First-time Lateral Patellar Dislocation: Evaluation and Management

Jarred K Holt[1], Bradley J Nelson[1,2]

Abstract

Lateral patellar dislocation is a common injury affecting a young, athletically active population. These injuries occur as a direct trauma to the knee or as a result of a twisting mechanism on a planted foot. They are typically accompanied by an audible "pop," acute pain, and substantial swelling. The nature of the injury results in a variety of bony and soft tissue disruptions including medial patellofemoral ligament tears and osteochondral lesions of the femoral trochlea and inferomedial patella. In the acute setting, initial treatment is directed toward obtaining a concentric reduction, though oftentimes, this has already occurred spontaneously following the injury. Further, management decisions are based on a multitude of factors including concomitant injuries and patient anatomic considerations. Historically, the first-time patella dislocations were treated conservatively; however, more recent literature supports operative care in an effort to prevent recurrent instability events. Given an overall lack of compelling evidence to support either treatment option, it is felt that a thorough risk assessment and shared decision-making model should be employed to guide care of the first-time patella dislocation.

Key words: lateral patellar dislocation, evaluation, surgical management

Epidemiology

Lateral patellar dislocation (LPD), a relatively common injury, can result in significant activity limitations and degenerative changes in cartilage health. Accounting for approximately 2–3% of all knee injuries, patella dislocations are the second most common cause of knee hemarthrosis, behind anterior cruciate ligament injuries[1], and the most common cause of knee hemarthrosis in children under the age of 14 years[2].Fithian et al. have shown that risk for patellar dislocation is highest among adolescent females, noting that primary patellar dislocation is largely an injury seen in a young, athletically active population[3, 4, 5].The authors noted that 61% of first-time dislocations occurred during sports participation. Although historically patellofemoral (PF) instability was felt to be largely a disorder seen in females, numerous authors have demonstrated a near equal distribution of acute traumatic LPD between the sexes[1,2,4,6].This may be a function of injury presentation, as in most publications a first-time LPD is identified in an acute care setting. The sex distribution of chronic patellar instability is less clear. Athletes at highest risk include girls gymnastics, boys football, and boys wrestling[7].

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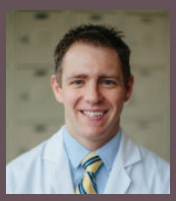

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Mechanism of Injury

It is important to determine the mechanism of injury during the assessment of LPD. Although direct trauma to the medial aspect of the anterior knee is an injury mechanism for LPD, more commonly patients report indirect injuries, often twisting the knee over a planted foot. This is frequently followed by spontaneous reduction of the patella, with a continued sense of apprehension during select activities. Low-energy dislocations tend to occur more frequently in those with risk factors for continued instability. This section will focus solely on primary or first-time traumatic patellar dislocations.

Physical Examination

The clinical examination of the acutely dislocated patella can be difficult depending on the presence of a spontaneous reduction and concomitant injuries. When the patella remains dislocated, the knee

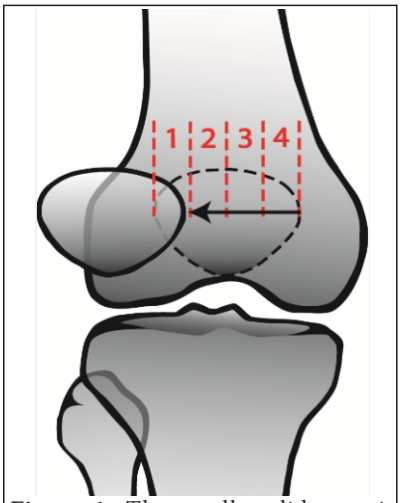

Figure 1: The patellar glide test is performed by creating a medial and lateral force vector at the patella with knee in full extension and quadriceps relaxed(copyright© 2017 regents of the University of Minnesota. All rights reserved).

