The Patellofemoral Joint: A Case-Based Approach

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10.1 Introduction

The incidence of acute patellar dislocation is 5.8 per 100,000. It increases to 29.0 per 100,000 in the age group 10–17 years [1, 2]. Recurrence rate ranges from 15 to 44% after nonsurgical management [2] and 58% of patients continue to experience pain and mechanical symptoms after the initial dislocation incident and 55% fail to return to pre-dislocation sports activity [3].

10.2 History and Examination

Several patellar stability tests are available. The most important are: (1) the patellar glide test where translation to less than two quadrants is considered normal while two or more quadrants indicate laxity of the medial patellar restraints. When this is not bilateral, related to hyperlaxity and is associated with acute injury, it represents an injury to the MPFL [4]. *(2) The patellar apprehension test which is performed with the knee in full extension and a lateral force is applied to the patella. The test is positive when the patient verbally reports apprehension and pain or quadriceps muscle contraction resisting lateral patella translation. In the previous two tests, more important than the absolute translation is the comparison to the opposite uninjured side, whether there is a firm or soft endpoint, and the presence of an apprehension sign* [5].

A 21-year-old male ice hockey player sustained traumatic dislocation of his right patella when checked into the boards 5 months previously. At that time, the patella spontaneously relocated 15 minutes after the initial event but knee swelled and return to play was impossible despite intensive physical therapy after an initial 5 days of rest with compression. Upon attempts at returning to vigorous activity, the patella felt unstable with notable clicking and shifting, even with a brace on. The patient had successful return to sport after prior anteromedial tibial tuberosity osteotomy (TTO) on the contralateral knee.

10.3 Imaging

Radiographs [6] *in the form of Standard AP, lateral in 30° flexion and axial views are mandatory. AP view must be taken with patient in standing position thus the relationship of the patella to the femur will be clear and the medial and lateral joint space narrowing may be detected* [7]. *The lateral view*

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must be taken in the lateral decubitus or standing with the knee flexed to 30° to place the patellar tendon under tension, and also with the posterior femoral condyles overlapped. From the lateral view, the patellar morphology, thickness, height [Caton-Deschamps (CD) and Insall-Salvati indices (IS)], and trochlear dysplasia can be assessed. Axial view is performed tangentially with the knee flexed 30°. In the axial view, the congruence angle may be measured and lateral patellar subluxation and tilt may be identified [8]. *CT scan is very important as it allows a true axial view of the patellofemoral joint in addition to the ease of patient positioning. With CT we can assess the TT-TG (tibial tuberosity trochlear groove) distance, lateral patellar tilt angle, and the grade of trochlear dysplasia. MRI is mandatory to assess the medial soft tissue restrains of the patellofemoral joint, the medial patellofemoral complex (MPFC) as well as the articular cartilage of the patellofemoral joint.*

30 degree knee flexion axial view of our patient demonstrated lateral translation of the right patella but no bony lesion (Fig. 10.1). MRI imaging showed evidence of distal medial patellar articular cartilage damage grade 3 with lateral subluxation. The lateral trochlea was also damaged with marginal articular disruption grade 3. TT-TG measurement was 18 mm, Caton-Deschamps index measured 1.2. Dejour B proximal trochlea (the available image in Fig. 10.1 shows more distal trochlea at 30 degrees knee flexion) No orthogonal views were available.

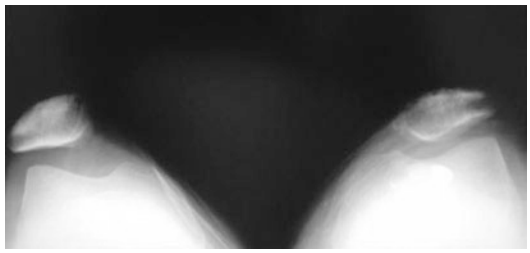

Fig. 10.1 Shows lateral translation of right patella

10.4 Diagnostic Arthroscopy

Arthroscopy after failed rehabilitation (recurrent feelings of instability but no more complete dislocation) revealed distal medial patellar and lateral trochlea articular lesions, evidence of lateral tracking, and medial patellofemoral complex (MPFC) interstitial disruption (Fig. 10.2a, b).

10.5 Options for Management

1. Resume rehabilitation and non-operative care after debridement of the lesion.
2. Isolated MPFC reconstruction [MPFL (medial patellofemoral ligament. reconstruction) or MQTFL (medial quadriceps tendon femoral ligament)].
3. MPFC reconstruction with lateral release or lengthening.
4. Medial TTO and MPFC reconstruction.

