First-time Traumatic Patellar Dislocation

A Systematic Review

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Acute patellar dislocations can result in patellar instability, pain, recurrent dislocations, decreased level of sporting activity, and patellofemoral arthritis. The initial management of a first-time traumatic patellar dislocation is controversial with no evidence-based consensus to guide decision making. Most first-time traumatic patellar dislocations have been traditionally treated nonoperatively; however, there has been a recent trend in initial surgical management. We performed a systematic review of Level I–IV studies to make evidence-based medicine recommendations on how a clinician should approach the diagnosis and treatment of a first-time traumatic dislocation. More specifically we answer the primary question of when initial treatment should consist of operative versus closed management. Based on the review of 70 articles looking at study design, mean followup, subjective and validated outcome measures, redislocation rates, and long-term symptoms, we recommend initial nonoperative management of a first-time traumatic dislocation except in several specific circumstances. These include the presence of an osteochondral fracture, substantial disruption of the medial patellar stabilizers, a laterally subluxated patella with normal alignment of the contralateral knee, or a second dislocation, or in patients not improving with appropriate rehabilitation.

Level of Evidence: Level II, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Acute patellar dislocation accounts for 2% to 3% of all knee injuries[1] and is the second most common cause of traumatic knee hemarthrosis.[20] Acutely, osteochondral and chondral fractures of the medial facet of the patella and/or the lateral femoral condyle can be a common finding on radiographs, MRI, ultrasound, arthroscopy, and open procedures (Figs 1–4).[5,12,16,18,23,38,46,49,52,55,56,64,65,67,68] The incidence of articular cartilage injuries and osteochondral fractures based on arthroscopy and open procedures is much more prevalent than found on initial radiographs.[42,49,64] Over the long term, acute patellar dislocations can result in patellar instability, pain, recurrent dislocations, decreased level of sporting activity, and patellofemoral arthritis.[1,3–5,7,17,21,23,26,28,30,34,36,37,43,44,53,58,60,69]

Primary and recurrent dislocations can be attributed to several predisposing factors including: patella alta, abnormal patella morphology, lateral patellar displacement, trochlear dysplasia, increased Q angle with lateralized tibial tuberosity, genu valgum, vastus medialis muscle hypoplasia, ligament hyperlaxity, external tibial torsion, subtalar joint pronation, and increased femoral anteversion.[4,5,7,10,30,35,41,43,44,56] A patient who has patellar malalignment with trochlear hypoplasia and bilateral patellar subluxation worse on the right is shown (Fig 4).

Most first-time traumatic patellar dislocations have been traditionally treated nonoperatively except for those with displaced associated patellar or lateral femoral condylar osteochondral fractures (Fig 1).[11,12,21,24,28,36] However, reports noting a redislocation rate of up to 44% and a recurrent

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Fig 1. This plain radiograph reveals an osteochondral defect of the medial facet of the patella in a first-time traumatic patellar dislocation. (Note: There is a well-aligned patellofemoral joint.)

Fig 2. This intraoperative photograph shows an osteochondral defect of the medial facet of the patella in an individual with a first-time patellar dislocation.
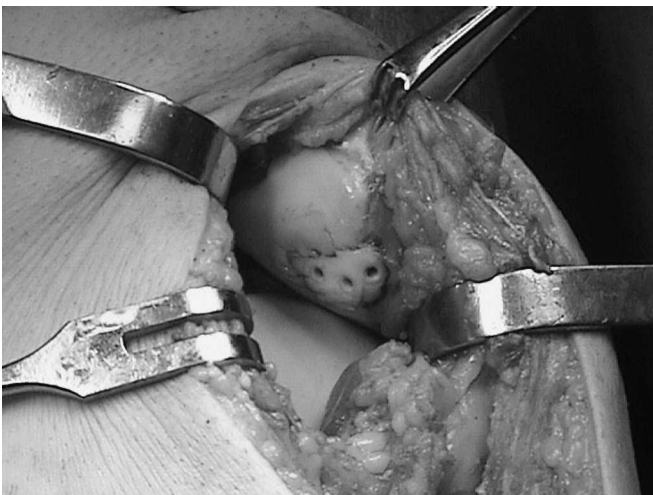

