Analysis of meniscal lesions accompanying anterior cruciate ligament tears

Lésions méniscales constatées lors de la reconstruction du ligament croisé antérieur

Siège et nature dans une série continue de 156 patients


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RÉSUMÉ

Le but de cette étude rétrospective continue était de documenter les types et les localisations préférentielles des lésions méniscales qui accompagnent les lésions du ligament croisé antérieur, mais également de mettre en évidence des liens entre les lésions méniscales et l’âge du patient d’une part et le délai « accident-chirurgie » d’autre part.

Cent cinquante-six patients sans antécédent de lésion méniscale ont été opérés d’une ligamentoplastie en 2003 par un seul opérateur. Le délai « accident-chirurgie » était en moyenne de 31,6 mois. Il s’agissait d’une étude rétrospective continue utilisant les compte-rendus opératoires détaillés.

Une lésion méniscale médiale isolée était présente chez 25,6 % des opérés, une lésion méniscale latérale isolée chez 21,8 % des opérés et 9 % des lésions concernaient les deux ménisques. La lésion la plus fréquemment retrouvée était une fissure longitudinale quel que soit le ménisque concerné. L’âge du patient et le délai « accident-chirurgie » étaient statistiquement associés avec la présence d’une lésion méniscale médiale. Aucun lien statistique n’a été mis en évidence pour le ménisque latéral.

La proportion de lésion méniscale latérale reste stable avec le temps et le délai « accident-chirurgie » et semble ainsi être contemporaine le plus souvent du traumatisme initial. Au contraire, l’incidence des lésions méniscales médiales augmente avec le temps et l’âge du patient confirmant le rôle important du ménisque médial comme frein à la translation antérieure du genou. Aussi, les auteurs recommandent une prise en charge précoce des lésions du ligament croisé antérieur afin d’éviter les méniscectomies médiales qui augmentent avec le délai « accident-chirurgie » et altèrent les résultats de cette chirurgie.

Mots clés : Lésion méniscale, ligament croisé antérieur, ligamentoplastie.

ABSTRACT

Purpose of the study

The purpose of this retrospective study of a continuous series was to document preferential types and locations of meniscal lesions accompanying anterior cruciate ligament tears and to demonstrate the relationships between meniscal lesions, patient age, and time from trauma to surgery.

Material and methods

One hundred fifty-six patients with no history of meniscal lesions underwent ligamentoplasty in 2003. All procedures were performed by the same operator. The time from trauma to surgery was 31.6 months on average. This was a retrospective continuous series using data from detailed operative reports.

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RESULTS

An isolated lesion of the medial meniscus was observed in 25.6% of cases. There was an isolated lesion of the lateral meniscus in 21.8% and lesions of both menisci in 9%. The most frequent injury was a longitudinal fissuration, for both menisci. Patient age and time from trauma to surgery were statistically correlated with presence of a medial lesion. There was no statistical relationship for the lateral meniscus nor for the type of meniscal injury.

DISCUSSION

The proportion of lesions to the lateral meniscus appeared to be unaffected by age or time to surgery after trauma, suggesting that lateral meniscal lesions occurred at the time of the initial cruciate injury. On the contrary, the incidence of medial lesions increased with time and patient age, confirming the important role of the medial meniscus to block anterior displacement of the knee. We therefore recommend early repair of anterior cruciate ligament tears in order to avoid medial meniscectomy, which may multiply with increasing time from injury to surgery and thus affect the postoperative outcome.

Key words: Anterior cruciate ligament, meniscal tear, ligament reconstruction.

INTRODUCTION

The development of sports activities in our society has contributed to the increase in anterior cruciate ligament injuries. The associated meniscus lesions have been frequently studied. Most of these studies show a predominance of lateral lesions at the acute stage [Binfield et al. (1), Cipolla et al. (2), Nikolic (3), Wickiewicz (4)], but other others report a predominance of medial lesions [Cerabona et al. (5), Keene et al. (6), Paletta et al. (7)].

