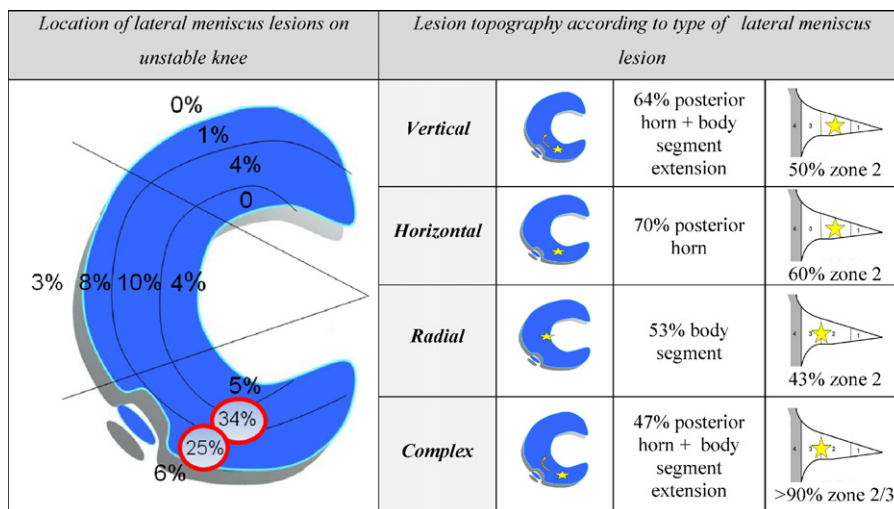


Figure 2 Topography of lateral meniscus lesions on unstable knee.

**Table 1** Parametric study according to type of ML lesion on unstable knee.

Elementary lesion	n	Age (years)	Sex-ratio (M/F)	Accident-to-surgery interval (weeks)	Cartilage lesions	
					Lateral femorotibial (%)	Medial femorotibial (%)
Vertical	301	27	2.3	18.7	7	14
Radial	28	27	8.0	12.0	7	15
Horizontal	28	29	4.5	35.0	30*	0
Complex	78	28	4.0	19.0	20*	20

\* Significant at  $p < 0.05$ .

sustained during sports activity in 87.5% of cases, including pivot-contact sport for 70% of cases. 69% of the 435 LM lesions were vertical (173 vertical tears, 74 flaps, and 54 bucket-handles), 6% horizontal (21 horizontal cleavages, with associated cyst in four cases, and seven horizontal flaps) 6% radial, and 18% complex. 70% of the LM lesions were in the posterior horn, usually in the central or peripheral zones (Fig. 2). 44% of LM lesions showed associated cartilage lesion of ICRS grade 2 or higher: 16% concerned the medial femorotibial, 17% the femoropatellar and 11% the lateral femorotibial compartment.

Parametric study by LM lesion type (Table 1):

- LM lesion type by patient characteristics: mean patient age varied from 27 to 29 years according to LM lesion type. The male/female sex-ratio was 2.3 in vertical, 8 in radial, 4 in complex and 4.5 in horizontal lesions. None of these differences were significant
- LM lesion type by accident-to-surgery interval: mean accident-to-surgery intervals varied from 12 weeks in radial tears to 35 weeks in horizontal lesions, but with no significant differences
- LM lesion type by cartilage lesion: 30% and 20% of horizontal and complex LM lesions, respectively, showed associated  $\geq$  grade 2 lateral femorotibial cartilage lesion, which was significantly higher ( $p = 0.0045$ ) than the 7% rate for vertical and radial LM lesions. No such significant difference emerged for medial femorotibial cartilage lesions

