Treatment of Acute Patellar Dislocation: Current Concepts

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André Costa, André Sarmento, Ana Leal, Nuno Sevivas, Pedro L. Ripoll, Ricardo Sampaio, Hélder Pereira, and João Espregueira-Mendes

Contents

A. Costa • A. Sarmento
Clínica do Dragão – Espregueira Mendes Sports Centre – Porto FIFA Medical Centre of Excellence, F.C. Porto Dragão Stadium, 4350-415 Porto, Portugal

Orthopedic Department, Centro Hospitalar de Vila Nova de Gaia, Vila Nova de Gaia, Portugal

A. Leal
Clínica Espregueira-Mendes F.C. Porto Stadium – FIFA Medical Centre of Excellence, F.C. Porto Dragão Stadium, 4350-415 Porto, Portugal

Mechanical Engineering Department, University of Minho, Minho, Portugal

CT2M – Centre for Mechanical and Materials Technologies, University of Minho, Campus Azurém, Azurém, Portugal

Orthopedic Department, Centro Hospitalar Póvoa de Varzim, Vila do Conde, Portugal

N. Sevivas
Clínica do Dragão – Espregueira Mendes Sports Centre – Porto FIFA Medical Centre of Excellence, F.C. Porto Dragão Stadium, 4350-415 Porto, Portugal

Orthopedic Department, Hospital de Braga, Braga, Portugal

ICVS/3B's – PT Government Associated Laboratory, Braga, Portugal

P.L. Ripoll
Orthopedic Department, Rypoll y De Prado Sports Clinic FIFA Medical Centre of Excellence, Murcia-Madrid, Spain

R. Sampaio
Imaging Department, Aveiro University, Aveiro, Portugal

H. Pereira
Clínica do Dragão – Espregueira Mendes Sports Centre – Porto FIFA Medical Centre of Excellence, F.C. Porto Dragão Stadium, 4350-415 Porto, Portugal

Orthopedic Department, Centro Hospitalar Póvoa de Varzim, Vila do Conde, Portugal

ICVS/3B's – PT Government Associated Laboratory, Braga, Portugal

3B's Research Group – Biomaterials, Biodegradables and Biomimetics, Univ. Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, Caldas das Taipas, Guimarães, Portugal

J. Espregueira-Mendes (✉)
Clínica do Dragão – Espregueira-Mendes Sports Centre – FIFA Medical Centre of Excellence, F.C. Porto Stadium, 4350-415 Porto, Portugal

ICVS/3B's Research Group – Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, Caldas das Taipas, Guimarães, Portugal

Department of Orthopaedics, Minho University, Braga, Portugal
e-mail: jem@espregueira.com

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14.1 Introduction

The incidence of primary patellar dislocation is 5.8 per 100,000 and this increases to 29.0 per 100,000 in the 10–17-year-old age group [21, 26].

The recurrence rate ranges from 15 to 44 % after nonoperative treatment of an acute injury [26]; 58 % of patients continue to experience pain and mechanical symptoms after the initial dislocation episode [2] and 55 % fail to return to full sports activity [2].

Instability of the patellofemoral joint is a multifactorial problem related with limb alignment, osseous architecture of the patella and trochlea, the integrity of the soft-tissue constraints and the interplay of the surrounding muscles [64].

Treatment of patellar instability requires an understanding of the aforementioned relationships and how to evaluate them. Conservative treatment for acute patellofemoral dislocation has been the classical approach for many years. Maenpaa and Lehto [34] presented their results with conservative treatment reporting a recurrence of 44 % of cases.

Surgical treatment was first described by Boring and O'Donoghue who repaired the medial capsule in 18 patients with no recurrences in the follow-up period [8]. Kaplan was the first to describe the medial patellofemoral ligament (MPFL) in 1957 [30]. However, it was only in 1996 that its repair was described for acute patellofemoral dislocation with no recurrent dislocation [47].

Other surgical procedures have been described to treat acute patellofemoral dislocation; however, it is still a matter of discussion whether surgical treatment is eligible and which is the adequate procedure to achieve optimal results.

The outcomes of nonoperative and operative treatment for acute patellofemoral dislocation are very variable and there are no straightforward guidelines accepted. Only nowadays, papers are being published with comparable randomized series with identical populations and similar treatment.

This review is intended to address the following questions: (1) How should a first-time acute patellar dislocation be evaluated (which are the most important factors to consider)? (2) Which is the relevance of combined osteochondral fractures? (3) When should the initial management be surgical versus nonoperative treatment?

14.2 Pathophysiology of Acute Patellar Dislocation (Major Factors to Consider)

The incidence of primary patellar dislocation is in average 5.8 per 100,000 per year in the general population [21]. The highest incidence occurs between the age of 10 and 17 (29 per 100,000) [29]. Currently, it is considered that most of these patients will not suffer subsequent instability episodes; however recurrence rates of 15–44 % after conservative treatment have been reported [29]. In a recent study focused on pediatric and adolescent populations, patients with acute patellar dislocation combining immature physes and trochlear dysplasia had a recurrence rate of 69 % [32]. Patellofemoral dislocation might occur after a traumatic event causing disruption of normal patella position in the trochlear groove. Two common activities that have frequently been associated with episodes of patellar dislocation are sports activities (61 %) and dance (9 %) [21].

The required force to dislocate the patella probably varies according to individual patellofemoral characteristics. When the femur rotates internally while the tibia suffers external rotation, with a foot fixed on the ground, the patella may dislocate without presence of preexistent pathological patellofemoral characteristics [53]. However, more frequently, patellar dislocation will occur in knees presenting risk factors for patellar instability (Fig. 14.1).

Risk factors for patellofemoral instability include patella alta, trochlear and patellar dysplasia, lateral patellar tilt, increased Q angle, *vastus medialis obliquus* (VMO) insufficiency, excessive TT-TG, patellar tendon length [38], genu valgum, medial patellofemoral ligament (MPFL) hyperlaxity, increased femoral anteversion, and increased external tibial external torsion [42] (16).