The presence of meniscal lesions stemming from anterior cruciate ligament tear can be explained by several mechanisms. The meniscus can be injured simultaneously with the ligament or the meniscus lesion can be secondary to the ligament injury. The natural history of chronic anterior laxities was studied by Dejour et al. (8) and Imbert (9). The lateral tibial surface acquires an abnormal pivot mobility, and the abnormal stresses on the medial and lateral compartments thus cause meniscal injury. Medial meniscectomy aggravates anterior subluxation of the tibial surface and encourages lateral dislocation, which increases the stresses causing varus. This favors cartilage lesions and finally arthrosis [Gillquist and Messner (10)].

The objective of this continuous retrospective study on 156 ligament reconstructions of the anterior cruciate ligament was to document the preferential types and locations of the meniscus lesions accompanying ligament injuries. We also sought to demonstrate any relations between time from trauma to surgery, age, and different lesion characteristics.

MATERIAL AND METHODS

Inclusion criteria

Patients with a history of surgery on the same knee were excluded from the study because the origin and date of meniscal lesions was too uncertain in cases of earlier meniscectomy or in cases of a second ligamentoplasty. Therefore, 156 patients were included in this study out of 176 patients operated on for ACL reconstruction in 2003 by a single senior operator (BM) using the blind tunnel arthroscopic technique.

Presentation of the patient series

The patient series included 45 women and 111 men. There were 76 right knees and 80 left knees. The age at surgery was 29.4 ± 10 years (range, 14-57 years).

One hundred sixteen patients (74.3%) were under 35 years of age (fig 1). The time from trauma to surgery was a mean 31.6 ± 59.7 months, ranging from 1 week to 30 years (fig 2). Ninety-one patients (58.3%) were operated on in the year following injury. Only four patients were operated on in the first month following the accident. In four cases, it was not possible to determine this time lapse, because when questioned the patient could not specify a particular incident causing the injury. The cause of injury was found in 97.4% of cases, a sports accident in 89% of cases. The sports involved were most often pivot sports, in particular soccer and skiing. Ball sports, other than soccer, accounted for approximately 20%.

Methodology

The patients’ medical charts were used to collect data on the history of the injury and the detailed surgery report. The time from trauma to surgery was noted in months rather than days to reduce the risk of errors with long delays before surgery. Several parameters were noted and analyzed: the presence of meniscal lesions (medial, lateral, or both), the type of meniscal lesion (longitudinal, radial, flap, horizontal, bucket handle tear or complex lesion), and the meniscus lesion location (anterior, middle, or posterior). We called “bucket handle” lesions longitudinal tears that were long enough to be susceptible to luxation in the femoral notch. We also noted the measurements of laxity taken with Daniel’s KT-1000 arthrometer before surgery. Three measurements were taken on the knee: KT1 (7 kg of traction), KT2 (9 kg of traction), and KTMax (maximum manual traction). The differential measurement retained was the greatest injured knee/healthy knee difference.
Data for each patient were collected and entered in an Excel 2000 spreadsheet. A descriptive analysis of all the parameters measured was done, using the means plus standard deviation and frequency distributions. Individual data were then treated using SPSS version 11.0 software for Windows (SPSS Inc., Chicago, IL, USA). A descriptive univariate analysis on the study’s population was done. The relations between certain characteristics (time from trauma to surgery, age) and the parameters noted were studied. The Student t test (after having verified the Gaussian distribution and the squared variance) was used for quantitative variables and Pearson’s chi square test or Fisher’s exact test was used for categorical variables. The analysis of variance (ANOVA) was used to compare the quantitative and qualitative data.

RESULTS

Meniscus lesions

Eighty-four patients (56.4%) had at least one meniscus injury: 25.6% presented an isolated medial meniscus lesion, 21.8% an isolated lateral meniscus lesion, and 9% lesions in both menisci. The most frequently found lesion of the medial meniscus was a longitudinal fissure of the posterior segment (44%). We found no radial lesions of the medial meniscus. In addition, 16% of the lesions found were bucket handle lesions.

The most frequently found lesion of the lateral meniscus was a longitudinal tear of the posterior segment (37%). There was nonetheless a higher proportion of radial and flap lesions than in medial lesions. In addition, we found 6% bucket handle lesions (table I).

The posterior segment was involved in 98.2% of medial meniscus injuries and in 43.8% of lateral meniscus tears; 83.5% of the meniscus lesions only involved a single segment (table II).