Fig 3. This photograph illustrates the intraoperative repair of the osteochondral defect from Figure 2.

instability symptom rate greater than 50% with nonoperative treatment[12] have led to an increase in initial management by operative repair and reconstruction of the medial patellar stabilizers (medial patellofemoral ligament,[2,5,10,17–22,26] vastus medialis obliquus [VMO],[11] and medial retinaculum[19,22,67,70]).[2,10,13,14,19,22,34,39,43,47,50,51,56,59,67,70,71]

This systematic evidence-based review is intended to address the following questions: (1) What should be included in the evaluation of a first-time traumatic patellar dislocation; that is, what is the role of arthrocentesis, radiographs, CT scan, and MRI; what is the relative incidence of osteochondral fractures? (2) When should the initial management of a first-time traumatic patellar dislocation be operative versus nonoperative? (3) What are the reported major risk factors associated with redislocation of first-time traumatic dislocations?

MATERIALS AND METHODS

For this systematic review, Level I–IV studies were included due to the lack of prospective randomized controlled trials or prospective controlled comparative studies on this subject. A Medline literature search was performed to identify all English language studies from January 1, 1966 to May 31, 2006 on first-time patellar dislocations. A PubMed Medline search using the terms "patella or patellar AND dislocation AND acute AND treatment" yielded 99 citations. An OVID Medline EMBASE search of the Cochrane Central Register of Controlled Trials using the search terms "patella or patellar AND dislocation AND acute or first time" yielded 131 citations. A hand review of over 20 orthopaedic and radiographic journals was performed to identify references that may not have been cited on Medline or EMBASE databases within the most recent 6 months. Lastly, multiple references cited in the bibliographies of the above articles were reviewed. Selection criteria included any title that made reference to anatomy, epidemiology, or treatment of patellar dislocations, acute or recurrent. These abstracts were then analyzed and full articles pulled if potentially helpful in answering the questions of this study or providing background information.
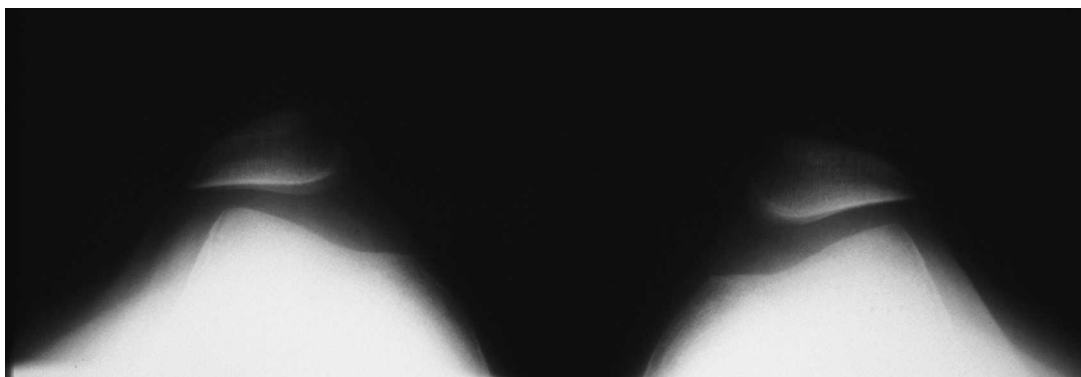

Fig 4. This is a patient with patellar malalignment, trochlear hypoplasia, and patellar subluxation that is worse on the right patella.