demonstrates a gross deformity. Knee motion is restricted. A large hemarthrosis is often present. Physical examination findings may be more subtle in cases where a spontaneous reduction has occurred. Patient guarding following the acute injury may make an examination difficult. The presence of an effusion should be noted. Careful palpation of the medial PF ligament (MPFL)is conducted at its patellar and femoral origins to help determine the location of soft tissue failure. The most common MPFL injury pattern is multifocal[8,9], with isolated patellar-based MPFL injury relatively rare (17%)[9].However, in children, a patella-based injury is nearly always present, in isolation or a part of a multifocal injury[10, 11, 12]. Direct tenderness may be noted just proximal to the medial epicondyle, indicating failure of the MPFL at its femoral origin(Bassett's sign)[13].In an adult male population, femoral-sided MPFL injuries were found to have a greater risk of subsequent redislocation[14].Direct palpation of the patella and patellar tendon can help rule out an extensor mechanism disruption. Crepitus during gentle range of motion (ROM) may indicate osteochondral fracture and/orthe presence of intra-articular loose bodies. An extensive supine examination should be performed to further evaluate for patellar instability. The patellar glide test is performed by creating a medial and lateral force vector at the patella with knee in full extension and quadriceps relaxed. When the patella translates laterally >75% of its width (3 or 4 quadrants) MPFL and/or medial retinacular laxity is present (Fig. 1).If this translation is greater than what is seen in the contralateral knee examination, MPFL deficiency/injury is suggested. Along with objective grading of patellar translation, the patient may experience substantial apprehension with this maneuver, further indicating patellar instability. In addition, a "J" sign may also be elicited with knee ROM, most notable in active knee open chain activity. When moving from 90° flexion into extension, the patella will deviate laterally, crossing the supracondylar ridge as it exits the trochlea. This phenomenon has been associated with medial incompetenceand/ortrochleardysplasia, though the exact anatomic componentseliciting this sign are not known. Examination of the uninvolved and ideally uninjured side should always be performed to evaluate the patient's "normal" anatomy for comparison. Finally, evaluation for systemic hypermobility should be documented, in particular, knee hyperextension, which can result in a type of "dynamic"patella alta and exacerbate any mild patella alta problems. Identification of hypermobility or collagen-based disorders may greatly impact the plan of care, especially in the patient with a first-time, low-energy type injury.

Imaging

In the case of the first-time dislocator, imaging evaluation should begin with a standard knee radiographic series. These images should be closely scrutinized for the presence of osteochondral injuries and for the evaluation of patellar position in the axial and sagittal planes. When possible, a low flexion angle axial view should be used[15].Advanced imaging such as magnetic resonance imaging (MRI)is indicated if there is concern for an osteochondral injury. Slice imaging, including computed tomography or MRI, is recommended in the evaluation to document the anatomic patella instability factors (APIFs) which help define the morphology of the PF joint. This is helpful in determining the risk of reinjury, and to guide future surgical

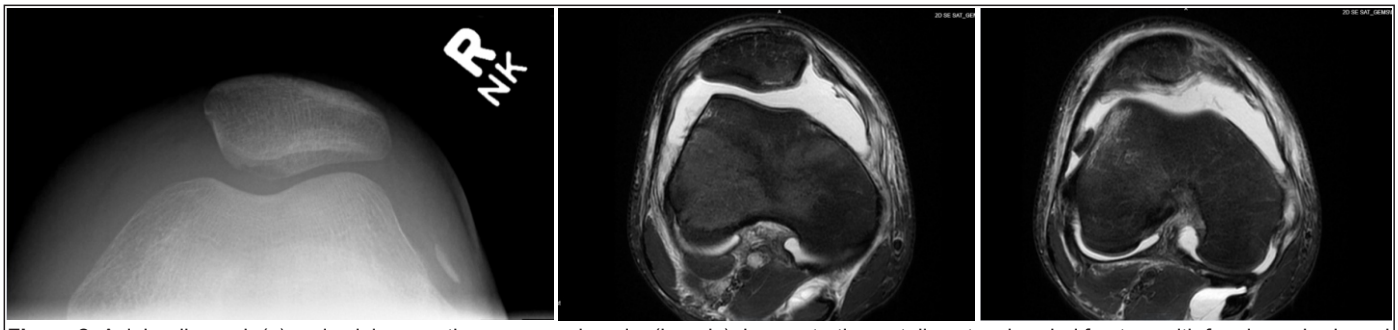

Figure 2: Axial radiograph (a) and axial magnetic resonance imaging(b andc) demonstrating patella osteochondral fracture with free loose body and femoral-sided medial patellofemoral ligament injury.

