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Original article

## Outcomes following anterior cruciate ligament injury with concomitant damage to the medial collateral ligament: an analysis from the registry of the francophone arthroscopic society

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## ABSTRACT

**Introduction:** Anterior cruciate ligament (ACL) rupture with concomitant damage to the medial collateral ligament (MCL) is frequently seen following knee trauma. Non-surgical treatment of the MCL lesion generally results in good internal healing, but surgery may be necessary depending on the location of the lesion, the severity, and the laxity.

**Objectives:** To determine outcomes following ACL reconstruction surgery when there is concomitant damage to the MCL compared to isolated ACL lesions, as assessed through a prospective, multi-center cohort study in France.

**Materials and methods:** In this prospective, multi-center cohort study, patients who had a primary ACL lesion with or without concomitant damage to the MCL, and who had undergone ACL reconstruction surgery were included. Complications related to the surgery were evaluated prospectively (ACL re-rupture, contralateral rupture, reoperation), and functional scores were obtained until the last follow-up (subjective IKDC, Tegner, ACL-RSI, and SKV).

**Results:** A total of 722 patients were included in the study: 314 (43.5%) with an isolated ACL lesion and 408 (56.5%) with a combined ACL + MCL lesion. The ACL + MCL group had a significantly higher reoperation rate than the ACL group (7.4% versus 3.2%,  $p = 0.015$ ). The ACL + MCL group also had mean IKDC and SKV scores at the last follow-up that were significantly poorer than the ACL group ( $p < 0.0001$ ). High-grade MCL lesions (grade II or III) were identified in 18.2% of cases, and this was found to be predictive of poorer functional scores at the last follow-up. The mean IKDC score was significantly better when non-surgical MCL treatment was possible ( $p = 0.005$ ). When MCL surgery was indicated, all of the functional scores were significantly better for ligament reinsertion surgery compared to ligament reconstruction.

**Conclusion:** For combined ACL + MCL lesions, the outcomes are poorer, with a higher reoperation rate and lower functional scores. For high-grade MCL lesions, the functional recovery is poorer, particularly when there are chronic lesions that require multi-ligament reconstruction.

**Level of evidence:** II; prospective cohort study

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## 1. Introduction

Knee trauma can often lead to anterior cruciate ligament (ACL) rupture with concomitant damage to the medial collateral ligament (MCL). Isolated grade I lesions that affect the medial ligament generally heal with basic treatment [1–3]. When the injury affects these two ligaments, a failure to diagnose the injury or delays to treatment can have significant consequences, such as residual laxity, central pivot graft failure, or persistent pain; this is especially the case for high-grade lesions (type II or III) that affect the MCL [3–5].

There is currently no clear consensus concerning the treatment of combined ACL and MCL injuries.

This can be attributed to the complexity of the medial and postero-medial structures, which link the joint capsule, the posterior oblique ligament (POL), and the superficial and deep MCL [6–8]. The choice of treatment is therefore affected by the surgeon's clinical experience and preferences. The decision-making process is aided by information concerning the anticipated development of the combined lesions at the time of diagnosis.

This study aimed to investigate outcomes following ACL reconstruction surgery when there are concomitant lesions affecting the medial structures of the knee, compared to isolated ACL lesions. This was assessed through a prospective, multi-center cohort study that was conducted in France. The outcome measures were the rates of re-operation, ACL re-rupture, and contralateral rupture, and the functional scores at the last follow-up.

The hypothesis was that damage to the MCL has a negative impact on clinical and functional outcomes following ACL surgery.

## 2. Methods

### 2.1. Patients

This study was a prospective, multi-center cohort study in France that compared patients with and without concomitant damage to the MCL, who were matched in terms of their sex, age ( $\pm 3$  years), and body mass index ( $\pm 3$  kg/m<sup>2</sup>).

This study was part of the national symposium of the French Society of Arthroscopy

Patients were included if they had a primary ACL lesion, confirmed through an MRI scan, with or without an associated MCL lesion. Patients were only included if they had undergone ACL reconstruction surgery between January 2020 and June 2022.

All patients provided written consent, and the study was approved by an ethics committee (RnIPH 2021-64).

Patients were excluded from the study if they were younger than 15 years of age, if they had been followed up for less than a year, if they had previously undergone ligament surgery on the affected knee, if they underwent an associated cartilage repair procedure such as microfracture or mosaicplasty, or if they had an isolated lesion affecting the medial structures, a bucket-handle meniscus tear, or a grade II + articular cartilage lesion (Outerbridge classification). Patients were also excluded if they refused to participate in the study.