Using the above search method, 70 articles had some relevance to acute patellar dislocations. Of these 70, 22 more specifically contributed in answering the primary question of this paper. All articles were reviewed and assigned a level of evidence independently by the two authors. Breakdown of these revealed two Level I, zero Level II, three Level III, and sixteen Level IV studies. Level of evidence was assigned based on the article by Spindler et al[61] or by the assignment already given in the article. Through this search, it was apparent strong controversy exists on the best treatment for first-time traumatic patellar dislocations. There are many descriptions of different surgical techniques for patellar instability, but few studies on closed treatment. We identified only two well-designed (prospective, controlled) Level I or II studies.[43,44] Most were retrospective Level III and IV studies with short-term followup. Clinical studies were critiqued for quality by both authors through assessment of study design (randomized control trial, nonrandomized control trial, cohort study, case control study, or a case series), study methods (prospective versus retrospective), presence of selection bias, use of a validated questionnaire, and the length of followup.

We determined a relative incidence of osteochondral fractures in acute patellar dislocation (Tables 1–4). Data were not used from the Ahstrom et al[6] or Rorabeck[55] et al series because their articles selected only patients with osteochondral fractures. With this in mind, the incidence of osteochondral fractures in this review was 24.3%. The total number of first-time traumatic dislocations was 1765. The male-to-female ratio was about equal with a distribution of 46% males versus 54% females. The average age was 21.5 years old. Many studies did not supply data about the age, gender, or well-defined genesis of their patients who had redislocations following their first traumatic dislocation. Therefore, an overall demographic picture of the patients that redislocated is not presented. However, multiple studies reported young female patients were much more at risk for subsequent redislocation.[10,11,43,44] Nikku et al[43] showed in their risk analysis that females with an open tibial tuberosity apophysis and patients with initial contralateral instability had the worst prognosis for future instability and redislocation. Larsen and Lauridsen[30] found the probability of redislocation in patients less than 20 years old was 0.52 per annum versus those older than 20 to be 0.034 per annum. Buchner et al[10] reported a higher redislocation rate of 52% in their patients younger than 15 years old compared with the total redislocation rate of 26% (p = 0.03). Cash and Hughston[11] similarly showed individuals 11 to 14 years old had a 60% incidence of redislocation compared to only 33% in patients 15 to 18 years of age (p = 0.0009).

The average length of followup of closed treatment of patients with only acute patellar dislocations was 8.4 years (Table 1). There was no uniform outcome measure between the five studies, but the two studies reporting subjective results[12,30] had an average of 76% excellent to good results and the two studies reporting Kujala scores[32,36] had an average score of 80 (of 100). Atkin et al[7] reported 58% of patients had limitations in strenuous activities and had substantially reduced sports participation at 6 months followup. The mean redislocation rate was 48% (range, 38–57%) when not including Atkin et al[7] (followup 6 months). In the articles reporting outcomes on the initial management of

TABLE 1. Articles Reporting Closed Treatment Outcomes Only

Reference	Level of Evidence	Knees (n)	Mean Age (years)	Mean Followup (years)	Sex M	Sex F	Mean Immobilization (weeks)	Subjective Score (%) Excel. Good	Fair Poor	OCFx	Kujala Score (max. 100 points)	Redislocation Rate (%)
Atkin et al[7]	IV	74	20	0.5	37	37	—	—	—	14 (19%)	—	0
Cofield and Bryan[12]	IV	48	18	11.8	19	26	3.5	58	42	7 (15%)	—	44
Larsen and Lauridsen[30]	IV	T 41 N 38	T 22 N 15	5.9	27	44	—	85	15	—	—	53@
Mäenpää, and Lehto[35]	IV	100	23	13	37	63	Cast 4 ± 1 Splint 3 ± 2 Brace 2 ± 1	—		—	Cast 80 ± 15 Splint 82 ± 11 Brace 74 ± 18	Cast 38 Splint 47 Brace 57
Mäenpää, Huhtala, and Lehto[32]	IV	75	NR 28 RD 19	11	13	25 15	3.6 22 2.9	—		—	83 80	49
Totals and averages		376	21	8.4	148	217	3.2	76	24	21 (17%)	80	48