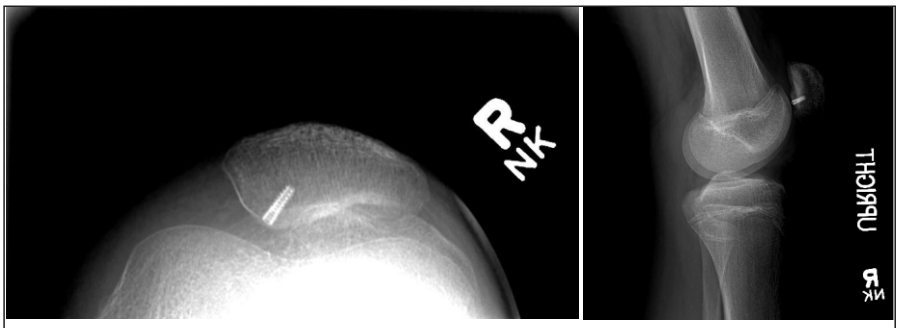

Figure 3: Post-operative radiographs demonstrating excellent reduction and internal fixation of osteochondral injury along with appropriate alignment of the patella within the trochlear groove.

discussions(please see accompanying article on imaging in this journal).

Management

In the acute setting, initial management should be directed toward obtaining and maintaining a concentric reduction. Reduction is usually easily obtained with a combination of assisted knee extension and manual medial manipulation, redirecting the patella into its previous alignment within the trochlea. Reduction can usually be accomplished by trained personnel outside of an acute care setting. More difficult reductions are performed in the emergency department following arthrocentesis of the hemarthrosis and injection of a local anesthetic. Long-term goals in treatment include preventing recurrent instability, limiting chronic pain, preventing further cartilage damage, and returning the patient to full physical function. Unfortunately, the most effective treatment algorithm for the first-time dislocator has yet to be elicited. The primary decision in management of the first-time dislocator is that of non-operative care versus early surgical intervention. Conventionally, most first-time patella dislocators, especially those with an acute, traumatic etiology have been treated non-operatively[16, 17, 18, 19, 20]. Of concern, recurrent instability is relatively common despite appropriate bracing, rehabilitation, and activity restriction. The incidence of recurrent patellar instability has been reported to range from 15% to 44%[21,22].In addition, up to 50% of patients may experience continued anterior knee symptoms, though they may not experience an overt recurrent dislocation[21].In one of the largest population-based studies, Christensen et al.[3] noted the cumulative incidence of recurrence was 29.6%, with a 7.4% chance of recurrence within 1 year and 23.3% chance at 5 years following the index injury, including a 5.4% cumulative incidence of contralateral dislocation. Even without an injury recurrence, one study noted only 26.4% of patients with the first-time LPD treated non-operatively were able to return to sport without limitation in the first 2 years post-injury[23]. Non-operative care of the first-time patella dislocator typically begins with a brief period of immobilization followed by rehabilitation. This is somewhat dependent on the degree of disability and knee swelling. Immobilization is used until quad activation is functional, and a near normal gait pattern is possible. A recent systematic review shows a wide variance in treatment preferences, with some period of immobilization having slightly better patient outcomes[24]. Immobilization may be initiated with a number of devices including a splint, cylinder cast, straight leg knee immobilizer, or locked hinged knee brace[20].The knee flexion angle during immobilization is debated. Full extension is most functional. However, the patella is most mobile in full extension when it is not yet fully engaged within the bony confines of the trochlea, and with quad contraction the patella superiorly ascends, placing the MPFL in its most elongated position[25,26], so some knee flexion is biomechanically superior. Weight-bearing is permitted as tolerated. Final focus is restoration of knee motion and strength, with restoration of appropriate body movement patterns, along with functional strengthening of the quadriceps, hip, and core musculature. Return to play should be withheld until there is absence of pain, full ROM, no effusion, symmetric lower extremity strength, and return of dynamic stability[27,28]. Some form of functional assessment should be done before return to sports[29](Table 1). Given the high rate of recurrent instability and associated symptoms, and the addition of MPFL surgery to the PF surgical algorithm, operative care

Table 1: Return to sport guidelines after lateral patellar dislocation*

No complaints of pain or knee instability
Full knee ROM/no new effusion
Completed neuromuscular training/proprioception
Test for CORE strength and endurance
Test for dynamic activities (e.g.) star excursion balance test
Limb symmetry index >85% on hop tests if going back to pivoting sports
Adequate performance in PT with sport-specific drills which simulate the intensity and body movement patterns of the athlete's given sport/activity
Athlete demonstrates a psychological readiness to return to sport (e.g.) (SANE score >80/100)