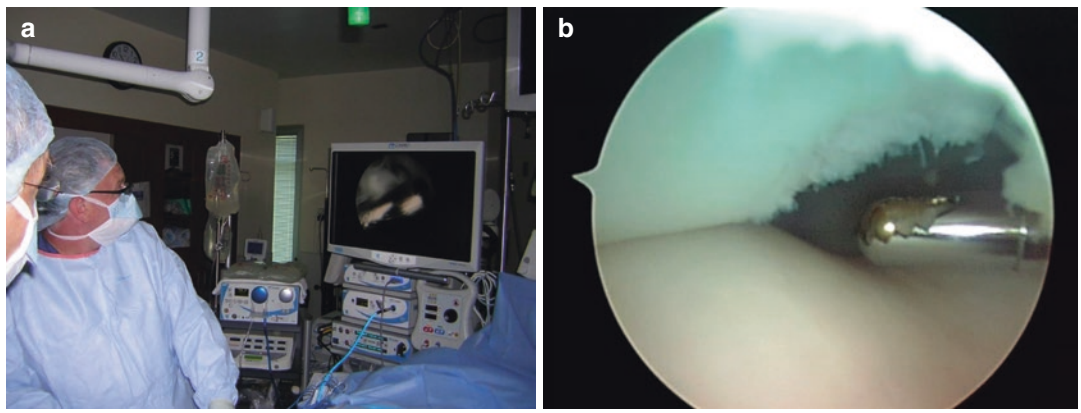

Fig. 10.2 (**a**) Shows diagnostic arthroscopy. (**b**) Distal medial patellar articular lesions

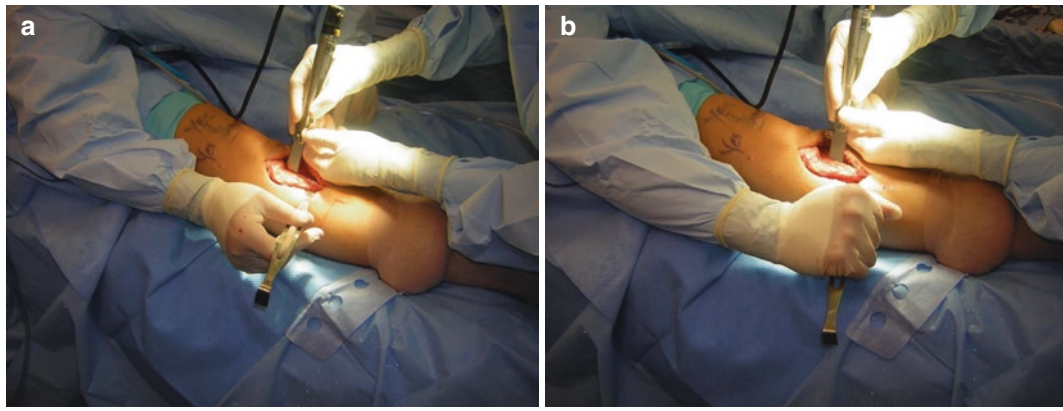

Fig. 10.3 (**a**) shows anteromedialization of the tibial tuberosity. (**b**) shows anteromedialization of the tibial tuberosity. Note the oblique orientation of the osteotome

5. OAT (osteochondral autograft transfer) or ACI (autologous chondrocyte implantation) resurfacing and MPFC reconstruction.
6. Isolated anteromedial TTO.
7. Anteromedial TTO with MPFC reconstruction.
8. Anteromedial TTO with ACI.
9. Trochleoplasty alone.
10. Trochleoplasty with MPFC reconstruction.
11. Trochleoplasty with ACI and anteromedial TTO.

10.6 Summary of Above Finding

1. *Torn MPFL.*
2. *Distal medial patellar articular lesion.*
3. *Lateral trochlear articular lesion.*
4. *Lateralization of the patella.*
5. *TT-TG 18 mm.*
6. *CD index 1.2.*
7. *Trochlear dysplasia Dejour type B.*

10.7 Definitive Management "1": Abdelkafy and Fulkerson

We choose option number 7: Anteromedial TTO with MPFC reconstruction (anteromedialization plus MPFL reconstruction) (Fig. 10.3a, b).

10.8 Definitive management "2": Kuroda

I choose option number 2: Isolated MPFC reconstruction [MPFL or MQTFL].

10.9 Discussion of definitive management "1": Abdelkafy and Fulkerson

Medialization of the tibial tuberosity moves the contact pressures of patella medially. So, in lateral patellar tracking, this improves the overall congruity and thus balances the overall contact pressures while decreasing lateral instability. However, in normal patellar tracking or in overmedialization, it will interrupt a congruous joint and thus increase the overall contact pressure focal loading and eventual iatrogenic medial overload with increase in medial forces in the medial compartment. On the other hand, anteriorization of the tibial tuberosity decreases joint reaction forces. A 10–15 mm anteriorization decreases PF stresses by 20%. While 20 mm reduces the patellofemoral compressive forces by approximately 50%. Most patients require no more than 10 mm of anteriorization, which is readily attainable with the anteromedialization (AMZ) procedure.