N = nontraumatic genesis; NR = no redislocation group; OCFx = osteochondral fractures; RD = redislocation group; T = traumatic genesis; (—) = not given in article; @ = includes both redislocation and instability episodes of traumatic and nontraumatic groups

TABLE 2. Articles Reporting Open Surgical Treatment Outcomes Only

Reference	Level of Evidence	Knees (n)	Mean Age (years)	Mean Followup (years)	Sex M	Sex F	Subjective Score (%) Excel. Good	Subjective Score (%) Fair Poor	OCFx	Redislocation Rate (%)
Ahmad et al[2]	IV	8	32	3.0	4	4	96	4	0	0
Boring and O'Donoghue[9]	IV	15	16	8.2	7	8	93	7	0	0
Harilainen and Sandelin[21]	III	53	29	6.5	15	38	80	20	23 (43%)	17
Jensen and Roosen[28]	IV	23	—	3.3	—	—	—	—	5 (22%)	9
Mäenpää and Lehto[34]	IV	T 177	24	4.1	75	102	77	33	34 (12%)	2
		NT 107	23		38	69	60	40		32
McManus, Rang, Heslin[38]	IV	28	—	2.6	—	—	—	—	3 (11%)	17
Nomura, Inoue, Osada[50]	IV	5	20	5.9	2	3	80	20	3 (60%)	0
Sallay et al[56]	IV	23	25	2.8	20	3	58	42	16 (68%)	0
Vainionpää et al[66]	IV	64	16	—	25	39	—	—	9 (14%)	—
Vainionpää et al[67]	IV	55	22	2.0	21	34	80	20	6 (11%)	9
Visuri and Mäenpää[69]	IV	68	20	6.0	68	0	41	59	11 (16%)	18
Totals and averages		626	23	4.4	275	300	69	31	110 (18%)	12

NT = nontraumatic group; OCFx = osteochondral fractures; T = traumatic group; (—) = not given in article

acute patellar dislocations by various operative techniques (Table 2) the mean followup was 4.4 years. The mean excellent to good subjective outcome was 69%. The average redislocation rate was 12% (range, 0–32%). However, the overall redislocation rate drops to 7.3% if the nontraumatic group of Mäenpää and Lehto[34] are excluded. In comparison, the operative group (Table 3) had an overall redislocation rate of 17% at an average 5.6-year followup (or a 6.5-year average followup when Nikku et al[44] 1997 is excluded because longer followup of the same patient population is given in Nikku et al[43] in 2005). The average followup for the five studies with both surgical and closed treatment outcomes was 5.6 years (Table 3). The subjective outcome measure showed the nonoperative group averaged 68% excellent to good results and the operative group averaged 72% excellent to good results. However, looking at the well-designed prospective randomized study of Nikku et al,[43] which had a 7-year followup, the excellent to good subjective outcome was 81% for the nonoperative group and 67% for the operative group despite having a higher recurrence rate in both groups. The redislocation rate for all five studies averaged 29% (range, 14–39%) for the nonoperative group and 17% (range 0–31%) for the operative group. In summary, the overall subjective outcome scores were similar between the operative and nonoperative groups, approximately 71% and 72% excellent to good results, respectively (Tables 1, 3). The redislocation rates were higher in the nonoperative treatment groups compared with the operative group; however, the mean followup comparing the closed treatment group (Table 1) with the surgical treatment group (Table 3) was almost double, 8.4 years versus 4.4 years, respectively.