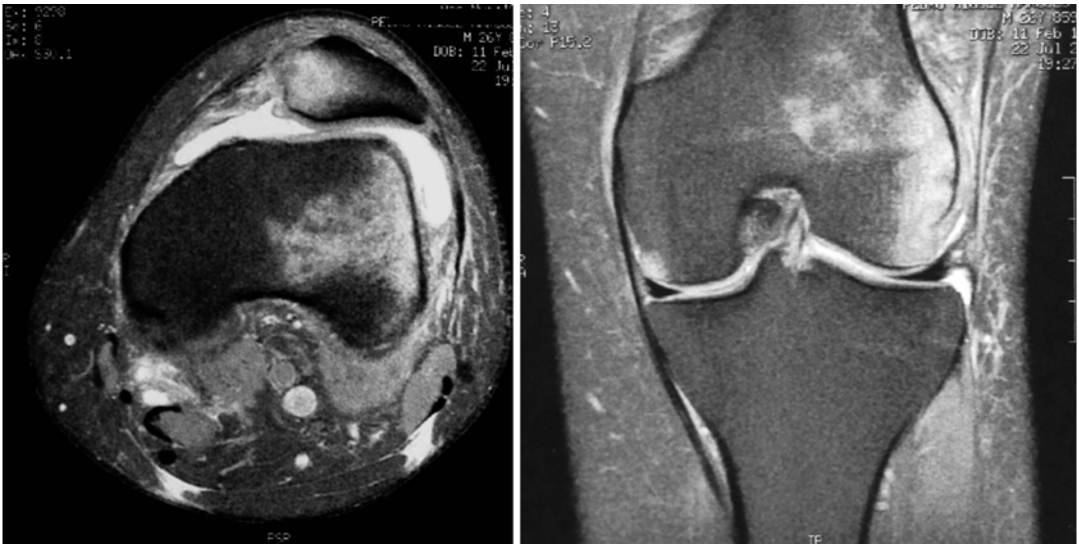


Fig. 14.1 Typical MRI aspect after acute patella dislocation, presenting effusion, MPFL injury, and bone edema in medial patella and lateral femur

These factors are described with further detail elsewhere within this publication.

In recent years, many researchers, like Kuroda [37] and Dejour, Arendt, and Zaffagnini [63], have focused on the importance of MPFL in patellar dislocation.

Anatomically, the MPFL is a thin band of retinacular tissue transversally connecting from the medial condyle to the medial aspect of patella, attaching to the undersurface of the VMO proximal to its patellar insertion. There is a region of common meshing fibers of approximately 20.3 mm between MPFL and VMO [31, 52]. The MPFL seems to be the most important dynamic stabilizer of the patella in early flexion [43]. Biomechanically, MPFL is the primary ligamentous restraint, providing about 50–60 % of the restraining force against lateral patellar displacement [6, 45]. Clinically, up to 94–100 % of patients suffer MPFL rupture after acute patellar dislocation. Some authors suggest that lateral patellar dislocation is frankly impossible without, at least a partial damage to the MPFL [18, 41].

MPFL injuries are located most frequently at the femoral attachment [41, 47] but are also located in the patellar attachment (Fig. 14.2) or in the mid-substance region [18, 54].

The origin of the medial patellofemoral ligament (MPFL) at the femur and its insertion at the patella are characterized by high individual variations. The origin on the medial femoral condyle is created by an arc of fibers originating from the anterior edge of the superficial medial collateral ligament near the medial epicondyle and fibers originating from the medial epicondyle or the adductor tubercle. This thin but wide ligament is located in layer 2 of the medial soft-tissue structures [5, 31, 42].

Senavongse et al. [51] reported that lateral patellar displacement occurred at the lowest restraining force (74 N) at 20° of knee flexion.

Currently, MPFL injury patterns have been identified and categorized into four types based on MRI findings: injuries in the patellar insertion, mid-substance, femoral origin, and combined injuries [3, 4, 61].

However, it is difficult to differentiate the mid-substance injury from patellar or femoral injury patterns when the injury is located at the mid-substance-patellar insertion or at the mid-substance-femoral insertion junction zones [64]. Additionally, the same mid-substance injury may result in different clinical outcomes, with or without the presence of VMO attachment [5].

Therefore, the VMO-based three-part classification, according to the injury location with or without VMO attachment, for acute MPFL injury was introduced: the overlap-region injury, non-overlap-region injury, and combined injures. Clinical nonsurgical outcomes for acute patellar dislocation were analyzed taking into account different injury types according to the latter classification system [5]. The hypothesis was that nonsurgical treatment would achieve better clinical results in stability and subjective patellofemoral function for the overlap-region injury than that for the non-overlap-region injury.

Nonsurgical treatment yielded satisfactory clinical outcomes when the injury was at the overlap region and therefore might be the treatment of choice for such type of injury. The optimal choice for the non-overlap-region injury still requires further researches.