### Influence of trauma to surgery time

The mean time from trauma to surgery was statistically ($p = 0.001$) greater for patients with a medial meniscal lesion (53.7 months ± 84.4) than for those with no medial meniscus injury (20.5 months ± 38).

The mean time from trauma to surgery was not statistically greater ($p = 0.195$) for patients presenting a lateral meniscus injury (40.9 months ± 78) than for those with no lateral meniscus injury (27.4 months ± 48.8).

### TABLE I. – Types of meniscal injuries

<table>
<thead>
<tr>
<th></th>
<th>Medial meniscus</th>
<th>Lateral meniscus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal tear</td>
<td>44%</td>
<td>37%</td>
</tr>
<tr>
<td>Bucket handle</td>
<td>16%</td>
<td>6%</td>
</tr>
<tr>
<td>Radial tear</td>
<td>0%</td>
<td>23%</td>
</tr>
<tr>
<td>Flap</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>Horizontal tear</td>
<td>9%</td>
<td>13%</td>
</tr>
<tr>
<td>Complex tear</td>
<td>11%</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### TABLE II. – Location of meniscus injuries

<table>
<thead>
<tr>
<th></th>
<th>Medial meniscus</th>
<th>Lateral meniscus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior segment</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Middle segment</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Posterior segment</td>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>At least two segments</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
The proportion of medial meniscus tears increased with time from trauma to surgery, increasing more after the 5th year, which was statistically significant. The proportion of lateral meniscus lesions seemed to remain relatively stable over time (fig 3).

**Influence of age**

The mean age of patients was statistically higher ($p = 0.001$) in patients presenting a medial meniscus lesion (33 years ± 11) than for patients with no medial meniscus lesion (27.6 years ± 9.1). The mean age of patients was not statistically different ($p = 0.551$) in patients presenting a lateral meniscus lesion (28.6 years ± 9.9) and in patients with no lateral meniscus lesion (29.8 years ± 10.3).

In patients under 30 years of age, the lateral meniscus was injured the most often. In patients over 30 years of age, the medial meniscus was the most frequently involved (table III).

Patients presenting a meniscal flap and those presenting a complex lesion of the medial meniscus were older, but the difference was not statistically significant. No statistically significant relation was demonstrated between age and type of meniscal lesion. In absolute values, a single complex lesion was found on the lateral meniscus. For the different lesions, the mean age seemed homogenous.

It should be noted that there was no correlation between age and time from trauma to surgery. These were two independent factors.

**Influence of laxity**

The mean KT1 was 7.4 mm ± 1.8 (range, 4-14 mm). The mean KT2 was 9.5 mm ± 1.9 (range, 5-15 mm). The mean Ktmax was 15.5 mm ± 2.7 (range, 6-22 mm). The mean differential was 7.2 mm ± 2.8 (range, 0-14 mm).

We found no correlation between the extension of the laxity and whether or not there was a medial or lateral meniscus lesion.

**DISCUSSION**

Our study could be criticized for one methodological issue. This was a case study and not a longitudinal study. Patients were recruited most often long after the accident, making it difficult to have an early MRI for each patient. Certain meniscal lesions indeed can heal spontaneously. This may have led us to underestimate the number of initial meniscus injuries.

Several studies have analyzed the progression of meniscus lesions with chronic ACL laxity. In a prospective study investigating 575 unstable knees, Smith and Barrett (11) found nearly as many medial as lateral meniscus injuries. The most frequently found lesion was a peripheral tear of the medial meniscus’s posterior segment. More than 56.4% of our study’s patients has a meniscus lesion, quite close to the rate found in other series: 72.8% for Tandogan et al. (12), 65% for Seitz et al. (13), and 59% for Binfield et al. (1). The proportion of medial and lateral meniscus lesions is comparable in these studies. We found 25.6% medial lesions and 21.8% lateral lesions (table IV).