Indications for MCL surgery depended on the valgus laxity upon clinical examination as well as the grade and location of the lesion. The lesion was classed as acute if it occurred within the previous 3 weeks, and chronic if it occurred more than 6 weeks beforehand. The valgus laxity was clinically assessed with the knees extended and flexed at 30° compared to the unaffected side. The location (body, tibial or femoral insertion) and grade of the medial ligament lesion were determined using MRI, according to the Hughston criteria [3].

### 2.2. Treatment of acute lesions

The decision concerning surgery took into account the clinical laxity and location of the lesion. Grade I MCL lesions were treated using a

flexible splint for 2–3 weeks depending on the pain and whether there was early rehabilitation. Grade II or grade III MCL lesions were also treated non-surgically if there was no pathological valgus laxity with the knees in extension, which involved using a rigid articulated splint for 6 weeks.

If there was a complete MCL tear (type III) at the tibial insertion, a ligament reinsertion was carried out using staples or anchors. Grade II or grade III tears affecting the femoral insertion or body were treated surgically if there was pathological laxity with the knee in extension. For lesions affecting the ligament body, synthetic or tendinous reinforcement of the gracilis was carried out at the same time as the primary suture [9]. The recovery of full knee extension was a prerequisite for programming the surgical procedure.

### 2.3. Treatment of chronic cases

For patients with pathological valgus laxity with the knee extended, ligament reconstruction was carried out on the POL and MCL using the Laprade or Lind technique [1,10]. Following surgery, the surgeon determined when patients could begin to bear weight on the limb, and the patients used a rigid articulated splint for at least six weeks.

For both acute and chronic lesions, patients with clinical valgus were not permitted to full weight-bearing for 6 weeks.

### 2.4. Evaluation methods

Patients were first followed up 4–6 weeks after surgery and then had regular follow-up appointments every 2–3 months with a sports physician. Complications were noted that related to the surgery: ACL re-rupture, contralateral rupture, and re-operation.

Several measures were collected prior to surgery and again at six months, one year, and two years following surgery: the functional IKDC (International Knee Documentation Committee) measure of knee function [11], the Tegner score, the ACL-RSI (Anterior Cruciate Ligament-Return to Sport after Injury) [12], and the SKV (Simple Knee Value), which involved the French Society for Arthroscopy (SFA) computer registry [11–14]. If the patients did not respond, they were contacted by telephone at the last follow-up.

### 2.5. Population

During the inclusion period, 488 patients were treated at the eight participating centers for damage to both the ACL and MCL (ACL + MCL). These patients were matched to 488 patients who were treated over the same period for an isolated ACL injury.

In total, 722 patients were included in the study: 314 (43.5%) with an isolated ACL injury and 408 (56.5%) with damage to both the ACL and MCL (Fig. 1). The two groups did not differ significantly in terms of their demographic characteristics (age, sex, body mass index) or follow-up (Table 1).

The patients' mean age was 30.3 ( $\pm 10.8$ ) years and the mean follow-up duration was 18.5 ( $\pm 5.2$ ) months. The frequency of meniscal lesions was higher in the ACL + MCL group (N = 217 (53.2%) versus N = 130 (41.4%);  $p = 0.001$ ), particularly lateral lesions (Table 2). A history of contralateral ACL rupture was significantly more common in the ACL group than in the ACL + MCL group (N = 29 (9.2%) versus N = 8 (2.0%);  $p < 0.0001$ ).

The reconstruction ACL surgery mainly involved a hamstring graft for both groups (72% and 78%), which preserved the tendon insertion [15]. For over 50% of cases, an anterolateral reconstruction was also carried out [16] (Table 3). In the ACL + MCL group, there were 98 patients (24%) who required medial ligament surgery, which involved either reconstruction (N = 57), reinsertion (N = 33), or mixed repair through ligament suture with reinforcement (N = 8; five gracilis and three synthetic). The medial ligament reconstruction involved an auto-graft for 53 patients (51 gracilis or hamstring, one tibialis posterior, one

fascia lata) and an allograft for four patients. The graft was to the semitendinosus (31 cases), patellar tendon (10 cases), quadriceps tendon (11 cases), or fascia lata (5 cases). In total, 84.8% of the patients who underwent a reinsertion procedure were immediately able to bear weight on the limb following surgery, compared to just 36.9% of the patients who underwent ligament reconstruction.