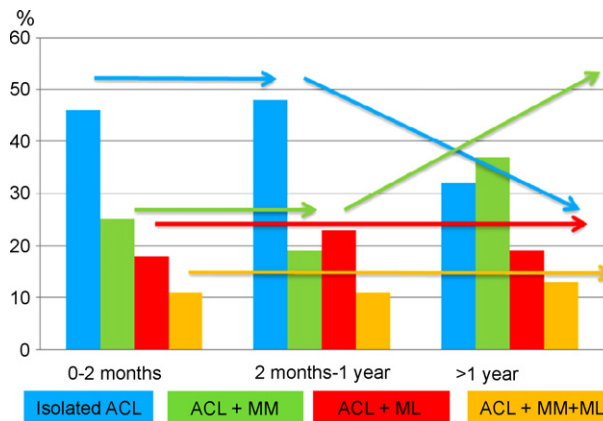
## 2nd series

One thousand and sixty-eight arthroscopic ACL reconstructions were included in this series. Mean age was  $27.1 \pm 9.5$  years (range: 9 to 64 years). Seven hundred and sixty-five patients were males (72%) and 303 females (28%) (sex-ratio = 2.5). 299 ACL reconstructions (30.0%) had an associated LM lesion and 409 (38.3%) an associated MM lesion. The mean accident-to-surgery interval was 23 weeks (range: 11–58 weeks). Four hundred and sixty-three of the 1068 patients (43%) were free of meniscal lesion at ACL reconstruction; 306 (28%) showed associated MM lesion, 196 (18%) associated LM lesion and 103 (10%) associated bi-meniscal lesion. There was no significant age or sex difference according to type of associated meniscal lesion. There was a non-significant trend towards a longer accident-to-surgery interval associated with MM and bi-meniscal lesions. Lateral femorotibial cartilage lesions were significantly more frequently associated with LM lesions ( $p < 0.001$ ), and

medial cartilage lesions with isolated MM or bi-meniscal lesions ( $p < 0.001$ ).

In terms of accident-to-surgery interval, the various lesion associations were classified as acute (zero to two months), intermediate or subacute (two months to one year) or chronic (more than one year) (Fig. 3). The frequency of isolated ACL lesions was comparable for the two shorter intervals (46% in acute and 48% in subacute cases) and lower (32%) after an accident-to-surgery interval exceeding one year. The frequency of associated MM lesions increased with increasing accident-to-surgery interval ( $p < 0.02$ ), from 25% and 19% in acute and subacute cases respectively, to 37% after one year. In contrast, LM lesion frequency was constant whatever the interval: 18% in acute, 23% in subacute and 19% in chronic cases ( $p > 0.05$ ). Likewise, bi-meniscal lesion frequency was constant, at 11% in acute and subacute cases and 23% after one year ( $p > 0.05$ ). Age, gender and accident-to-surgery interval did not correlate with presence of LM lesions ( $p > 0.05$ ), but a long accident-to-surgery interval or advanced age at time of accident (but not gender) were significant risk factors for MM lesions ( $p < 0.0006$  and  $< 0.0003$ , respectively).

In the series as a whole, only 28% of LM lesions were repaired, 52% led to meniscectomy and abstinence was indicated for the other 20%. In 13% of cases, meniscectomy involved all three segments, amounting to total or subtotal loss of meniscal substance. The relative frequencies of management varied according to accident-to-surgery interval. In the acute period (zero to two months' interval), 41% of patients were treated by meniscus repair, with 36% abstinence and only 23% managed by meniscectomy;



**Figure 3** Meniscal lesions on unstable knee according to accident-to-surgery interval.

with an accident-to-surgery interval exceeding one year, the trend was reversed, with 58% meniscectomy and 27% repair surgery. There would thus seem to have been a tendency for surgical attitude to be influenced by the accident-to-surgery interval, although the differences were not significant ( $p = 0.051$ ).

## Discussion

The present series is one of the largest in the literature for LM lesions on unstable knee or, more precisely, associated with ACL tearing [1,4,11,17]. Although retrospective, the study was continuous, and confirms certain concepts found in the literature. It further suggests that therapeutic attitude may vary according to the interval between the acute accident and surgical treatment. The objective was to describe LM lesions in ACL tearing and to analyze associated lesions according to LM lesion type. The main limitation concerned the description of the LM lesions, as the surgical report review was sometimes imprecise due to the retrospective and multicenter nature of the study; even so, the various descriptions always corresponded to one or other of the elementary lesion types: vertical, horizontal or radial. In case of associated or degenerative lesions, the classification given was of "complex lesion". Finally, the series was long and lesion-type description could be harmonized.