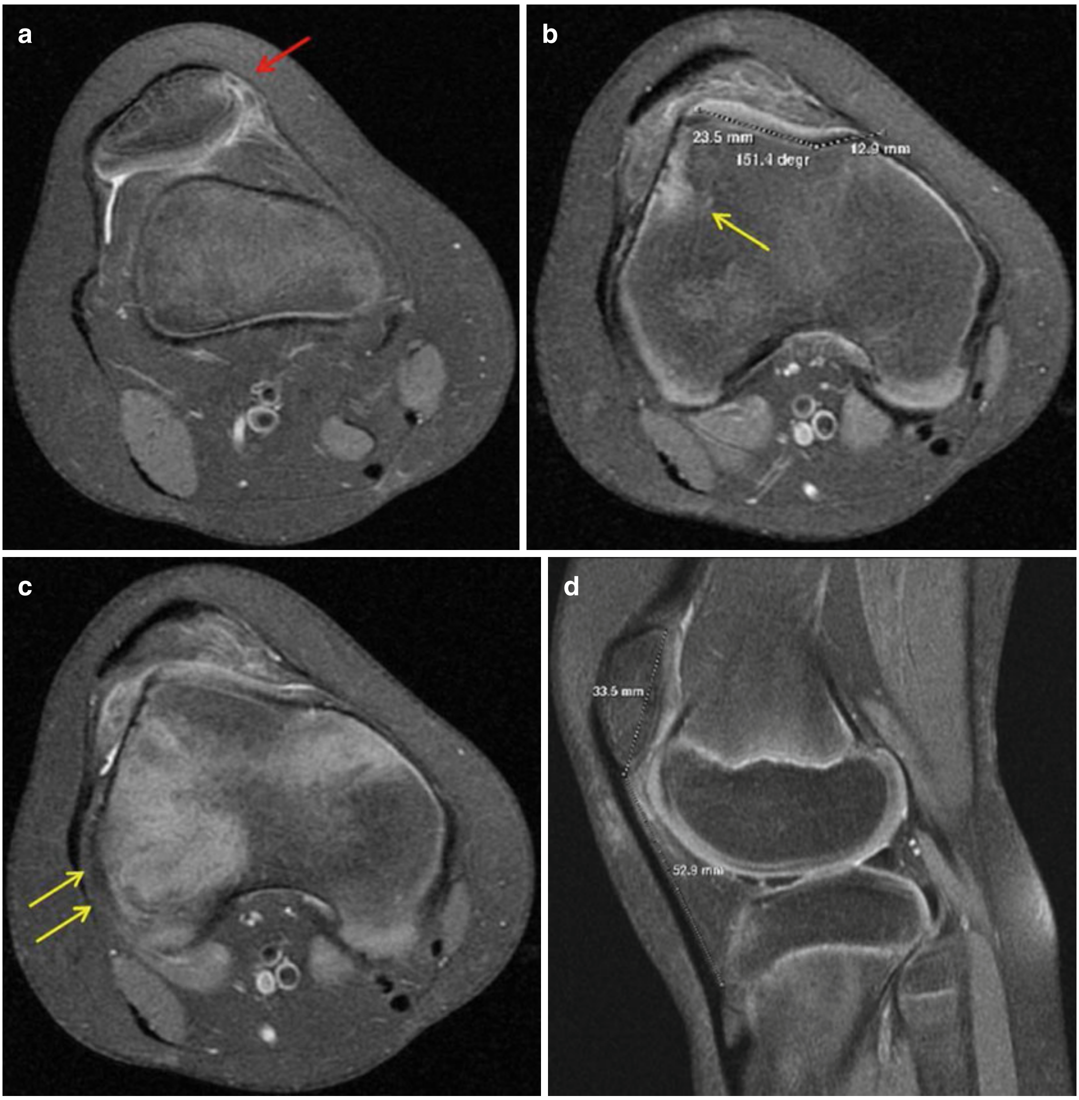
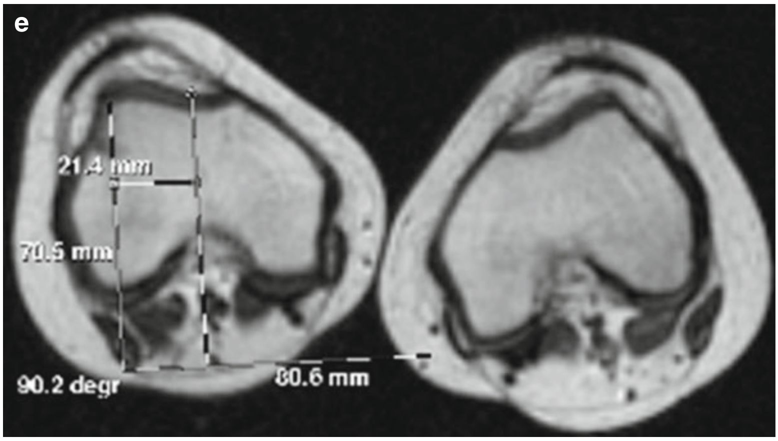


Fig. 14.2 MRI study specific for patellofemoral joint on a 10-year-old patient presenting trochlea dysplasia: rupture of MPFL with small avulsion (*red arrow* – **a**); sulcus angle 151° (**b**); bone edema (*yellow arrows* – **b** and **c**); patella *alta*, Insall-Salvati index 1.6 (**d**); TTGT = 21 (**e**)

Fig. 14.2 (continued)



14.2.1 Evaluation of First-Time Acute Patellar Dislocation

The initial evaluation of a first-time traumatic patellar dislocation should include an appropriate patient history, family history of patellar dislocation, and hyperlaxity.

Aspiration of the knee joint might be performed as a diagnostic and therapeutic gesture in patients with moderate to severe effusions [46, 58]. Fatty globules visible on aspirate are suggestive of an osteochondral fracture. It increases patient comfort and diminishes pressure within the joint. Clinical and radiographic evaluation (particularly Merchant's view at 45° flexion, schuss view, and 30° lateral view, which might be difficult with concomitant severe hemarthrosis) are important. Following ACL ruptures, acute patellar dislocations are the second most frequent etiology of acute knee hemarthrosis [24]. A hemarthrosis around 50 mL volume or higher has been associated with a lower recurrence rate [58]. The proposed *rationale* is that bigger hemarthrosis might represent a more traumatic event versus a patient with dislocation after lower-energy mechanism which might have previous risk factors, thus requiring a less amount of energy to make the patella dislocate.

Physical examination (Fig. 14.3) is mandatory to rule out other injuries, such as anterior cruciate and/or medial collateral tears that involve similar mechanisms and might also occur concomitantly [29].

Alignment of lower extremities must be checked and presence of global laxity ruled out (hypermobility of the opposite knee, elbows, thumbs; small fingers) (Fig. 14.4).

Patellar mobility and apprehension might be inspected. However it can be difficult to assess on the acute setting. Global stability of the knee joint should be tested to check other structures. Palpation is important aiming to find specific areas of tenderness. Palpable defects in the VMO, adductor mechanism, medial patellofemoral ligament (MPFL), and an easily dislocatable patella have been considered prognostic factors for poor nonoperative outcomes [28].

Radiographic assessment should include an AP extended knee weight-bearing view, a Merchant's view with comparison of the opposite knee, Schuss view, and a 30° flexion lateral view. Osteochondral fractures have been reported to be missed in 30–40 % of initial radiographs (Fig. 14.5) based on both surgical and MRI studies [57].