## 2.6. Statistical analysis

Statistical analyses were run using STATA® Version 18.0 (StataCorp, College Station, TX, USA). Quantitative data were summarized using means and standard deviations. Qualitative data were summarized using frequencies and percentages. The percentages were calculated based on the total number of data points that were available.

The two groups (isolated ACL versus ACL + MCL) were compared in terms of their characteristics and their clinical and functional outcomes. For the quantitative variables, this involved running Student t-tests or non-parametric Mann-Whitney tests, as appropriate. For the qualitative variables this involved Chi-square tests or Fisher's exact tests. These tests were run using the available data. Multivariate analyses were not run because there were few complications. Sub-group analyses (ACL + MCL group) adopted the same statistical tests. The significance level was  $p < 0.05$ .

## 3. Results

### 3.1. Comparison of the clinical/functional outcomes for the ACL and ACL + MCL groups

Patients in the ACL + MCL group had a significantly higher reoperation rate compared with the ACL group (7.4% (N = 30) versus 3.2% (N = 10);  $p = 0.015$ ). Most of the reoperations in the ACL + MCL group were related to stiffness that required secondary arthroscopic arthrolysis (N = 22, 73.3%; Table 4). At the last follow-up, the patients in the ACL group had significantly higher functional IKDC and SKV scores compared with the ACL + MCL group (IKDC: 86.52 (SD: 12.79) vs 82.28 (12.59);  $p < 0.0001$ ; SKV: 85.68 (12.44) vs 79.71 (16.02);  $p < 0.0001$ ; Table 4).

### 3.2. ACL + MCL group: Clinical/functional outcomes following surgical versus non-surgical treatment of the MCL

The mean IKDC score was significantly better for patients who underwent non-surgical MCL treatment ( $p = 0.005$ ; Table 5). When medial ligament surgery was required, all of the functional scores were significantly better following ligament reinsertion procedures compared with ligament reconstruction (Table 6).

**Table 1**

Demographic characteristics: 'Anterior cruciate ligament' (ACL) group and 'anterior cruciate ligament and medial collateral ligament' (ACL + MCL) group.

	ACL N = 314 (43.5%)	ACL + MCL N = 408 (56.5%)	P value
Age, mean (SD)	30.92 (11.29)	29.86 (10.35)	0.188
Follow-up in months, mean (SD)	18.46 (4.04)	18.57 (6.00)	0.777
Sex: male, n (%)	195 (62.1%)	252 (61.8%)	0.926
Injury: right side, n (%)	161 (51.3%)	209 (51.4%)	0.983
BMI, mean (SD)	23.81 (3.48)	24.34 (3.67)	0.051
Time between injury and surgery in months, mean (SD)	5.80 (10)	4.65 (6.55)	0.729
Meniscal lesion, n (%)	130 (41.4%)	217 (53.2%)	0.001
Medial	69 (22%)	70 (17.2%)	
Lateral	27 (8.6%)	91 (22.3%)	
Both	34 (10.8%)	56 (13.7%)	

SD: Standard Deviation.

**Table 2**

Characteristics of the meniscal lesions in each group.

Lateral meniscal lesions N (%)	ACL N = 61 (19.4%)	ACL + MCL N = 147 (36%)
Radial	8 (13%)	19 (12.9%)
Flap	8 (13%)	18 (12.2%)
Complex	7 (11.5%)	24 (16.3%)
Longitudinal	8 (13%)	41 (27.9%)
Radial root	15 (24.6%)	14 (9.5%)
Root avulsion	4 (6.5%)	7 (4.8%)
Partially stable or healed	11 (18%)	23 (15.6%)
Meniscectomy sequela	0	1 (0.7%)
Medial meniscal lesions N (%)	ACL N = 103 (32.8%)	ACL + MCL N = 126 (30.9%)
Radial	0 (0.0)	6 (4.7%)
Flap	21 (20.4%)	4 (3.2%)
Ramp	60 (58.3%)	37 (29.4%)
Complex	4 (3.9%)	7 (5.6%)
Longitudinal	13 (12.6%)	59 (46.8%)
Partially stable or healed	5 (4.8%)	11 (8.7%)
Meniscectomy sequela	0 (0.0)	2 (1.6%)

On average, the medial ligament reinsertion was carried out 1.7 months after the injury, while this was 6.26 months for reconstruction surgery ( $p < 0.0001$ ). The re-rupture and reoperation rates did not differ between the different medial structure treatments (Tables 5 and 6).

