MPFL in First-Time Dislocators

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Abstract

Purpose of Review Historically, the standard of care for patients with an acute patella dislocation has been non-operative with the exception being those with a loose body or osteochondral fracture requiring fixation or removal.

Recent Findings Recent literature has brought into question this standard of care approach and defined a higher risk subset of first-time dislocators who may benefit from early operative treatment. In addition, these studies suggest that operative treatment not only reduces the risk of recurrence but may improve outcomes overall and specifically in the pediatric population.

Summary Though the “high risk” population of first-time dislocators has been more clearly defined, how we treat them remains controversial. We continue to need more evidence-based guidelines to help us manage who we should be fixing and how we should be fixing them. We currently have several multi-center studies in progress, including one specifically looking at the question of medial patellofemoral ligament reconstruction in first-time pediatric and adolescent dislocators.

Keywords Patella · Instability · MPFL · Trochlear dysplasia · Patella alta · Pediatric dislocators

Introduction

The incidence of patella dislocation is variable in the literature with younger female patients having higher incidences [1–4]. Dislocations commonly occur during athletic activity [3] but may also occur atraumatically in patients with predisposing risk factors [5].

There are many risk factors that have been linked to patella instability. The demographic risk factors include young age, female sex, history of contralateral dislocation, or family history of patella instability. The anatomic risk factors include trochlear dysplasia, elevated tibial tubercle to trochlear groove distance (TT-TG), patella alta, femoral and/or tibial malalignment or rotational deformity, ligamentous laxity, and neuromuscular imbalance/control.

Recently, literature has defined trochlear dysplasia as the number one predisposing risk factor for recurrence [6•]. In

children who sustain a primary acute patella dislocation, > 90% will sustain injury to the medial patella femoral ligament [7•]. In the pediatric population, this injury is most commonly seen at the patella attachment [7•].

The medial patellofemoral ligament (MPFL) has been clearly defined as the primary restraint to lateral dislocation [8]. Injury to this ligament occurs in nearly all patients with an acute patella dislocation [7•] and has been referred to as the “essential lesion” of patella instability. It is for this reason that addressing the MPFL in cases of patella dislocation has become the mainstay of surgical treatment over the last decade. Several authors have investigated the relationship of the MPFL origin on the femur to the distal femoral physis in pediatric and adolescent patients, identifying the ligament distally to the growth plate. Techniques have been described to avoid injury to the distal femoral bone altogether including techniques that use a free graft and wrapping it around the adductor attachment distally or the intermuscular septum [9,10].

Green et al. and others have demonstrated that even a traditional bony socket can be safely angled distal to the physis to reconstruct the MPFL without growth disturbance [11–13].

There are numerous techniques described for imbrication, repair, and reconstruction of the MPFL. We know from the literature that repair in the recurrent dislocator or chronic setting does not provide favorable results [14,15]. However, there are no clear indications based on the current literature of when to repair vs. reconstruct in a first-time dislocator.

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Associated Risks

The risk of recurrence in the young patient with trochlear dysplasia is estimated at almost 70% [16,17•]. This high risk of recurrence can have significant effects on these young patients as well as a significant economic cost to society [18•]. In addition to the high risk of recurrent instability, there is the associated injury risk of damage to the cartilage which can have great consequence in this young patient population. There is clearly some degree of injury to the cartilage with each and every dislocation [19,20] but the risk of recurrent instability increases the severity of cartilage injury [21]. Newer studies have shown the long-term risk to these young joints is high with the risk of progressive cartilage damage and arthritis being almost six times higher in patients with a single patella dislocation compared to the rest of the population [22]. Given that the highest risk of instability is in the pediatric and adolescent population and that this study showed the risk of arthritis increased significantly between 20 and 25 years after the patella dislocation [22], this puts most patients in their 30s and 40s and poses significant implications of young patients with arthritis and our limitations in treating them.

Prediction Models

Given the clear risk of each dislocation to the long-term health of the joint, it is helpful to identify those with higher risks of repeated dislocations (recurrent instability). Thanks to recent literature, we have a much clearer picture of who the high-risk patients are.

Fithian et al. demonstrated a fairly low risk of recurrence after a first-time dislocation [3]; however, this study looked at all comers including young patients and old, and those with significant anatomic risk factors as well as those with fairly normal anatomy. The more recent studies have separated these groups and come up with prediction models. Lewallen et al. demonstrated a nearly 70% risk of recurrence in patients with open growth plates and any degree of trochlear dysplasia [16]. The same group then increased their study population and determined that age under 25 years (not necessarily open physes) along with trochlear dysplasia was the most significant predictor of recurrence [23•]. These high numbers have been validated by numerous authors [17•,24–25], all demonstrating young age with trochlea dysplasia to be highly predictive of recurrence.

Recent Literature Review

We now have powerful evidence to counsel patients and families about their risk of recurrence and about the

associated injuries. However, we do not yet know what to tell them we should do about it. Over the last decade, there has been more high-quality research examining whether we should be fixing the first-time dislocator [26,27•,28]. The early studies were the right study design in that they were prospective and randomized with control groups; however, the surgical treatments were not considered “standard of care.” One study used an isolated lateral release as the treatment in the surgical arm, which is well known to worsen patellofemoral instability [24]. As this higher quality research continued, they began to study the more current surgical techniques and then began to demonstrate improved outcomes in the groups randomized to surgical treatment.