*ISAKOS Orthopaedic Sports Medicine Committee, Almquist F, Arendt EA, Coolican M, Doral N, Ernlund L. Guidelines for the evaluation, management, and safe return to sport after lateral patellar dislocation or surgical stabilization in the athletic population. ISAKOS return to play consensus meeting; May 2012; London, England. ROM: Range of motion

following the first-time dislocation has been explored. Acute surgical treatment haslargelybeen focused on repair or reconstruction of the injured medial soft tissues, primarily MPFL repair/ reconstruction[30, 31, 32],and medial retinacular repair with or without lateral release[30,31,33, 34, 35, 36, 37, 38, 39].If elected, MPFL repair should be focused at the site of injury, as determined by MRI, and ideally undertaken only if there is an isolated insertional lesion, which is rare. This may be accomplished with a number of techniques including direct suture repair or use of suture anchors. Vastus medialis oblique and medial retinacular repair may be incorporated into the procedure.A number of recent studies have compared operative repair versusnon-operative management of acute MPFL injury, with no clearconsensus to guide our clinical practice[40, 41, 42, 43, 44, 45]. MPFL reconstruction has been described with a number of techniques and graft options (see accompanying article in this journal). A review of current literature regarding outcomes comparing operative and non-operative care in the first-time dislocator produces conflicting results.Nikkuet al.,in 1997, first reported on a prospective cohort of 125 patients treated non-operatively[36] and operatively[36]throughproximal realignment procedures such as medial retinacular repair, lateral release, and MPFL augmentation with adductor magnus tendon[36].All patients, including the non-operative control group, did undergo examination under anesthesia and diagnostic arthroscopy at the time of initial diagnosis. At 2-year follow-up, they found subjective results (VAS, Lysholm scores) were similar between both groups. In addition, they noted similar instability recurrence, with 20 non-operative and 18 operative patients reporting instability symptoms or frank redislocation at mean follow-up of 25 months. Four serious complications occurred in the operative cohort. It was concluded routine operative care could not be recommended for the treatment of primary patella dislocation. Outcomes of this same cohort at medium-term follow-up (mean 7 years) similarly concluded no benefit of primary operative care. In contradiction, Bitar et al.[46] randomized 41 knees into non-operative (3 weeks immobilization followed by physical therapy) or surgical groups (acute MPFL reconstruction) and evaluated outcomes at 2 years. They found statistically significantly higher Kujala scores and good/excellent results with surgical care, leading them to conclude MPFL reconstruction offered better functional outcomes and lower recurrent instability rates. Several other reports have been published attempting to answer this question with no clear consensus[40,42,47, 48, 49, 50]. In an effort to summarize and determine current best available evidence regarding operative and non-operative care of the first-time patellar dislocations, Erickson et al. critically reviewed four meta-analyses encompassing a number of Level I, II, and III studies[51]. This work included Jadad algorithms to determine which analyses provided the highest quality data for basing the treatment decision. The analysis comprised a total of 1984 patients previously reported on (997 surgical, 987 conservatively managed). It was noted that patients treated operatively had a 24% rate of repeat patellar dislocation and 32.7% rate of recurrent patellar instability. Non-operatively managed patients had a 34.6% rate of repeat patellar dislocation and 33.0% rate of recurrent instability. Hughston and VAS scores were 84.2 in the operative group compared with 90 in the non-operative group. Kujala scores were also evaluated, demonstrating an aggregate mean of 87 in the operative group and 82 in non-operative group. Application of Jadad algorithms found two of the four analyzed papers[52,53] to have the highest level of currently available evidence. The study by Hing et al.[52] showed no major differences between groups but did find higher satisfaction scores in the non-operative group but with fewer patellar instability symptoms in the operative group. Zheng et al.[53] similarly showed a lower chance of recurrent patellar dislocation with operative care but no difference between groups in subjective outcomes. Of note, one meta-analysis did suggest an increased risk of PF osteoarthritis in the operative group as well[24].Indeed, this data suggests the lack of superiority of surgical intervention in the first-time dislocator with respect to objective patient-reported outcomes; however, this comes at the expense of a higher risk of recurrent instability with non-operative treatment. Despite the conflicting evidence for and against acute surgical care, several relative indications do exist in support of early operative management. Evidence of substantial chondral injury, intra-articular loose bodies, and osteochondral fractures all should be considered indicators for arthroscopic or open treatment, depending on their size and location. Osteochondral fractures have been noted to be present in 24.3–34% of acute, traumatic, and primary patella dislocations[1,12].The osteochondral or chondral damage is most often found at the inferomedial border of the patella or the lateral border of the lateral femoral condyle; on occasion, both may be involved[12].These injuries can be repaired with internal fixation utilizing headless compression screws if there is sufficient bone present on the displaced fragment. Chondral darts or suture fixation can be used to repair purely