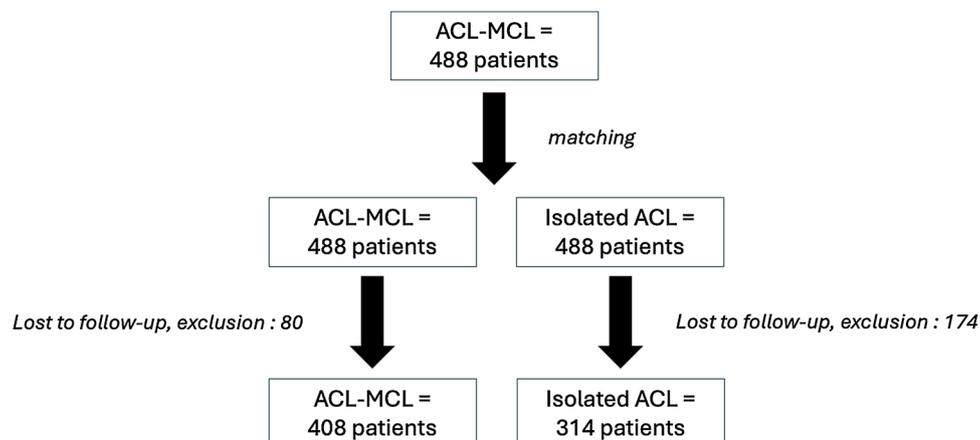


Fig. 1. Flowchart.

**Table 3**  
LCA reconstruction surgery methods.

ACL graft	Isolated ACL	ACL + MCL
Patellar tendon	16 (5.1%)	39 (9.56%)
Hamstring	226 (71.97%)	318 (77.95%)
Other	72 (22.93%)	51 (12.5%)
Associated antero-lateral reconstruction	173 (55.1%)	249 (61%)
<i>Gracilis</i>	167 (96.5%)	150 (60.2%)
<i>Iliotibial Band</i>	6 (3.5%)	95 (38.2%)
<i>Allgraft/Other</i>	0	4 (1.6%)

**Table 4**  
Comparison of the clinical/functional outcomes for the ACL and ACL + MCL groups.

	ACL	ACL + MCL	P value
N	314 (43.5%)	408 (56.5%)	
ACL re-rupture	1 (0.3%)	8 (2.0%)	0.085
Time to re-rupture (months)	24.54	11.66 (2.92)	
Contralateral ACL rupture	10 (3.5%)	6 (1.5%)	0.086
Time to contralateral ACL rupture (months)	11.8 (7.01)	11.61 (3.08)	0.664
<b>Reoperation</b>	<b>10 (3.2%)</b>	<b>30 (7.4%)</b>	<b>0.015</b>
<i>Cyclops lesion</i>	4	15	
<i>Arthroscopic arthrolysis</i>	2	6	
<i>Manipulation under anesthesia</i>	0	1	
<i>Secondary medial meniscectomy</i>	2	3	
<i>Tibial screw removal</i>	2	2	
<i>Infection</i>	0	1	
<i>Repeat ACL rupture</i>	0	1	
<i>Drain removal</i>	0	1	
Time to reoperation (months)	8.69 (5.51)	8.52 (4.8)	0.927
<b>IKDC, mean (SD)</b>	<b>86.52 (12.79)</b>	<b>82.28 (12.59)</b>	<b>&lt; 0.0001</b>
Tegner, mean (SD)	6.08 (2.11)	6.41 (2.22)	0.058
ACL-RSI, mean (SD)	71.87 (23.47)	71.39 (22.96)	0.793
<b>SKV, mean (SD)</b>	<b>85.68 (12.44)</b>	<b>79.71 (16.02)</b>	<b>&lt; 0.0001</b>

**Table 5**  
Clinical/functional results according to the surgical or non-surgical treatment of the MCL in the ACL + MCL group.

