ORIGINAL PAPER

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Classification of lesions of the medial patello-femoral ligament in patellar dislocation

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Abstract The remnants of the medial patello-femoral ligament (MPFL) of 67 knees, 18 with acute patellar dislocation and 49 with chronic patellar dislocation, were studied. The MPFL injuries of the acute cases were categorised into 2 groups: an avulsion tear type and a substantial tear type. The chronic cases were put into 3 groups: those with loose femoral attachment (9 knees), those with scar tissue formation or abnormal scar branch formation (29 knees), and those with no evidence or continuity of the ligament (absent type) (11 knees). It is concluded that incompetence of the medial patello-femoral ligament is a major factor in the occurrence of recurrent patellar dislocation and/or an unstable patella following an acute patellar dislocation.

Résumé Dans cette étude, on a évalué le ligament patellofémoral médial (MPFL) de 67 genoux, dont 18 ayant une dislocation patellaire aiguë et 49 ayant une dislocation patellaire chronique. Les blessures du ligament MPFL des cas aigus ont été répartis en deux groupes: un type de déchirure par avulsion et un type de déchirure substantielle, chaque groupe comptant respectivement 7 et 10 genoux. Les cas chroniques ont été répartis en 3 groupes: 1) Attache fémorale relâchée: 9 genoux, 2) Formation de tissu cicatriciel ou formation de ramification cicatricielle anormale: 29 genoux, 3) Pas d'évidence ou continuité de reliquat de ligament (type absent): 11 genoux. A partir de cette étude, on conclut qu'un grand facteur dans la survenue de dislocation patellaire récurrente et/ou d'instabilité de rotule à la suite d'une dislocation patellaire aiguë est l'insuffisance du ligament patellofémoral médial.

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Introduction

In recent years attention has been focused on the medial patello-femoral ligament (MPFL) as an important medial patellar stabiliser. The effect of an MPFL injury in acute patellar dislocation (APD) and the results of MPFL reconstruction have been reported [1–12, 14]. However, the role of the MPFL in chronic patellar dislocation (CPD) has not yet been clearly defined, and it follows, therefore, that the importance of MPFL reconstruction in the treatment of recurrent patellar dislocation is not yet fully understood.

The objectives of this study were to assess the importance of medial patello-femoral ligament injury in acute patellar dislocation cases, to identify and classify the remnants of the medial patello-femoral ligament in chronic patellar dislocation cases, and to discover any causative factors in the appearance of recurrent patellar dislocation after an acute dislocation.

Materials and methods

The types of damage of the MPFL in 67 knees of 63 patients were observed macroscopically during surgery. Patients with unstable patellar hypermobility who had no history of an acute patellar dislocation or with habitual and/or permanent dislocation were excluded from this study. Acute patellar dislocation is generally accepted to be an initial traumatic dislocation. However, in order to observe MPFL injury only the cases in which the time interval from initial dislocation to the time of surgery was less than 3 weeks were considered as an APD. Chronic patellar dislocation was used to describe cases where patellar dislocation had occurred at least twice, or where patellar instability following the initial dislocation had continued for more than 3 months.

Eighteen knees in 18 patients (5 males and 13 females) were classified as APD. There were 6 left knees and 12 right knees. The mean age at the time of surgery was 19 ± 6 years (range 12 to 38 years). The number of days between initial dislocation and surgery was 8 ± 4 days: 10 were within 7 days, 6 within 8 to 14 days, and 2 within 15 to 21 days.

A total of 49 knees in 45 patients (11 males and 34 females) had chronic patellar dislocation; 4 were bilateral and all these were in females. The mean age (and standard deviation) at the time of surgery was 22 ± 9 years (range 13 to 48 years) and the

mean age at initial patellar dislocation was 15 ± 3 years (range 8 to 27 years). There were 6 knees with a history of a single dislocation, 19 knees with multiple dislocations (2 to 10 dislocations) and 24 knees with more than 10 dislocations. For knees with a history of only a single dislocation surgery was performed as these patients continued to complain of instability after their initial dislocation. The time from initial dislocation to surgery was less than 1 year in 11 knees, within 1 to 5 years in 17 knees and greater than 5 years in 21 knees (maximum time period was 34 years), with an average of 7 ± 9 years.

Results

Normal anatomy

The normal medial patello-femoral ligament extends from the superior two-thirds of the medial patellar margin to just distal to the adductor tubercle, and with the superficial fibres extending to the posterior capsule. Although the MPFL does not appear to have a bony distal attachment the under-surface is in fact firmly anchored to the femur just distal to the adductor tubercle (Fig. 1a, Fig. 2). This anatomical characteristic can be considered a single point fixation [8].

Acute patellar dislocation

Among the 18 patients with acute patellar dislocation, 17 knees had a visible medial patello-femoral ligament injury. In the one knee with no visible injury the MPFL was very loose.

The MPFL injuries were categorised into 2 major types: 1) an avulsion tear type (detachment) of which there were 7 knees, and 2) a substantial tear type (rupture) of which there were 10 knees.