Intra-articular loose bodies have been reported to be a major factor for poor outcome for nonoperative or late surgical treatment [29, 58]. In such cases, arthroscopic or open surgical approach should be performed in acute setting.

CT scan has played a relevant role in evaluating patellofemoral joint in last decades [16]. It is a less expensive method (comparing to MRI) for assessment of patellofemoral alignment and risk factors for instability or to detect osteochondral fractures or loose bodies. CT scanning is useful in

Fig. 14.3 Deformity and effusion after patellar dislocation

Fig. 14.4 Thumb-forearm apposition maneuver in a patient with hyperlaxity

measuring patellar tilt, translation, tibial tuberosity trochlear groove (TTTG) distance, and trochlear dysplasia [27]. It is also useful in evaluating lower-limb alignment (torsional deformities) and determining the rotational relationship between the tibial tuberosity and femoral sulcus in different degrees of flexion. However, it has limited capacity to assess soft tissue. Furthermore, in

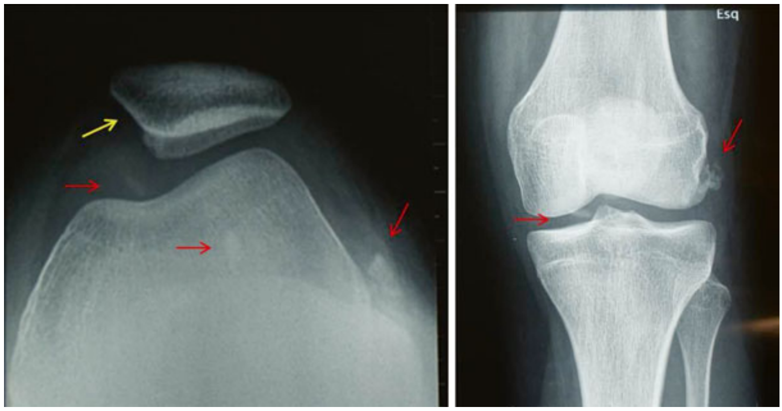


Fig. 14.5 X-ray presenting loose bodies (*red arrows*) and sit of patellar osteochondral defect (*yellow arrow*)

skeletally immature patients, the cartilaginous femoral sulcus contour is shallower than the underlying bone. For this reason, measurement of the bony femoral sulcus angle in these circumstances is less accurate than evaluating the cartilaginous femoral sulcus angle by ultrasound or MRI [39].

MRI assessment is important to assess cartilage status of patellofemoral joint and to evaluate the site and extent of soft-tissue damage to the medial patellar stabilizers (mainly MPFL). Moreover it has higher capacity to evaluate different soft tissues including meniscus and ligaments which might be concomitantly damaged or constitute differential diagnosis.

With the development of magnetic resonance sequencing, MRI is becoming more specific in assisting the surgeon in deciding on nonoperative versus operative management and also combines the possibility to measure "classical instability factors initially described on CT" [48] (Fig. 14.6).

Fithian et al. [21] described that, if evidences of acute injury in the MPFL or VMO are visible on MRI, it might represent a tendency for lower risk of subsequent patellar instability [21]. However, no statistical significance was achieved. Injury on the femoral side of MPFL might be predictive of higher-risk subsequent patellar instability [56]. Once more, it remains unclear if MPFL reconstruction in this setting leads to improved long-term clinical outcomes.

Dynamic MRI evaluation of patellofemoral joint might bring, in near future, further knowledge concerning guidelines for operative versus conservative treatment decision in acute setting (Fig. 14.7).

14.3 Current Treatment Options

The treatment of patellar dislocation involves the resolution of the acute situation (deformity, pain, functional impairment) but also aims to minimize squeals such as recurrent instability, painful subluxation, or osteoarthritis. However, controversial management of first-time patellar dislocation is the mainstay found in the literature, with little exceptions.

14.3.1 Nonoperative Treatment

Nonsurgical, "atraumatic" reduction of the patella should be performed as fast as possible. It delivers pain relief and reduces the risk of further osteochondral injury to the articular surface of either the patella or the lateral femoral trochlea. The prereduction and postreduction radiographs have to be analyzed and compared for evidence of intra-articular loose bodies.

From this step on, little evidence or consensus exists concerning conservative treatment after acute patellar dislocation [59].

Currently, treatment programs vary from immediate mobilization without orthoses or bracing to cast immobilization in extension for 6 weeks.

Fig. 14.6 MRI basic protocol for patellofemoral evaluation: Insall-Salvati Index (**a**); TT-GT (**b**); trochlear depth (**c**); lateral trochlear inclination (**d**); sulcus angle (**e**); patellar tilt (**f**)

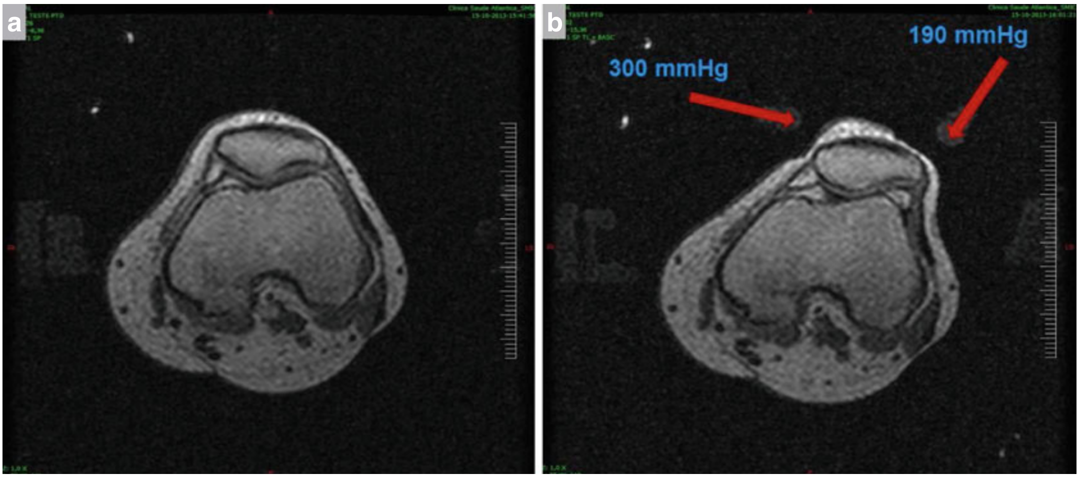


Fig. 14.7 Dynamic MRI evaluation: check patellofemoral joint at rest (**a**) opposing to dynamic evaluation (**b**) with external lateral translation and tilt forces (*arrows*)

Immobilizing the knee in extension might proportionate a better environment for healing to the medial structures. However, the risk of stiffness, muscle weakness, and loss of proprioception must be considered [29]. Patient's own will and compliance with treatment regimen might also be a factor implicated in decision for conservative treatment.