	No surgery	Surgery	P value
N	310 (76%)	98 (24%)	
Re-rupture	7 (2.3%)	1 (1.0%)	0.686
Contralateral ACL rupture	6 (2.0%)	0	0.343
Reoperation	22 (7.1%)	8 (8.2%)	0.724
<b>IKDC &gt;median</b>	<b>166 (53.5%)</b>	<b>36 (36.7%)</b>	<b>0.005</b>
Tegner >median	92 (29.7%)	32 (32.6%)	0.598
ACL-RSI >median	161 (51.9%)	43 (43.9%)	0.180
SKV >median	152 (49%)	42 (42.8%)	0.321

**Table 6**  
Clinical/functional results according to the type of MCL surgery.

	Ligament reinsertion	Reconstruction / Mixed repair	P value
N	33 (8.1%)	65 (16.0%)	
Time from injury to surgery (months)	1.70 (2.27)	6.26 (7.79)	0.0001
Antero-lateral reconstruction	25 (75.8%)	20 (30.8%)	0.0001
Re-rupture	1 (3.0%)	0	0.336
Contralateral ACL rupture	0	0	–
Re-operation	1 (3.0%)	7 (10.8%)	0.260
<b>IKDC, mean (SD)</b>	<b>83.37 (15.19)</b>	<b>75.54 (12.61)</b>	<b>0.012</b>
Tegner, mean (SD)	7.35 (1.91)	5.91 (2.34)	0.005
ACL-RSI, mean (SD)	77.53 (23.35)	62.26 (23.74)	0.004
SKV, mean (SD)	80.59 (17.27)	71.63 (18.80)	0.031

**3.3. ACL + MCL group: Clinical/functional outcomes according to the grade of the lesion**

In the ACL + MCL group, there were 337 (82.6%) patients who had a grade I lesion and 71 (17.4%) patients who had a grade II/III lesion. These two groups did not differ in terms of the re-rupture or reoperation rates. Surgery was required on the medial structures in addition to ACL reconstruction in 69% of patients with a grade II/III lesion compared with 14.5% of those with a grade I lesion ( $p < 0.0001$ ), and this took place 2.79 months after the injury (versus 4.93 months,  $p < 0.0001$ ).

The functional scores at the last follow-up (IKDC, ACL-RSI, and SKV) were significantly better for the ACL + MCL patients with grade I lesions, and these were comparable to patients with isolated ACL lesions (Table 7).

**4. Discussion**

The results of this study support the initial hypothesis, showing that combined ACL + MCL lesions lead to significantly higher re-operation rates (7.4%) compared to isolated ACL lesions, as well as significantly lower functional scores, as assessed using the IKDC and SKV. The presence of a medial ligament lesion therefore has a negative impact on the expected outcomes following ACL surgery.

Our results are in line with the Swedish registry study, which found that non-surgically treated concomitant MCL lesions significantly affected the functional outcomes and re-rupture rates at two years [17]. In our study, the ACL re-rupture rate was also found to be higher when there was an associated MCL lesion that was treated non-surgically, although this was not statistically significant (2.3% versus 1%).

There has been much controversy concerning the strategy that should be adopted when there are combined ACL and MCL lesions. Some groups favor a combined surgical strategy from the outset [18]. Previous studies by Fetto et al. and Hughston et al. showed that surgical repair in the acute phase enables good recovery in terms of stability and pain, while dissatisfaction rates were close to 20% when the MCL was treated non-surgically [3,4]. Studies by Shirakura et al. and Hughston et al. both reported Lysholm scores and return-to-sport rates of 94% when MCL repair was carried out in combined injuries [19,20]. The majority of studies conclude that the knees are stable following combined surgery, but that there is a higher risk of postoperative complications, which mainly relate to stiffness [4,21].

In contrast to this, some groups promote non-surgical treatment of the MCL lesion and obtain satisfactory functional results, a reduced risk of stiffness, and faster muscle recovery [22–24]. However, it is difficult to analyze the different studies due to the small sample sizes and the lack of information concerning the MCL lesion grade.