RESULTS

The initial evaluation of a first-time traumatic patellar dislocation should include an appropriate patient history, family history of patellar dislocation and hyperlaxity, physical examination, and diagnostic studies. Aspiration of the knee joint is both diagnostic and therapeutic, and should be performed for several reasons in patients with moderate to severe effusions. First, it increases patient comfort and helps achieve joint depression. A local anesthetic can be injected to improve clinical examination and radiographic assessment (namely the 45° flexion Merchant view, 45° flexion weight-bearing view, and 30° lateral view, which are difficult to obtain in patients with an acute hemarthrosis). Second, acute patellar dislocations are the second most common injury noted with acute knee hemarthrosis next to ACL rupture.[20] Third, a larger hemarthrosis volume (approximately 50 mL) represents a more major injury to the medial patellar stabilizers and/or osteochondral injury and is associated with a lower recurrence rate.[31,32,67] It is suggested a larger volume represents a more traumatic dislocation versus a patient with a lower energy mechanism who may have one or more predisposing risk factors and a less traumatic injury. Lastly, the presence of fatty globules is indicative of an osteochondral fracture. In the acute setting, physical examination is important in making the diagnosis of acute lateral patellar dislocation and for noting any concurrent knee or lower extremity injury.[4,26] Physical examination should include assessment for malalignment of lower extremities[4] and hypermobility of the contralateral knee.[6,63] Patellar apprehension and mobility is assessed by medial and lateral patellar translation. Knee joint stability should be tested to rule out concomitant injury to other structures. Palpation is important in detecting areas of retinacular tenderness and soft tissue injury. Palpable defects in the VMO, adductor mechanism, medial patellofemoral ligament (MPFL), and

TABLE 3. Articles Reporting Both Open and Closed Treatment Outcomes

Reference	Level of Evidence	Knees (n) N	Knees (n) O	Mean Age (years) N	Mean Age (years) O	Mean Followup (years)	Sex M	Sex F	Subjective Score Good/Excel N	Subjective Score Good/Excel O	Lysholm II Score N	Lysholm II Score O	Hughston VAS N	Hughston VAS O	OCFx	Redislocation (%) N	Redislocation (%) O
Buchner et al[10]	III	63 (126)	63	21	20	8.1	71	55	42 (67%)	48 (76%)	85	85	—	—	6 (5%) / 6 Fixed	27	25
Cash and Hughston[11]	III	74# (103)	29#	22	22	8.0	70	30	43# (58%)	24# (82%)	—	—	—	—	29 (28%) / 20 Fixed	36#	10#
Hawkins, Bell, Anisette[23]	IV	20 (27)	7	19	19	2.8	14	13	—	—	—	—	—	—	14 (52%) / 0 Fixed	14	0
Nikku et al[44]	I	55 (125)	70	19	20	2.1	43	82	39 (71%)	49 (70%)	89	88	90	87	27 (22%)* / 0 Fixed	27	17
Nikku et al[43]	I	57 (127)	70	20	20	7.0	45	82	46 (81%)	47 (67%)	—	—	94	89	27 (21%)* / 0 Fixed	39	31
Totals and averages		508	239	20	20	5.6	243	262	68%	72%	87	87	92	88	103 (20%) / 25% Fixed	29	17

N = nonoperative group; O = operative group; OCFx = osteochondral fractures; (#) = includes patients with predisposing factors to dislocation; (—) = not given in article; (*) = all fixable OCFx excluded from study.

a grossly dislocatable patella are prognostic factors for poor nonoperative outcomes.[26] Also, hypermobility of articular joints (small finger metacarpophalangeal hyperextension, passive thumb-forearm apposition, and elbow and knee hyperextension greater than 10°)[63] is a helpful diagnostic indicator. Stanitski[63] noted the frequency of articular lesions increased by 2.5 times in patients without articular hypermobility. If nonoperative management is chosen, followup examinations are critical. Intraarticular loose bodies have been reported to be a substantial factor in decreased subjective and functional outcomes of closed treatment in studies of late operative intervention in patients not progressing well with functional rehabilitation.[23,43] In this case, arthroscopy should be considered to diagnose and address possible intraarticular pathology.[23] Clinical subluxation is substantially more common in the nontraumatic group (p = 0.016)[30] and may suggest underlying predisposing factors that need to be recognized and potentially addressed, especially if redislocation occurs.