The role of patellar braces and straps on the outcome of acute primary patellar dislocation has not been determined to date.

In a controlled study enrolling 100 primary patellar dislocations [34], patellar bandage or brace, posterior splint, or plaster cast was compared. The immobilization in the splint and cast groups was performed for 6 weeks. The immediate mobilization group had a risk of redislocation three times higher. Stiffness was more frequent in the cast group.

Most clinicians propose a short period of immobilization, early weight bearing (as tolerated) with crutches, followed by rehabilitation of the knee, with or without bracing [59].

14.3.2 Surgical Treatment

The most consensual indication for operative intervention after acute first-time patellar dislocation is a large displaced osteochondral fracture with a loose body that may be possible to fix in place (Fig. 14.8).

Arthroscopic procedure can be performed for diagnostic purposes and the removal of intra-articular loose bodies such as large blood clots and osteochondral fragments (Fig. 14.9) or medial retinacular repair [50].

The recent literature does not support any use of an isolated lateral release for the treatment of patellar instability.

A number of different procedures have been advocated to reconstruct the medial structures [14] or repair the MPFL [11, 13–15, 17, 22, 23, 49].

The surgical objective is, in most cases, to stabilize the patella by an "anatomical" MPFL reconstruction at the patella and femur using a mini-open technique (Fig. 14.10).

A gracilis tendon graft is widely chosen for this purpose because the load to failure of the native MPFL is lower (208 N) and implicates lower surgical damage (leaving the stronger semitendinosus tendon available). Fixation at the patella is usually performed using resorbable anchors or bone tunnels. Care should be taken to avoid long tunnels in the frontal plane. Transversal drilling of the patella from side to side dictates significant risk of fracture [44]. Short- to long-term results showed a low redislocation rate and significant patient satisfaction. Extreme caution to avoid graft malpositioning, this may lead to a change in the patellofemoral joint forces and may lead to pain, restricted range of motion, redislocation, and articular cartilage

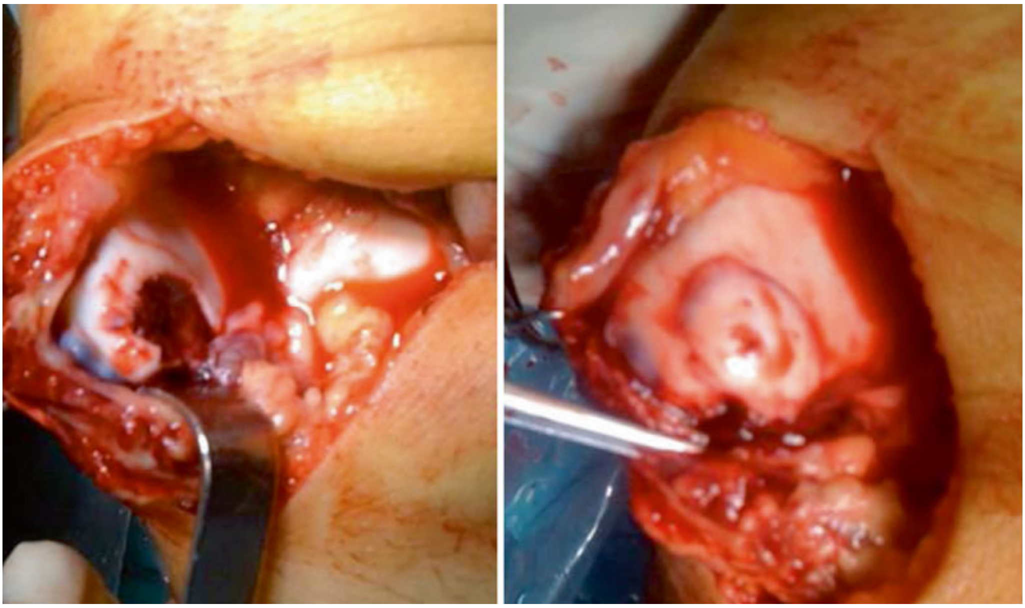


Fig. 14.8 Osteochondral defect of the patella fixed "in situ"