In our study, non-surgical treatment was used for 76% of cases, and we found that the IKDC scores were better than for patients who underwent MCL surgery. However, for patients with significant laxity,

**Table 7**  
Clinical/functional results according to the MCL lesion grade.

	ACL + MCL grade I N = 337	ACL + MCL grade II-III N = 71	P value
Time from injury to surgery (months)	4.93 (7.32)	2.79 (3.34)	0.0001
MCL surgery	49 (14.5%)	49 (69%)	0.0001
Antero-lateral reconstruction	184 (54.6%)	43 (60.6%)	0.379
ACL re-rupture	1 (0.3%)	1 (1.4%)	0.332
Contralateral ACL rupture	3 (0.9%)	0	1.000
Re-operation	16 (7.7%)	8 (11.3%)	0.055
<b>IKDC, mean (SD)</b>	<b>83.00 (12.85)</b>	<b>78.03 (14.52)</b>	<b>0.016</b>
Tegner, mean (SD)	6.54 (2.28)	6.47 (2.30)	0.839
ACL-RSI, mean (SD)	74.01 (20.64)	65.94 (24)	0.015
SKV, mean (SD)	81.33 (13.72)	76.60 (15.38)	0.031

reinsertion surgery was preferred, whenever possible, which led to statistically better functional recovery compared to ligament reconstruction, with no increased risk of complications.

When planning treatment, it is essential to consider the lesion grade, because this affects the outcomes.

In our cohort, grade II/III MCL lesions were linked to significantly lower functional scores (IKDC = 78.03, ACL-RSI = 65.94 and SKV = 76.6) compared with low-grade MCL lesions. The reoperation rates were also higher, at around 16%, which mainly concerned cases of cyclops lesion and stiffness, which required secondary arthrolysis. In contrast, grade I MCL lesions that were treated non-surgically led to functional outcomes that were identical to those seen for isolated ACL lesions.

In a previous study by Funchal et al., which included 112 patients with high-grade MCL lesions and a floating meniscus (defect in the meniscal attachment to the tibia), the ACL re-rupture rate at 2 years was 29% for the group who had non-surgical MCL treatment, while this was 3% for the group who underwent multi-ligament reconstruction [25]. In another study, Lucidi et al. did not find any long-term differences between patients with ACL + MCL grade II lesions that were treated non-surgically compared to a group with isolated ACL lesions. However, the sample size was small (17 and 28 patients in each group, respectively) [26].

A further study by Halinen et al. also found no functional differences at two years for patients with grade III MCL lesions who were treated non-surgically, when the ACL reconstruction was carried out in the acute phase. The clinical criterion was the valgus laxity, and they only found mild pathological laxity in extension in certain cases [27].

In addition to the lesion grade, as determined using imaging, the clinical examination (along with possible dynamic images) can detect pathological valgus laxity, particularly in extension, which is predictive of a poor functional outcome. For these patients, surgical treatment is necessary because residual valgus laxity places pressure on the central pivot, which could potentially lead to the failure of the ACL reconstruction [28–33]. However, this clinical measure is rarely evaluated in studies on the subject, although they generally report the lesion grade according to imaging.

In our study, the clinical examination was used to guide the patients' treatment. For instance, the MCL was surgically repaired when there was acute ligament injury along with pathological laxity in extension. Ligament reconstruction was generally carried out for chronic cases with residual pathological valgus laxity in extension and flexion.

The limitations of this study relate to the multi-centric and observational nature of the study. For instance, there were variable times to surgery for the different centers as well as slightly different post-operative rehabilitation protocols, especially concerning when patients could begin to bear weight on the limb. This is in line with the lack of consensus concerning the treatment of these injuries and despite the expertise of the participating centers. However, the inclusion of different centers leads to more representative results. In addition, it can be seen that there is consensus concerning certain points, most notably with surgical repair being carried out in the acute phase whenever possible, and with joint movement being recommended early on.

The strengths of this study relate to the sample size, particularly the group with ACL + MCL lesions, which included 408 patients. The clinical indications for surgical repair or reconstruction were also standardized and depended on the location of the ligament injury and the presence of laxity in extension.

## 5. Conclusion

For combined ACL + MCL lesions, the outcomes are poorer with a high reoperation rate and lower functional scores. Treating low-grade MCL lesions non-surgically enables a level of recovery that is identical to isolated ACL lesions. For high-grade MCL lesions, surgical repair of the MCL is advised when there is pathological valgus laxity in the acute

phase, as this leads to better functional recovery than multi-ligament reconstruction in the chronic phase.

## CRedit authorship contribution statement

C. Kajetanek, E. Cavaignac, N. Bouguennec: writing and re-reading the article.

E. Berard: statistical analysis, re-reading the article.

All authors were involved in data collection.

## Declaration of Generative AI and AI-assisted technologies in the writing process

No artificial intelligence was used to write the submitted work.

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## Declaration of competing interest

C. Kajetanek is a consultant for FH Ortho and Depuy Synthes.

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