Radiographic assessment should include an AP extended knee weight-bearing view, a Mercer-Merchant view with comparison of the contralateral side,[40] a 45° flexion weight-bearing view, and a 30° flexion lateral view. A Merchant view in a first-time traumatic patellar dislocator shows an osteochondral fracture of the medial facet of the patella in a well-aligned patellofemoral joint with no lateral subluxation of the patella (Fig 1). MRI assessment is important to evaluate the chondral surfaces of the patellofemoral joint and to look at the location and extent of soft tissue damage to the medial patellar stabilizers (most specifically the MPFL, which is the primary restraint to lateral subluxation of the patella in early flexion).[15,29] Osteochondral fractures have been reported to be missed in 30% to 40% of initial radiographs based on both surgical and MRI studies.[15,64] For example in 1976, Rorabeck and Bobechko[55] reported the incidence of osteochondral fractures in children was only 5% based on plain radiographic appraisal. There is certainly a role for a CT scan.[4] It is a less expensive method of evaluating patellofemoral alignment, predisposing risk factors for dislocation, and detecting the presence of osteochondral defects.[4] CT scanning is useful in measuring patellar tilt, translation, tibial tuberosity trochlear groove (TTTG) distance, and trochlear dysplasia.[25] It is also helpful in evaluating long bone torsional deformities and determining the rotational relationship between the tibial tuberosity and femoral sulcus in varying degrees of knee flexion.[26] However, in patients younger than 18 years old, the cartilaginous femoral sulcus contour is shallower than the underlying bony sulcus and, therefore, measurement of the bony femoral sulcus angle on radiograph or CT scan is less important than measurement of the cartilaginous femoral

TABLE 4. Articles Reporting Osteochondral Fractures not Included in Tables 1–3

Reference	Level of Evidence	Knees (*n*)	Mean Age (years)	M	F	Mode of Evaluation	Chondral Injuries	OCFx	Patients not Seen Preoperatively
Ahstrom[6]*	IV	18	17	11	6	O	—	18 —	17% 3
Danier et al[14]	IV	29	21	26	3	A	—	25	40% 10
Elias, White, and Fithian[16]	IV	81	20	32	49	M	61 75%	12 15%	NA
Lance, Deutch, and Mink[29]	IV	22	—	11	11	M	—	16 73%	—
Nietosvarra et al[42]	IV	72	13.3	22	47	A	—	28 39%	18% 5
Nomura et al[49]	IV	39	18	7	29	A	37 95%	28 72%	—
Rorabeck and Bobechko[55]*	IV	18	14	8	10	X	—	18 100%	—
Stanitski et al	IV	48	14	24	24	A	34 71%	28 58%	33% 11X
Vironlainen et al[68]	IV	24	20	24	0	A	19 76%	11 46%	—
Totals		378	14.8	141	179		79%	198	27%
Totals without Ahstrom[6] and Rorabeck and Bobechko[55]		342	14.6	122	163		79%	162	

A = arthroscopy; M = MRI; O = open surgery; X = xray; (*) = only cases of osteochondral fractures provided; (—) = not given in study

sulcus angle using ultrasound or MRI.[41] CT scan is also limited in looking at the location and extent of soft tissue defects of the medial patellar stabilizers (medial patellofemoral ligament, medial patellomeniscal ligament, medial retinaculum, medial patellotibial ligament, and VMO). With the information available utilizing newer types of magnetic resonance sequencing, MRI is becoming more specific in assisting the surgeon in deciding on nonoperative versus operative management; and, in the case of operative treatment, it is assisting in defining the specific surgical procedure to perform. However, with increasing MRI evidence being used as an indication for early operative intervention,[2,45,56,57] the epidemiological study by Fithian et al[17] noted a strong trend toward lower risk of subsequent patellar instability if MRI showed evidence of trauma in the MPFL or VMO. This series was not large enough to show statistical significance, however, a prospective randomized study comparing MRI findings of operative versus nonoperative treatment for acute patellar dislocations (including both traumatic and nontraumatic genesis) would be very helpful in better defining the role of MRI and its use in determining the best treatment approach.