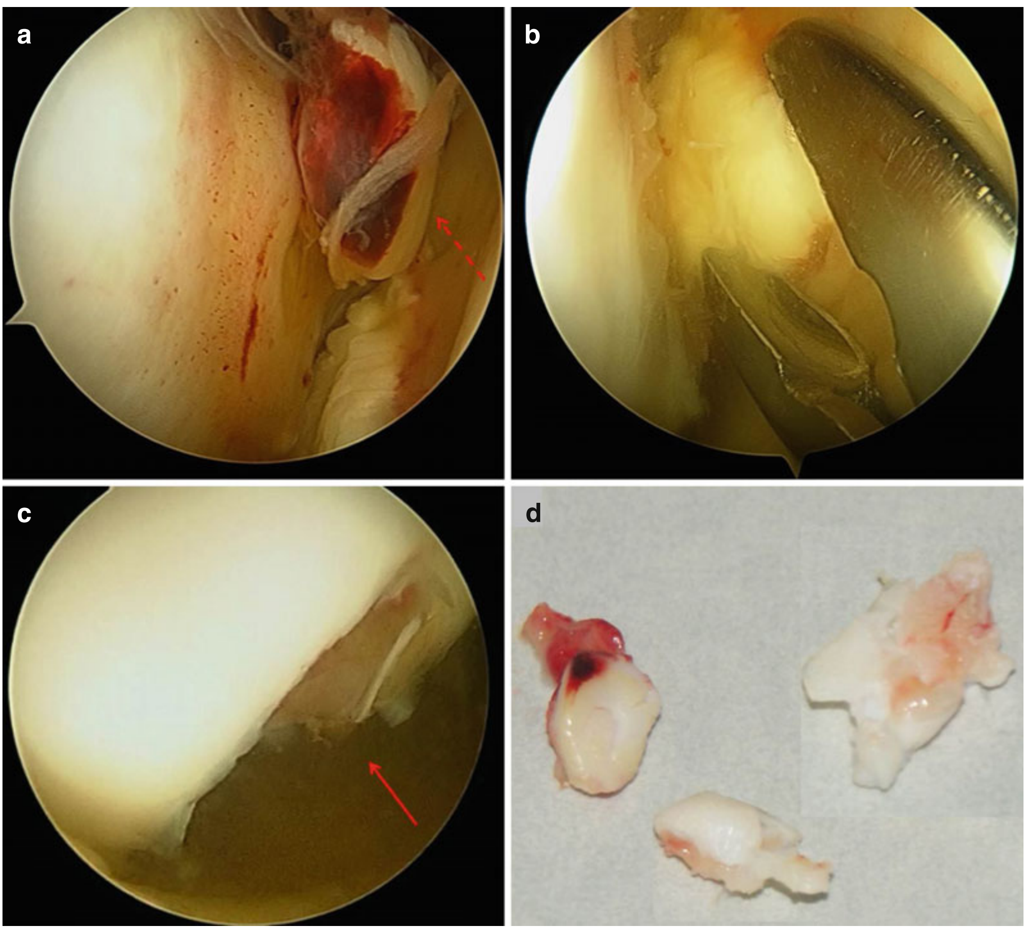


Fig. 14.9 Arthroscopic view of loose bodies after acute patellar dislocation (**a**, **b**); zone of the patellar defect (**c**); loose fragments removed (**d**)

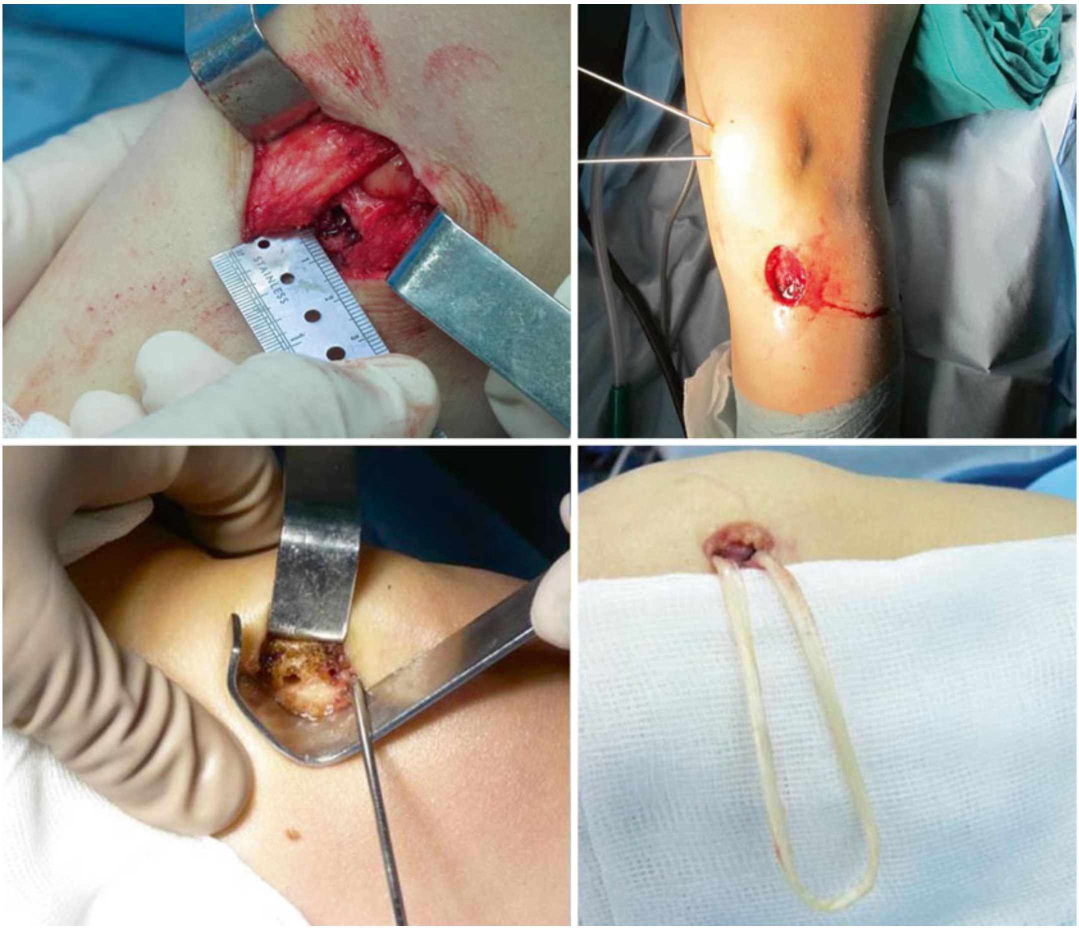


Fig. 14.10 Combined Elmslie-Trillat and MPFL repair procedures. Small anterior approach enables both harvesting of gracilis tendon and medialization of tibial tuberosity

deterioration over time. Therefore, correct tunnel placement is required [44].

Surgical approach might combine distal realignment procedures and might be considered in patients with predisposing risk factors (e.g., increased TT-TG or patella *alta*; Figs. 14.2 and 14.6). These approaches are described elsewhere within this publication.

14.4 Systematic Literature Review

Most studies in the literature are retrospective and nonrandomized level IV studies. We selected our review based on the following criteria: (1) English language, (2) level I–IV studies, (3) a minimum of ten patients in the series at baseline who underwent surgical or conservative treatment for acute patellofemoral dislocation, and (4) a minimum of 6 months of follow-up. Review articles, case reports, and technique articles without reported patient data, and studies which did not state inclusion criteria were excluded. Tables 14.1 and 14.2 summarize the results of papers matching inclusion criteria.