An avulsion tear type is defined as a detachment injury limited to the deep layer of the MPFL at its femoral attachment, but with no actual rupture of the ligament itself (Fig. 1b).

The substantial tear type is defined as a complete rupture or tear of the MPFL (Fig. 1c), and is usually found in the immediate vicinity of the femoral attachment.

Chronic patellar dislocation

No normal MPFL was observed among the 49 CPD knees. Figure 3 shows the types of damage to the MPFL in the CPD cases and these are categorised into 3:

Type 1

Loose femoral attachment. Type 1 damage in 9 knees. In this type of injury the ligament may at first glance seem intact. However, the MPFL is 'relaxed' due to the fact that there is no solid fixation to the femur. There may be a slight scar formation at the femoral attachment.

Fig. 1a–c Schematic diagrams of classification of the injury of the medial patello-femoral ligament in acute patellar dislocation. **a** Normal anatomy of the medial patello-femoral ligament. **b** Avulsion-tear type. Arrow A or white arrow, detachment area of the femoral attachment. **c** Substantial-tear type. White arrow, tear site. FA or black oval, femoral attachment; VM, vastus medialis; AT, adductor tubercle; P, patella; MCL, medial collateral ligament

Fig. 2 Photograph of the medial patello-femoral ligament (black oval, femoral attachment)

Type 2

In this type scar tissue forms in the body of the MPFL (Type 2a) or as an abnormal scar between the adductor tubercle and/or the medial collateral ligament (Type 2b). There were 29 knees with this type of damage, and in all of these scar tissue formation and/or abnormal scar formation was found near the femoral attachment. In all Type 2 knees the damaged MPFL was relaxed due to either its 'elongation' or to its abnormal attachment (Fig. 4, Fig. 5)

Type 3

In this type the MPFL seemed to have completely disappeared (absent type). There were 11 examples of this in

Fig. 3 Classification for the remnant of the medial patello-femoral ligament in chronic patellar dislocation. *Type 1* Loose femoral attachment; *Type 2a*, Scar tissue formation on anatomical course of the MPFL; *Type 2b*, Abnormal scar branch formation toward the adductor tubercle and/or medial collateral ligament; *Type 3*, No evidence or no continuity of the MPFL remnant (absent type)

the series. The MPFL either could not be identified at all, or only a small amount of the original ligament fibres remained. In all 11 examples there was no continuity of the MPFL.

Discussion

In acute patellar dislocation injuries to the capsule, medial retinaculum and/or vastus medialis obliquus have been recorded [5, 13, 15]. Recently, injury to the MPFL has also been reported [1, 7, 9, 11, 12, 14].

No authors have previously given either a detailed description of the actual damage to the MPFL in cases of acute patellar dislocations, or a classification of the MPFL damage in chronically dislocating patellae. In this study injury of the MPFL following APD has been classified into 2 types. According to a previous anatomical study [8] the width and thickness of the MPFL becomes narrower and thinner as it approaches the femur. Therefore, a substantial tear type injury of the ligament is most likely to occur in the vicinity of this distal attachment. However, in this series it was surprising also to find avulsion type injuries [11]. This may be due to the specific structure of the femoral attachment of the MPFL. In acute cases with an avulsion type injury the lateral restraining function of the MPFL on the patella is decreased because of the lack of distal fixation at the femoral attachment. The area of attachment is very small, and it is suspected that this is a morphological and anatomical weak point.

In chronic patellar dislocation cases, the MPFL damage has been classified into 4 types and in no case was there a normal MPFL. In the acute patellar dislocation cases there were none with total absence of the MPFL. But in the 49 CPD knees, no ligament could be found (Type 3 damage). Type 3 damage seemed to increase with the length of time from the initial dislocation, and also the numbers of further dislocations. The MPFL damage in CPD may be complicated as the site of re-injury can occur at the site of the original APD (Fig. 4). With repeated dislocations it is reasonable to suppose that the usual characteristics of the MPFL damage occur-

Fig. 4 *Type 2a.* A large scar tissue formation (*black arrows*) is seen in the vicinity of the femoral attachment. The abnormal scar tissue attachment extends to the adductor magnus tendon. *AT*, adductor tubercle; *VMO*, vastus medialis obliquus

Fig. 5 *Type 2b.* Abnormal scar branch formation extended to the adductor magnus tendon and medial collateral ligament (*four arrows*). There was no normal femoral attachment of the MPFL. *AT*, adductor tubercle

ring as a result of the original APD are lost. Abnormal scar tissue formation appears, and suggests that the MPFL is attempting to re-attach itself both proximally and distally.

It is generally recognised that several predisposing factors, such as soft tissue or bone abnormalities are involved in patellar dislocation. However, this study reveals a high incidence of MPFL damage in APD, and abnormalities of the MPFL in all the CPD cases. It is there-

fore concluded that MPFL damage and insufficiency is a significant factor involved in the production of recurrent patellar dislocation and/or an unstable patella following an acute dislocation.

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