When should a patient with a first-time traumatic patella dislocation undergo an operative procedure? There are many studies regarding operative treatment on acute patellar dislocations with greater than 100 surgical techniques, both open and arthroscopic.[1–5,9–11,13,14,17,19–23,26,34,43,44,47,50,51,56,59,62,64,66,67,69–71] Eight studies are identified assessing closed treatment, most of which are retrospective and have short-term followup,[7,12,24,27,30–32,36] and only five studies compared closed versus operative treatment of acute patellar dislocations head to head.[10,11,23,43,44] In all five of those studies, the authors recommended nonoperative treatment for first-time traumatic patellar dislocations accept in cases where there is evidence of an osteochondral fragment. In the case of an osteochondral fracture, arthroscopy was recommended for excision of the fragment or open repair if its size was amendable to this. More specifically, the well-designed prospective, randomized study by Nikku et al[44] compared operative versus closed treatment in 125 patients with a 2-year followup. The results were evaluated subjectively by the patient's own overall opinion (excellent, good, fair, and poor), the Lysholm II score, and the Hughston visual analog scale (VAS). The authors concluded operative and conservative treatment gave almost identical outcomes after 2 years in terms of subjective score, recurrent instability, and function. However, major complications only occurred after operative treatment.[44] Conclusions based on this study were difficult to make because of the report of closed treatment by Mäenpää, Huhtala, and Lehto,[32] who showed more than half of their redislocations occurred 2 years or more after the primary dislocation. In 2005, Nikku

et al[43] published their 7-year medium-term prospective, randomized study on 127 patients. The study compared nonoperative treatment of immobilization and functional rehabilitation against individually adjusted proximal realignment surgery (extensor mechanism realignment, repair of medial patellar ligaments, and/or lateral release). Their clinical outcomes were similar between the nonoperative and operative groups. Therefore, Nikku et al[43] recommended against proximal realignment surgery for treatment of first-time patellar dislocations. This series is the only Level I prospective randomized study with long-term followup comparing surgical management to closed treatment of first-time patellar dislocations. Furthermore, the episodes of redislocation and recurrent subluxation are put together in one group, called instability episodes, which likely contributes to the slightly higher recurrence rate in their series. Therefore, based on the evidence (Tables 1–3), it is our recommendation first-time traumatic patella dislocations be treated initially with nonoperative measures unless there are clinical, radiographic, CT, and/or MRI findings of chondral injury, osteochondral fractures, or large medial patellar stabilizer defects (MPFL, medial retinaculum, VMO). Arthroscopy should be performed if chondral injury or osteochondral fracture is suspected. If the osteochondral fracture is greater than 10% of the patella articular surface or part of the weight-bearing portion of the lateral femoral condyle, open repair should be performed as long as the fragment is amendable to fixation. Large soft tissue medial patellar stabilizer defects should undergo open repair or reconstruction, especially in patients with a high level of athletic participation. All patients with first-time traumatic dislocations should be suspected as having an osteochondral injury until proven otherwise by MRI, CT scan and/or continued clinical examinations of both the injured and contralateral knee.