Combination of anteriorization & medialization (AMZ) in patients with lateral position of tibial tubercle (TT-TG > 20 mm) + PF instability + lat-

eral chondral or distal chondral lesions decreases lateral facet pressure and also decreases overall patellofemoral contact stresses by shifting contact area proximally & medially & improves PF tracking. AMZ tips-up the inferior patella, which unloads the distal patellar chondral lesion.

Once the AMZ has been completed, the surgeon should determine if restoration of MPFC [8] *is necessary by MPFL or MQTFL reconstruction. ACI is not usually necessary after unloading and rebalancing of articular tracking. Trochleoplasty is not generally necessary as the AMZ procedure gets the patella to the trochlea earlier in flexion so that the patella may engage the deeper trochlea sooner.*

Isolated MPFC reconstruction would likely prevent redislocation and might be the procedure of choice for many surgeons since it is less surgery. However, the question of whether to add AMZ is largely based on the surgeon's assessment of the articular lesions and whether unloading of these will add benefit to the outcome. It is a reasonable option given the elevated TT-TG of 18 (less than 20 mm). Examination of the other knee and establishing baseline tracking pattern would help in this decision as well, as a J-sign or defined lateral tracking of the other knee would increase the need for AMZ. In cases of this nature, it may be wise to obtain consent for MPFC reconstruction and AMZ also so that the surgeon will have the advantage of intra-operative assessment before deciding which way to go with the surgery.

10.10 Discussion of definitive management "2": Kuroda

Previous studies have shown that young patients are at high risk for having recurrent dislocation compared with adult patients [9, 10]. *Particularly, younger patients with other risk factors such as trochlear dysplasia, patellar alta, and increased TT-TG have significantly high odds ratios of having redislocation after the first-time dislocation* [11, 12] *as seen in this patient. In the preoperative assessments for the presented patient, the risk/predisposing factors need to be considered are the Dejour B proximal trochlea and the TT-TG distance of 18 mm. Other osseous abnormalities including mal-rotational and valgus limb alignment were not available.*

Considering the surgical invasiveness, MPFL reconstruction would be the most reasonable choice. Although the shape of the trochlea is flat in the proximal part, the distal part of the sulcus in flexion is maintained. Therefore, the degree of the dysplasia seems to be not severe if MPFL reconstruction is performed. In addition, we obtained favorable outcomes even in patients with increased TT-TG of >20 mm after isolated MFPL reconstruction [13]. *Therefore, TT-TG of 18 mm would not be an indication for tibial tuberosity transfer when performing MPFL reconstruction. At least for the current patient. Therefore, I recommend isolated MPFL reconstruction. During surgery, patellar tracking and patellar tightness should be checked and additional lateral release may be needed.*

Fact Box 1

Combination of anteriorization & medialization (AMZ) in patients with lateral position of tibial tubercle (TT-TG > 20 mm) + PF instability + lateral chondral or distal chondral lesions decrease lateral facet pressure and decrease overall patellofemoral contact stresses by shifting contact area proximally & medially & improve PF tracking and pain.

Fact Box 2

AMZ tips-up the inferior patella, which in turn unloads the distal patellar chondral lesion.

Fact Box 3

A 10–15 mm anteriorization decreases PF stresses by 20%. While 20 mm reduces the patellofemoral compressive forces by approximately 50%.

Fact Box 4

Isolated MPFL reconstruction is a reasonable option when the elevated TT-TG remains below 20 mm, no or mild trochlear dysplasia, normal limb alignment, normal patellar height and no lateral retinacular tightness.

Take Home Messages

1. Acute traumatic patellar dislocation has a higher recurrence rate after conservative treatment and more than half of the patients continue to have pain and fail to return to the pre-dislocation activities.
2. Radiographs, CT, and MRI are mandatory for the pre-operative assessment of every patellar instability case.
3. It is important to accurately diagnose articular cartilage injuries of the patella and trochlea as this will have a great impact on the plan of management as well as the final outcome.
4. AMZ in patients with lateral chondral or distal chondral lesions decreases lateral facet pressure and decreases overall patellofemoral contact stresses by shifting contact area proximally & medially. AMZ tips-up the inferior patella, which in turn unloads the distal patellar chondral lesion.
5. Isolated MPFL reconstruction is a reasonable option in TT-TG below 20 mm, no or mild trochlear dysplasia, normal limb alignment, normal patellar height and no lateral retinacular tightness.

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