Risk assessment and management of primary patellar dislocation is complex and multifactorial: a survey of Australian knee surgeons

Lachlan S Huntington, Kate E Webster, Brian M Devitt, Julian A Feller

ABSTRACT

Objectives Recurrent patellar instability following first-time lateral patellar dislocation is associated with a variety of bony, soft tissue and patient-related risk factors. The specific management of recurrent dislocation may vary depending on the presence and combination of these factors as well as the treating physician’s interpretation of these. Therefore, this study aimed to determine which factors Australian knee surgeons regard as increasing the risk of recurrence following first-time patellar dislocation and to characterise the surgical decision-making process of these surgeons in the management of lateral patellar instability.

Methods An online survey was sent to all active members of the Australian Knee Society (AKS). The survey addressed (i) risk factors for recurrence following first-time patellar dislocation and (ii) the surgical decision-making process in treating patellar instability.

Results Seventy-seven per cent (53 of 69) Australian Knee Society members responded. Factors identified by respondents as significantly increasing the risk of recurrence were a history of contralateral recurrent patellar dislocation (74% respondents), an atraumatic injury mechanism (57%), trochlear dysplasia (49%) younger age (45%), patella alta (43%) and generalised ligamentous laxity (42%). Forty-four per cent replied that there may be an indication for surgical intervention following first-time patellar dislocation with no apparent loose body present. All respondents would recommend operative management of recurrent patellar dislocation after a third episode, with 45% of surgeons recommending surgery after a second episode. The most common surgical procedures performed by respondents were medial patellofemoral ligament (MPFL) reconstruction (94%), tibial tuberosity medialisation (91%) and tibial tuberosity distalisation (85%). Only 23% of respondents consider trochleoplasty for primary surgical intervention.

Conclusion Surgeons identified a large number of factors that they use to assess risk of recurrence following first-time patellar dislocation, many of which are not supported by the literature. The two highest ranked factors (history of contralateral recurrent patellar dislocation and an atraumatic injury mechanism) are without a significant evidence base. There was considerable variation in the criteria used to make the decision to perform a patellar stabilisation procedure. MPFL reconstruction was the most commonly used procedure, either in isolation or combined with another procedure.

Level of evidence Cross-sectional study; expert opinion (Level V).

What are the new findings

► A survey of members of the Australian Knee Society revealed that the members use multiple risk factors to assess risk of recurrent patellar dislocation, many of which are not supported by the current evidence base.
► More than 40% believe there may be a role for surgical stabilisation following first-time patellar dislocation, but few do this in practice.
► A medial patellofemoral ligament reconstruction is the most frequently used procedure in patellar stabilisation surgery.
► Indications for tibial tubercle osteotomy vary widely among the group, and the majority of surgeons would only consider trochleoplasty in the setting of revision surgery.

INTRODUCTION

Lateral dislocation of the patellar occurs in 23–42 per 100 000 person years,1 2 with recurrence reported to occur in 22.7% of non-operatively managed patients. A number of risk factors for recurrence following a first-time patellar dislocation have been proposed and investigated.3–5 However, there remains a lack of consensus regarding treatment following both first-time and recurrent patellar dislocation, and which risk factors should influence management decisions.

Although many potential risk factors have been proposed, few are supported by evidence, with only five (younger age, open physes, trochlear dysplasia, patella alta and elevated tibial tuberosity-trochlear groove (TT-TG) distance) of a total 28 proposed factors across the literature having a meta-analysis established association with the risk of recurrence.6 Notably, the presence of multiple risk factors has been established to significantly increase the risk of recurrent dislocation.3–5 7 Operative intervention for patellar dislocation can range from arthroscopic removal of a loose osteochondral fragment to a variety patellar stabilisation procedures.8 Broadly speaking, there have been two fundamental approaches to the surgical management of patellar instability.9 10 One focuses on reconstructing the medial patellofemoral ligament (MPFL) which is the main anatomical restraint to patellar dislocation that is injured when the patella dislocates,9 and the second is based on correction of anatomical risk factors predisposing to patellar instability.10 Many variations and combinations of surgical procedures have been described and the choice of procedure...
can in part depend on the presence or absence of individual risk factors. The combination of multiple proposed risk factors and multiple surgical procedures presents challenges for clinical decision-making, which is exacerbated by a relative lack of evidence on the topic.8

The aim of this study was therefore to assess (i) which factors are used by a specialty group of knee surgeons to assess the risk of recurrence after first-time dislocation and (ii) how they make their decisions regarding the surgical management of patellar dislocation.

METHODS

Target population

The target population consisted of the 69 active members of the Australian Knee Society (AKS), a subspecialty society of the Australian Orthopaedic Association. Membership criteria of the society include having a practice comprising at least 50% knee surgery in the prior 2 years and having published an article on a knee-related topic in a peer review national or international journal.