chondral injuries in certain circumstances. Osteochondral injuries accounting for <10% of the articular surface are often too small to repair and are treated with debridement and loose body removal. In addition to the evaluation of the injury itself, attention should be given to the presence of other factors predisposing to recurrent instability. Patients with the first-time LPD have an increased number of APIF in both the adult and pediatric population[54,55]. Factors predictive of a recurrent dislocation includes trochlear dysplasia, patella alta, age <18 years at the time of first dislocation, elevated tibial tubercle to trochlear groove distance, and female sex[3,5,56].Trochlear dysplasia appears to have the highest association with recurrent lateral patellar instability[55,57],often with a number of dysplastic anatomic factors present[54].Patients with an index dislocation at age <25 years who have trochlear dysplasia demonstrate 60–70% risk of recurrent instability within 5 years of the initial injury[58].If a number of these risk factors are present greater consideration may be given to surgical management following primary dislocation, given the risk for recurrence and associated chronic long-term morbidity. However, operating on an acute first-time LPD also carries the risk of increased arthrofibrosis, and more difficulty in managing necessary rehabilitation factors including faulty body movement patterns[27,29]. Although we have knowledge of APIF in the patient with a first-time LPD, a major challenge for treatment is when to correct these anatomic risk factors. It remains unclear of when (at what threshold) and how (what surgical procedure) to reduce each anatomic (imaging) risk factor. Correction of these risk factors offers more surgical and rehabilitation challenges and complication risk.

Case Example

A 14-year-old male athlete presents with the right knee pain and swelling following a valgus twisting injury during wrestling. He is unclear if his patella dislocated and has no previous injury to this knee. Physical examination demonstrated a large effusion as well as marked tenderness along the entirety of the MPFL. There was significant patella apprehension. He had a negative Lachman's and 5 mm of opening to valgus stress. Plain radiographs and MR imaging were obtained (Fig. 2) which demonstrated an osteochondral injury to the medial facet of the patella and tearing of the MPFL consistent with an acute patellar dislocation. An osteochondral loose body was noted in the lateral gutter. An extensive discussion with the patient and his family was had regarding the nature of his injury and the treatment options. Surgical treatment was elected, and the patient underwent diagnostic arthroscopy, open reduction and internal fixation of the osteochondral fragment, and repair of the MPFL. Fracture fixation was achieved with a 2.7 mm headless compression screw (Fig. 3). Postoperatively, the patient was allowed to bear weight as tolerated in full extension while wearing a knee brace. A continuous passive motion machine was utilized to begin passive ROM. He was allowed to begin gentle strengthening at 6weeks and returned to light running at 12 weeks. He returned to wrestling approximately 6 months postoperatively.

Summary

Acute, the first-time patellar dislocations are a common injury, often occurring in the young athletic population. There is current debate on the ideal plan of care for the first-time dislocator. Non-operative treatment with a short term of immobilization followed by functional rehabilitation appears to provide similar clinical outcomes as operative management following the initial injury. Although recurrence rate may be higher in non-operative management, overall patient satisfaction and quality of life metrics appear to favor non-operative management at this time. However, there is agreement on the importance of patellar focused rehabilitation, the need for close follow-up, and parent/patient education on the risk of reinjury. Given the overall lack of compelling evidence supporting operative or non-operative management, it is felt that a shared decision-making model should be employed to guide patient care. A thorough assessment of risk factors for recurrence, surgical risks and benefits, and patient expected functional goals is best presented to develop an individualized treatment plan.

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