The history of meniscus injuries seems to be different depending on whether they are lateral or medial. We found a statistically significant increase in medial meniscus lesions with increasing time from trauma to surgery, whereas the proportion of lateral meniscus injuries was stable, in agreement with the literature. In a series of
ACL lesion beyond 120° recent study, Williams and Logan (15) showed that in an
meniscus is different from that of the lateral meniscus. In a
lateral tibial surface. The biomechanics of the medial
part of the lateral condyle and the posterior edge of the
cal level, this corresponds to an impact between the anterior
eral condyle and the lateral tibial surface. On the pathologi-
the most frequent lesion found was a contusion of the lat-
bone contusions on the knee's lateral compartment.
transmitted to the medial tibial compartment. This tends to
subluxate the medial condyle backward and thus create
medial meniscal lesions. Recently, a German biomechani-
cal study [Von Eisenhart-Rothe et al. (17)] demonstrated
an increase in medial femur condyle translation in unstable
knees, whereas the meniscotibial translation remained
unchanged. This may explain the potential for injury to the
posterior segment of the medial meniscus, in support of the
data in the literature.

The most frequently found meniscal lesion was a longi-
tudinal tear of the posterior segment [Keene et al. (18)], for
both the medial meniscus and the lateral meniscus. However,
there was a high proportion of radial lesions on the lateral
meniscus. We were not able to demonstrate a sta-
tistical relation, probably because the patient sample was
too small. In 764 patients, two studies, Tandogan et al. (12)
and Cerabona et al. (5), noted a statistically higher propor-
tion of radial lesions on the lateral meniscus. We found few
complex lesions (2% lateral and 11% medial). This may
very well originate from the relatively short time from
injury to surgery. More than 75% of the patients operated
on in 2003 were operated on within 2 years of their acci-
dent. The large number of lesions, both medial and lateral,
probably results from the combination of several mecha-
nisms: the complexity and diversity of the initial mecha-
nisms of injury, on the one hand, and the time from injury to
surgery, on the other hand. It would have been interesting to
specify the meniscal zones where the tears were found
(peripheral or central), since different zones do not have the
same potential for healing, but the surgery report did not
provide enough details for this analysis.

We were not able to demonstrate a correlation between
the degree of laxity and the presence of meniscal lesions,
even though this is noted in the literature [Baker et al. (19)].
Age was also related to the presence of medial meniscal
damage, with a statistically significant relation. As for the
type of lesion, in our study it seems that the proportion of
complex lesions or meniscal flap lesions was greater in
older patients. The small sample size for certain types of
tears did not allow us to bring out a statistical relation
(e.g., one complex tear of the lateral meniscus in the
series). Tandogan et al. (12) found a statistically significant
difference between age and the complexity of the medial
meniscus injury, with age a predominating factor [Ross

| Table IV. – X

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>Mean time to surgery (months)</th>
<th>Meniscus injuries (%)</th>
<th>Lateral meniscus injuries (%)</th>
<th>Medial meniscus injuries (%)</th>
<th>Injuries to both menisci (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binfield 1993 (1)</td>
<td>400</td>
<td>23.3</td>
<td>58.6</td>
<td>30.3</td>
<td>21.3</td>
</tr>
<tr>
<td>Tandogan 2004 (12)</td>
<td>764</td>
<td>19.8</td>
<td>72.8</td>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>Our series</td>
<td>156</td>
<td>31.6</td>
<td>56.4</td>
<td>21.8</td>
<td>25.6</td>
</tr>
</tbody>
</table>
et al. (20)]. A statistical relation was established in our study for medial meniscus injuries. There was a very clear inversion of the curves, illustrating the high proportion of lateral meniscus injuries in young subjects, whereas in subjects over the age of 30, medial meniscus lesions predominated.

From a therapeutic point of view, these results encourage early surgery [Seitz et al. (13)], which would make it possible to preserve the meniscus stock. Keene et al. (18) estimate that 80% of acute medial meniscal tears are repairable, whereas it was estimated that 46% of chronic tears could be repaired. The results of ligamentoplasty in terms of instability and arthrosis progression are less promising in cases of meniscectomy, even partial [Gillquist and Messner (10)]. Acute lateral meniscus tears have a high potential for healing because they are often located in a vascularized peripheral zone [Arnoczky and Warren (21)]. Therefore, retaining the meniscus stock should be preferred, and even more so for the lateral meniscus [Hulet et al. (22)], Pierre et al. (23), because of their demonstrated role in the biomechanics of the knee [Fairbank (24), Walker and Erkman (25)]. Furthermore, this is a prognostic factor for residual laxity [Laffargue et al. (26)].

References