Survey information

The survey contained 20 questions based on four themes:

► Information about the respondent (three questions); respondent’s annual first-time patellar dislocation case load, proportion of their practice comprising patellofemoral disorders and years in practice.

► Risk factors for recurrence following first-time patellar dislocation (four questions); categorisation (no, mild, moderate, significant increase in risk of recurrence) of 23 potential risk factors according to their perceived influence on the risk of recurrence, including the upper acceptable limits of two commonly used radiological measurements (TT-TG distance and patellar height). Risk factors were selected for inclusion on the basis of an evaluation of the literature and the factors proposed to be associated with increased risk of recurrence.

► Surgical intervention for patellar instability (seven questions), the number of dislocations after which operative treatment should be recommended, the differentiation between subluxation and dislocation, the use of different surgical procedures in managing recurrent patellar dislocation and the specific indications for tibial tuberosity osteotomy and trochleoplasty.

► Clinical scenarios (six questions) to assess a respondent’s management of lateral patellar dislocation in the setting of multiple risk factors.

The full survey can be found in online supplemental appendix 1.

Survey procedures

The survey was an online form using SurveyMonkey (SVMK). The survey link was distributed via email, with one follow-up email distributed to all society members, and a second to those who had not yet responded to the survey. The survey link remained open for 33 consecutive days.

Analysis of survey outcomes

All results were analysed descriptively and are presented either descriptively or graphically. Continuous variables were assessed for normality. Normally distributed continuous data were presented as means with measures of dispersion reported as SD. Non-normal data were presented as median values, with IQR and range reported as measure of dispersion.

RESULTS

Demographics and response rate

Fifty-three (77%) of active AKS members responded to the survey. Of those who responded, 95% completed the entire survey. Forty-two per cent of the respondents had more than 20 years of experience as a qualified orthopaedic surgeon, with 85% of respondents having more than 10 years of experience. Thirty per cent of respondents indicated that they see more than 20 patients with first-time lateral patellar dislocation per year, with a further 25% seeing between 11 and 20 patients. One respondent reported not seeing any primary dislocations. Overall, respondents considered patellofemoral disorders to comprise a median 10% of their practice (IQR: 7, range: 0%–36%, n=53 respondents) of their clinical practice.

Risk factors for recurrence after first-time patellar dislocation

Respondents’ categorisation of risk factors for patellar dislocation are listed in figure 1. Only two factors were regarded by more than 50% of respondents to significantly increase the risk of recurrence—a history of contralateral recurrent dislocation (77%) and an atraumatic injury mechanism (57%). A further four factors were regarded as significantly increasing the risk by between 40%–50% of respondents - trochlear dysplasia (any type) (49%), younger age (45%), patella alta (43%) and generalised ligamentous laxity (42%). When the categories of ‘significantly increase’ and ‘moderately increase’ are combined, an additional seven factors were regarded as important by more than 50% of respondents, including a history of single episode of contralateral patellar dislocation, J-tracking on examination (defined as a medial translation of the patella during knee flexion as it engages the trochlear groove), an elevated TT-TG distance, family history of recurrent patellar dislocation, female sex, complete MPFL disruption and genu valgum. Only one respondent reported using ‘personalised’ measures of TT-TG distance.

Decision-making and management of recurrent patellar dislocation

Of surgeons that have a threshold number of recurrent dislocations before recommending operative treatment, 10% use one recurrence, 45% use two and all would advise intervention after three recurrent dislocations. A significant proportion (43%) of respondents indicated that there may be an indication for surgical intervention in first-time patellar dislocation even in the absence of evidence of a loose body being present.

MPFL reconstruction was the most frequently considered procedure for patellar stabilisation surgery (considered by 94% of respondents), followed by two bony procedures: tibial tuberosity medialisation (91%) and tibial tuberosity distalisation (85%) (figure 2).

With regard to tibial tuberosity medialisation, 84% of respondents replied that an elevated TT-TG distance was an indication, while J-tracking, patella alta and lateral patellar or trochlear chondral damage were considered by 25%, 22% and 24% of respondents, respectively, to contribute to their decision to perform this procedure. In planning patellar stabilisation surgery, the thresholds for intervention in the form of a tibial tuberosity medialisation were a median 19 mm for CT (IQR: 2, range: 9–25, n=15 respondents) and 18 mm for MRI (IQR: 2.75, range: 15–20, n=8 respondents). Sixteen respondents did not specify which modality they use. Eight per cent of respondents reported never performing medialisation of the tibial tuberosity.