14.5 Discussion

Most of the studies published are not prospective and/or blinded randomized studies. Nonetheless, several conclusions can be depicted.

First, understanding the biomechanics of the patellofemoral joint is necessary to understand

Table 14.1 Demographics of studies

Study	Study type	Patients number	Age (years) (st/ct)	Treatment N=st/N=ct	Follow-up (years)
Bitar et al. [7]	RC	41	12-/38	21st/20ct	Minimum 2
Apostolovic et al. [1]	RNC	37	12–16	14 st/23 ct	6.1
Mariani et al. . [36]	CS	17	NR	All st	2.2
Camanho et al. [10]	RNC	33	24.6/26.8	17st/16 ct	3.4
Nietosvaara et al. [40]	RNC	71 (74knees)	<16	36st/28 ct	2
Sillanpaa et al. [56]	RC	40	20	18st/22 ct	7
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Silanpaa et al. [52]	RNC	76	19–22	30st/46 ct	7
Christiansen et al. [13]	RCT	80 (3 lost to f-up; final n=77)	20.0/19.9 (13–39)	42 st/35ct	2
Buchner et al. [9]	CC	126	NR	63st/63 ct	8.1
Atkin et al. [2]	CS	74	19.9	All ct	19.9
Maenpaa et al. [33]	CS	100	NR	All ct	13
Maenpaa et al. [33]	CS	270	Women: 23.5 (range 9–56) Men: 22.6 (range 12–42)	All st	4.1
Harilainen et al. [25]	CS	53	29.1 (range 17–57)	All st	6.5
Vainiopaa et al. [60]	CS	55	21 .5 years (range 14–54)	All st	2
Cash and Hughston [12]	CC	399	9–72	All ct	8
Yamamoto et al. [62]	CS	30	NR	All st	1–7
	CS	75	37 (median age 19) had a recurrence; 38 (median age 28) no recurrence	All ct	6–24
Lewallen et al. [32]	CC	222	14.9	All ct	12
Bitar et al. [7]	RC	41	12–38	21st/20ct	Minimum 2
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Lewallen et al. [32]	CC	222	14.9	All ct	12

RC randomized controlled, *RNC* randomized noncontrolled, *CC* case control, *CS* case series, *NR* not referred, *st* surgical treatment, *ct* conservative treatment

Table 14.2 Summary of outcomes according to treatment

Treatment	Study	Type of surgical procedure	Results
Conservative	Lewallen et al. [32]		62 % success rate for conservative treatment after first-time patellar dislocation 10.8 % required operation
	Atkin et al. [2]		58 % presented limitation in strenuous activities after 6 months
	Maenpaa and Lehto [34]		0.17 dislocations per year of follow-up
	Cash and Hughston [12]		75 % good/excellent results if no risk factors were found
Surgical	Mariani et al. [36]	Arthroscopic repair of MPFL	No redislocations; Lysholm 90 (72–100) 14/17 returned to sports at the same level
	Maenpaa and Lehto [35]	Medial capsular reefing (all) + lateral retinacular release ($n=243$) + Elmslie-Roux-Trillat procedure ($n=2$)	Excellent/good subjective results: Traumatic group: 76.8 % Non-traumatic group: 60.4 % Redislocation rate: Traumatic group: 2.4 % Non-traumatic group: 38.6 % No significant difference was found between methods of postoperative treatment: immobilization or mobilization. "The subjective result of operative treatment was better and the re-dislocation rate was lower if the injury mechanism was traumatic rather than non-traumatic and if there was no history for family occurrence of patellar dislocation"
	Harilainen and Sandelin [25]	Medial retinacular suturing ($n=7$) or reefing ($n=46$) and lateral capsular discission (within 1 week of injury)	17 % recurrence More recurrence with greater patellofemoral incongruence
	Vainiopaa et al. [60]	Medial capsular suture and lateral release when lateral retinaculum was tight Removed/refixed displaced osteochondral fragments	9 % recurrence; Most returned to previous sports activities
	Yamamoto et al. [62]	Arthroscopic medial capsular repair/ lateral release	Successful stabilization of the acute dislocation Early accurate diagnosis Accurate restoration of normal anatomy
Conservative *vs* surgical	Bitar et al. [7]	MPFL reconstruction	Mean Kujala operated 88.9/nonoperated 70.8 0 recurrence operated group; 35 % recurrences nonoperated group
	Apostolovic et al. [1]	Arthroscopic surgery: Medial retinacular and capsular repair and lateral retinacular release	No statistical difference between groups
	Camanho et al. [10]	MPFL repair vs conservative group	0 relapse operated; 50 % relapses nonoperated
	Nietosvaara et al. [40]	Medial repair/lateral release alone	66 % good/excellent operated; 75 % good/ excellent nonoperated No difference in redislocation between treatment groups; Predisposing factor – family history
	Silanpaa et al. [56]	MPFL repair vs conservative group	0 redislocation operated 6/21 redislocation nonoperated
	Silanpaa et al. [55]	Arthroscopic medial capsular repair	19 %redislocation operated; 81 % pre-injury level 23 % redislocation nonoperated 56 % pre-injury level
	Christiansen et al. [13]	Reinsertion MPFL to the adductor tubercle vs conservative treatment	Redislocation rates were 17 and 20 % in the operative and conservative treatment groups, respectively (not significant)
	Buchner et al. [9]	MFPL reconstruction	No difference in redislocation between the two groups

the pathology of patellar dislocation. Recent studies have focused on the medial patellofemoral ligament (MPFL) and have shown that the MPFL is the most significant passive stabilizer of the patella. It is accepted that primary patellar dislocation leads to MPFL injury [18].

Because of the insufficient evidence in literature, there is currently no universally accepted, optimal strategy approach for acute primary patellar dislocation.

The complexity of patellar instability leads to challenges in decision making between different treatment modalities.

Most cases seem to be suitable for initial nonsurgical management in the first episode, although recurrent instability might occur [29].

Osteochondral fragments amenable for surgical fixation are an indication for surgery [58].