A study in 2008 looked at delayed repair of the MPFL vs. non-operative treatment for first-time dislocators and found no difference in the rate of recurrence between the two groups [29]. Also published the same year from Palmu et al. was a prospective randomized controlled study in children younger than 16 years [24]. This study’s operative arm included either repair or isolated lateral release depending if the patella was dislocatable at the time of the surgery. They did not demonstrate a difference in either the recurrence rate or the subjective outcomes between the two groups.

The next prospective randomized controlled study changed the operative treatment to the more well-accepted MPFL repair, and this study demonstrated significantly decreased rates of redislocation and increased subjective outcome scores compared to non-operative treatment group [26]. In another prospective randomized controlled study, the same group looked at MPFL reconstruction in the first-time dislocator and their results showed significantly lower redislocation rates and significantly better subjective outcomes [30]. Though these studies were well designed and the surgical interventions were more current and standard of care, the populations they studied were not isolated to the high-risk population that we have since defined. They included older patients who we now know may not have gone on to further dislocations.

We need to focus our research efforts on the high-risk pediatric, adolescent, and young adult dislocators. Dodwell and Green looked at operative vs. non-operative treatment in this high-risk pediatric population in their systematic review. Though the studies were not all PRCTs, they concluded that surgical treatment of first-time dislocation in the pediatric and adolescent population is associated with a lower risk of recurrence and higher health-related quality of life and sporting function [31]. The same group looked specifically at the quality-of-life benefit as well as the cost-utility of surgical vs. non-surgical treatment of the first-time dislocation in the pediatric and adolescent population and found that surgical treatment (both immediate and delayed) was cost effective, but that immediate surgical treatment yielded the highest quality-adjusted life years (QALY).

Future Research

We currently have several large multi-center studies underway to help us better define whether operative treatment is appropriate for the high-risk pediatric and adolescent first-time dislocator and if it is, then what kind of surgery should be done? Is acute repair better as it avoids risk of injury to the growth plate? Or is MPFL reconstruction the better choice given the high degree of laxity in these patients and possibly poor-quality/multi-focally injured tissue that is being repaired? The answer currently is that we do not know. We seek to answer these questions with better quality prospective randomized controlled studies (as our colleagues have done across the Atlantic) as well as to emulate our MOON colleagues with our multi-center registry group JUPITER.

Conclusion

Patellofemoral instability is multifactorial and thus has proven difficult to study and define specific treatment guidelines. A recent survey of the International Patellofemoral Study Group (IPSG) [32] found that current expert opinion believes that non-operative treatment is still the best option in the first-time dislocator. The study also suggested that based on its experienced group of high-volume patellofemoral surgeons, if a loose body or osteochondral fracture was seen and thus driving the decision towards surgery, that surgical stabilization in the form of an MPFL repair or reconstruction should be performed at the same time as treatment of the fragment.

A salient counter-argument to the absolute avoidance of surgical intervention in first-time dislocators is a study by Magnussen et al. in 2017, which followed first-time dislocators treated non-operatively for an average of 3 years. Only 26% of these patients returned to their activities without limitations, and 87% of those who failed to return cited the injured knee as the reason for their inability [33]. This information, combined with the literature above on risk of recurrent instability and cumulative cartilage injury, leads the authors to suggest considering surgical intervention for patients at high risk of recurrence based on age and trochlear morphology. Ligament reconstruction is quickly becoming a mainstay of our treatment algorithm for recurrent patellofemoral instability, but the literature is lacking on outcomes for first-time dislocators compared to repair.

Compliance with Ethical Standards

Conflict of Interest Beth E. Shubin Stein is a consultant for Arthrex and a member of the nominating committee for AOSSM. Simone Gruber and Jacqueline M. Brady declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- history of acute patellar dislocations. The probability of transition between each health state was informed by the available literature. Direct costs were estimated using a statewide ambulatory surgery database, and indirect costs were estimated based on parental lost productivity. Effectiveness was expressed in quality-adjusted life years (QALYs). The principal outcome measure was the incremental cost-effectiveness ratio (ICER). In the base case for our model, non-operative treatment only was the least costly (\$7300) but also the least effective (5.30 QALYs); initial non-operative treatment with delayed surgery cost \$10,500 for a 5.93 QALY benefit, while immediate surgical treatment cost \$17,100 and provided 6.32 QALY benefits. Compared with non-operative treatment only, initial non-operative treatment with delayed surgery was associated with an ICER of \$5100 per QALY. When immediate surgery was compared with a strategy of delayed surgery, immediate surgery provided incremental benefits at an ICER of \$17,000 per QALY. The model was sensitive to the probability of surgical vs. non-operative treatment to achieve a full return to preinjury activity vs. an intermediate lower state. When the probability of achieving a full return to preinjury activity with initial non-operative treatment exceeds 47.5% (compared with 34.2% in the base case), then initial non-operative treatment with delayed surgery is preferred to immediate surgery. Similarly, when the probability of achieving a full return to full preinjury activity with surgery falls below 51% (compared with 64% in the base case), then delayed surgery after initial non-operative treatment is preferred. Immediate surgery and delayed surgical treatment are both cost-effective treatment options; however, immediate surgical treatment provides the highest QALY gains within a 10-year time horizon. Our model sensitivity analysis highlights the role of optimizing functional and quality-of-life benefits in the treatment of acute traumatic patellar dislocations. These findings have implications for clinical guidelines and policy decisions relating to adolescent patellar dislocations
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