In nonoperative treatment, patients should be briefly immobilized initially for comfort (2–3 weeks). There are no well-designed studies assessing the most appropriate form or length of initial immobilization. Mäenpää and Lehto[36] treated patients in a posterior splint, cylinder cast, or patellar bandage/brace (Table 1). The posterior splint group had the lowest proportion of knee joint restriction, lowest redislocation frequency per followup year, and fewest subsequent problems at final followup. However, the group treated in a cast was immobilized almost twice as long as those in the posterior splint. In a study using MRI to look at the effect of bracing on patella alignment and patellofemoral joint contact area in skeletally mature women with patellofemoral pain, Powers et al[54] showed the On-Track brace and the Patellar Tracking Orthosis (PTO) increased total patellofemoral joint contact area compared to the no-brace control group. A similar study using newer commercially available patellar braces in

first-time patellar dislocation could potentially help define nonoperative management. It is our opinion after the brief period of initial immobilization, functional rehabilitation should be initiated. Although traditional reports recommend "select VMO recruitment" and strengthening, research has not supported this and we suggest entire quadriceps strengthening as a unit with quadriceps activity incorporated into functional patterns early in the rehabilitation process.[26] Early mobilization is important to help maintain articular cartilage health.[26]

Relative indications of early surgical treatment include concurrent osteochondral injury, palpable disruption of the MPFL-VMO-adductor mechanism, MRI findings of a large complete avulsion or midsubstance rupture of the MPFL, a patella subluxated on plain Mercer-Merchant view compared to the other knee, and patients who fail to improve with nonoperative management. However, there are no long-term studies in the English language with an adequate number of patients reporting results of acute surgical repair of the MPFL in first-time patellar dislocations. It is reasonable and becoming more accepted to think large defects or avulsions are not going to heal or have a good functional outcome with closed treatment especially in individuals with high-level athletic participation and those with evidence of one or more predisposing factors.[2,8,48,50,56]

The risk factors for redislocation could not be adequately calculated in this review due to lack of consistent and quality reporting in many articles. The trend towards the young female being at greatest risk for redislocation is evident,[10,11,43,44] however, in most of the articles presented in this review, there is some element of sampling bias. In the summary of Mäenpää's doctoral thesis, "The Dislocating Patella," which is a summary of five articles he authored on acute patellar dislocations, Mäenpää reported radiographically confirmed unstable patellar type (II/III-Jagerhut), spontaneous reduction of the primary acute patellar dislocation, and a mild hemarthrosis all had prognostic value for recurrence after closed treatment of a primary acute patellar dislocation.[31,33] Most studies reporting on demographics in this review were not population based, but rather more orthopaedic practice specific. Furthermore, there are likely regional to country differences in the type and extent of athletic participation among males and females at different ages. We would like to commend Atkin et al[7] on their population-based study and encourage them to report their data from a longer sampling time.

DISCUSSION

First-time traumatic patellar dislocations traditionally have been treated with nonoperative management. Due to high

rates of redislocations and findings of late symptoms such as anterior knee pain, there has been a trend towards initial surgical treatment. In this review, we attempted to synthesize the literature and help provide the clinician with a logical approach to treatment of first-time traumatic patellar dislocations based on the data reviewed here and the experience of the senior author.[5]

As pointed out in Arendt et al,[5] we also found terms that did not have precise definitions or consistent use (ie, acute dislocations, instability, and malalignment). The literature lacks higher level trials which would allow doctors to select the best form of treatment, but it does require some agreement on terms. We urge the orthopaedic community to perform more prospective randomized studies with consistent, quality data and a well-defined definition of terms to help guide future treatment in this complex issue.

Treatment of first-time traumatic patellar dislocations is a complex problem confounded by many short-term retrospective studies having variable methods of management, both operative and nonoperative. Until more long-term prospective randomized studies comparing specific operations with specifically defined characteristics to closed treatment, we recommend nonoperative treatment for first-time traumatic patellar dislocations except in the following situations: (1) evidence on imaging or clinical examination of osteochondral fracture or major chondral injury; (2) palpable or MRI findings of substantial disruption of the MPFL-VMO-adductor mechanism; (3) a patella laterally subluxated on the plain Mercer-Merchant view with normal alignment on the contralateral knee; (4) a patient fails to improve with nonoperative management especially in the presence of one or more predisposing factors to patellar dislocation; and 5) subsequent redislocation.

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