In the setting of surgical treatment, MPFL reconstruction might be a more reliable method of stabilizing the patella than repair, which has inherent limitations related to the MPFL injury location [53].

The MPFL injury location can be assessed by MRI with increasing feasibility. Despite the current thought that considers the femoral attachment as the most frequent site of lesion after acute dislocation, this still remains debatable and further prospective studies will be needed.

Several recent studies advocate MRI after acute patellar dislocation, as the acutely injured knee usually shows hemarthrosis as a sign of tissue damage and clinical diagnosis can sometimes be difficult [21, 54]. MRI can be used to diagnose the signs of acute patellar dislocation and associated injuries, such as osteochondral fractures and meniscal or ligament injuries [19].

Yamamoto [62] studied arthroscopic repair of the MPFL, showing overall good or excellent results, only 1 redislocation of 30 operated knees. Sillanpaa et al. [55, 56] reported limited efficacy of an arthroscopic MPFL repair compared with conservative treatment. The redislocation rate was similar in both treatments, and the authors stated that the explanation for these unsatisfying results was that the MPFL injury has different patterns and locations. Sillampaa [56] followed 44 patients after first-time patellar dislocation and subjected to conservative treatment for 7 years. They found femoral avulsions of the MPFL to be a significant predictor for subsequent patellar instability, and these were less likely to return to prior activity level, but without significant differences in the Kujala score.

A prospective trial from Camanho et al. [10] comparing conservative and operative treatment in 33 patients with acute patellar dislocations revealed a significantly better Kujala score (92/100) and no recurrence in the operative group compared to a Kujala score of 69/100 and 8 relapses in the conservative group.

On another study, no redislocation was observed in the operated group comparing to six cases (over 21) among those treated conservatively [56].

The median Kujala scores were 91 points for the surgically treated patients and 90 points for the nonoperatively treated patients. Thirteen (over 17) patients in the operated group and 15 (over 21) in the nonoperatively treated group returned to their pre-injury physical activity level. The authors concluded that the rate of redislocation for those treated with surgical stabilization was significantly lower than the rate for those treated without surgical stabilization. However, no clear patient-referred clinical benefits were seen at long-term follow-up from initial surgery [56].

It seems useful to define the exact location of the MPFL tear after a primary episode of dislocation; however there is no agreement on this issue. Considering this fact, dynamic MRI might be a significant step to diagnose, classify the grade of severity, and permit more effective guidelines for treatment. The Porto-knee testing device (PKTD) [20] is under development for patellofemoral application to assist on more accurate diagnosis capacity and understanding of patellofemoral anatomy and kinematics (Fig. 14.7).

It is common experience that there are different types of dislocations with different tear patterns. From a clinical point of view, this issue has clear surgical implications since the surgeon must be ready to change the treatment on the basis of pathoanatomical findings. In fact, the femoral attachment of MPFL is located in the second tissue layer, below the superficial fascia and above the capsule, and if torn the hemorrhage is extraarticular. When a patellar avulsion is suspected, then an arthroscopic examination can be carried out in order to define the exact location of tear and to plan the surgical repair. In cases of ligament avulsion from its patellar insertion, a direct repair could be applied [53]. However, there is no consensus on the matter and currently systematic arthroscopy is not a rule for first-time dislocation.

It seems that younger patients more often sustain patellar-based ruptures, while older patients more often sustain femoral-based ruptures of the MPFL. Incomplete MPFL ruptures are correlated with lower Insall-Salvati indices than complete ruptures, and trochlear dysplasia is correlated with higher rates of redislocation [53].

Osseous surgery is usually not needed if surgery is planned after primary dislocation, but corrections are needed in cases with severe bony abnormalities [21].

Previous randomized studies of primary patellar dislocations concluded that surgery is not superior to nonsurgical treatment if all the patients with different types of MPFL injuries are treated similarly [59].

In contrast, a recent prospective randomized study in comparing nonsurgical treatment with surgical reinsertion, surgery resulted in better stability than nonoperative treatment. This was true for either femoral or patellar surgical attachment [7].

Because of the high (44–70 %) redislocation rate after primary dislocation, some cases might benefit from initial surgery, and surgery should definitely be considered for cases with a high risk of failure after nonsurgical treatment [7].

Patients with patellar MPFL avulsion fracture and MPFL disruption at the femoral attachment seem to be at greater risk of subsequent dislocation. In these patients, restoring the integrity of the MPFL might be necessary to ensure better stability [53].

Ruptures at the MPFL mid-substance or patellar insertion regions are generally not related to significant subsequent patellar instability.

The clinical outcomes of various MPFL injuries, however, remain highly uncertain with regard to the well-known factors that predispose a patient to patellar instability, such as trochlear dysplasia, axial and torsional lower-limb alignment abnormalities, and MPFL injuries. Most likely, the more dysplastic the trochlear shape, the more devastating the injury to the MPFL is to patellar stability. Whenever required, surgical treatment needs to be tailored individually, based on the diagnosis (MRI findings of the MPFL injury and osseous anatomy).

The precise risk factors for redislocation could not be adequately calculated in this review due to lack of consistent and quality reporting in several articles. To date, there is no evidence that the natural history of a person suffering primary patellar dislocation is improved by surgical intervention in the acute setting. Considering the previous, surgical stabilization of the patella cannot be firmly recommended after the first event of patella dislocation. However, after the second episode, the risk of redislocation is known to be much higher (49 %), and surgical intervention should be considered [29].

Conclusion

It seems that the predominating factors for patellar dislocation are heterogenetic morphology in combination with individual predisposition. The only consensual indication for surgical treatment after acute primary patellar dislocation is the presence of a concomitant osteochondral fracture still suitable for "in situ" fixation or the presence of loose bodies inside the joint. When surgical treatment is required, it should specifically address the correction of the implicated pathomorphology in each case. The type and site of MPFL injury seem to be a relevant factor to be considered as prognostic for redislocation. Low-energy events causing dislocation usually occur in persons with risk factors of patellofemoral instability, thus having higher risk for recurrence.

Conservative treatment is currently performed in most cases of a first-episode patella dislocation.

The optimal treatment has not yet been established and further prospective randomized studies are required.

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