Of the various LM lesions on unstable knee, vertical posterior horn lesions were found to be the most frequent. Nikolic [3] likewise reported vertical posterior horn lesions in zones 2 and 3 to be the most common, at 87.5%. Tandogan [15], Yuksel [17] and Gadeyne [4] respectively found vertical tears in 72%, 66% and 37% of LM lesions on unstable knee. These findings corroborate our own. We found no significant impact of age or accident-to-surgery interval on the presence of LM lesions, in agreement with other authors [2–7]. Only Yuksel *et al.* [17] and Tandogan *et al.* [15] reported an increase in LM lesion frequency over time. Likewise our finding of increasing MM lesion frequency over time is in agreement with the literature [2,5,7]. This difference in evolution between medial and lateral meniscus lesions is due to their role in knee stabilization. In case of anterior laxity, the medial meniscus has been shown to play a role in stabilizing the knee [18], with considerably increased stress in the posterior horn. [19], which accounts for the increase over time of the rate of MM lesions in unstable knees [2,5]. The lateral meniscus, on the other hand, is more mobile and little involved in stabilization [18], so that it is under less stress than the medial meniscus in cases of chronic laxity; thus few if any new LM lesions occur over time.

Lateral femorotibial compartment cartilage lesions of ICRS grade  $\geq 2$  were significantly more frequent in horizontal and complex LM lesions. On the basis of these findings, we can affirm that a horizontal or complex LM lesion associated with ACL tearing is of very poor prognosis with regard to the cartilage and that no parameter which can be acted on, such as the accident-to-surgery interval, has any effect on the onset of such lesions. Fortunately, however, they are not the most frequent. The present series focused on types of LM lesion and associated chondral lesions rather than on the occurrence of chondral lesions in unstable knees. We were

thus able to distinguish a certain number of lesion types, although some types of lesion were no doubt overlooked.

The variations found in LM lesion treatment, especially according to the accident-to-surgery interval, raise the issue of the management of anterior laxity of the knee with associated LM damage. We found a significant correlation between the presence of an LM lesion and presence of a lateral compartment cartilage lesion of grade 2 or more; this is in agreement with Murrell *et al.* [11], who showed the presence of a meniscal lesion to significantly increase the risk of cartilage lesion over time. The risk of osteoarthritis may also be increased, even on a stabilized knee [13,14]. Lateral meniscectomy during ACL reconstruction leads to poorer results [8,9,20,21], causing pain and swelling of the knee [10]. We were able to distinguish a non-negligible group of LM lesion patients (13%) who had undergone total or subtotal meniscectomy; they can be considered as being at high risk of osteoarthritis, and perhaps should be given more intensive follow-up or at least more detailed information about the possible evolution of their knee. Shelbourne *et al.* [21,22] and Wu *et al.* [23] showed suture to give better results than meniscectomy. Finally, where the meniscal lesion is stable, abstention appears as a serious alternative to meniscectomy [24–28]: spontaneous healing may occur in meniscal lesions left *in situ* [29,30].

Looking at the treatment options adopted in the present series, conservative attitudes prevailed in the acute and subacute periods, with a tendency for meniscectomy to be more frequently employed in chronic cases. It does indeed seem logical to operate early on patients presenting with ACL damage, especially when associated with meniscal lesions, so as to slow down the evolution towards arthritis; even so, repair remains to be shown to provide benefit over abstention. New indications for repair, however, are being reported in the literature. Ahn *et al.* [31] drew up a classification of complex lesions of the posterior horn of the lateral meniscus; Yoo *et al.* [32] reported three cases of complete and unstable radial lesion suture. In these indications, meniscectomy creates a predisposition to LM extrusion [33], functionally equivalent to total meniscectomy.

From the present study it emerges that vertical posterior lesions are the main form of LM lesion on unstable knee, independently of age, gender and accident-to-surgery interval. Lateral femorotibial compartment chondral lesions are more frequently associated with other lesion types, such as horizontal cleavages and complex forms. The study raises two problems to which no precise answer can yet be given: what attitude to adopt in case of anterior laxity associated with LM damage; and what medical follow-up to provide after lateral meniscectomy performed during ACL reconstruction. Early surgery, including ACL reconstruction, with conservative treatment of the meniscus lesion, could limit the rate of LM lesion sequelae. Further investigation, however, will be required to confirm this hypothesis.

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