For tibial tuberosity distalisation, 80% of respondents regarded radiographic patella alta as an indication, while 39%
considered the presence of J-tracking to contribute to their decision to distalis the tuberosity. With regard to radiological measurements, the thresholds at which patella alta was considered to warrant tibial tuberosity distisation were a median 1.5 for the Insall-Salvati index (IQR: 0.30, range: 1.2–1.8, n=17 respondents) and 1.3 for the Caton-Deschamps index (IQR: 0.28, range: 1–1.5, n=20 respondents).

Tibial tuberosity anteromedialisation was not part of the surgical repertoire for 35% of respondents. Of those who did consider it, 67% of respondents consider using it in the setting of an increased TT-TG distance and 51% consider using it when lateral patellar or trochlear chondral damage is present.

Sixty-one per cent of respondents reported that they do not perform trochleoplasty as part of their management of patellar instability. Of the 20 who did perform trochleoplasty, 8 regarded it as a salvage procedure for revision surgical cases only. Nine of 20 reported that high grade trochlear dysplasia would contribute to their decision to perform a trochleoplasty, while six stated that they would only perform trochleoplasty in the setting of a supratrochlear spur.

Case studies

Scenario 1.a: ‘A 14-year-old female presents following an atraumatic primary patellar dislocation. There is no J-tracking on physical examination. Radiographically, there is high grade trochlear dysplasia (Dejour type D), with normal patellar height, normal TT-TG distance and open growth plates. There is no osteochondral loose body. Which, if any, surgical intervention would you choose to perform?’

Seventy-six per cent of surgeons would treat this patient without surgical intervention, while 16% would perform an MPFL reconstruction and 4% would combine this with a trochleoplasty.

Scenario 1.b: ‘If you elected not to perform surgical intervention, and the patient suffered two further dislocations within a year, would you change your management?’

For those surgeons who would initially manage this patient non-operatively, two recurrences would shift management towards an MPFL reconstruction for 64% of surgeons. An MPFL reconstruction and trochleoplasty would be the management by 15% of surgeons, while 5% would continue to manage this patient non-operatively.
Scenario 2: ‘A 15-year-old male presents after a third time patellar dislocation. J-tracking is obvious on examination. Radiographically, there is no trochlear dysplasia, there is significant patella alta, with an Insall-Salvati index of 1.6, TT-TG distance is within normal limits, and growth plates are open. There is no osteochondral loose body.’

Most (78%) respondents would manage this case with surgical stabilisation, with 59% choosing to use an MPFL reconstruction. Approximately one-third would combine this with a tibial tuberosity distalisation procedure. Ten per cent of respondents would perform an isolated tibial tuberosity distalisation.

Scenario 3: ‘An 18-year-old female presents after the 5th patellar dislocation in 2 years. Marked J-tracking is present. Radiographically, there is high grade trochlear dysplasia (Dejour D), the Insall-Salvati index is 1.5, TT-TG distance is within normal limits, and growth plates are closed.’

All respondents would manage this case surgically. Of the interventions offered, 43% surgeons would perform a MPFL reconstruction and tibial tuberosity medialisation, while 19% would perform an MPFL reconstruction alone. One surgeon (1%) selected a combined MPFL reconstruction combined with tibial tuberosity medialisation and distalisation.

Scenario 4: ‘A 17-year-old female presents with recurrent (4th time) patellar dislocation. Radiographically, there is no trochlear dysplasia, the Insall-Salvati index is 1.3, the TT-TG distance is 22mm and growth plates are closed.’

All surgeons would manage this case surgically. Of the interventions offered, 43% surgeons would combine an MPFL reconstruction and tibial tuberosity medialisation, while 19% would perform an MPFL reconstruction alone. One surgeon (1%) selected a combined MPFL reconstruction combined with tibial tuberosity medialisation and distalisation.

**DISCUSSION**

This survey found that a group of subspecialist knee surgeons consider a wide variety of factors as increasing the risk of recurrence following first-time patellar dislocation, but there were only two factors which were regarded by more than 50% of surgeons as significantly increasing the risk—a history of recurrent contralateral patellar instability and an atraumatic injury mechanism. It is noteworthy that these two risk factors are not supported by the available evidence. This suggests that assessment of the risk of recurrent patellar dislocation by a group of specialist knee surgeons is complex and multifactorial. It may
reflect a combination of previous teaching and anecdotal experience (particularly given the target population of the survey), but may also reflect a lack of awareness of the most recent evidence on this topic. In a recent systematic review and meta-analysis, which was published after the survey was completed, Huntington et al.13 identified young age, open physics, patella alta, trochlear dysplasia and elevated TT-TG distance as risk factors for recurrent patellar dislocation. Of these, only young age, patella alta and trochlear dysplasia were selected as significant risk factors in the current study. Ten of the thirteen factors rated by the respondents as moderately or significantly increasing the risk were not found to be risk factors in the meta-analysis.

Huntington et al.13 also analysed the effect of having multiple risk factors and reported a risk of recurrence of over 70% when three or more risk factors were present. While this raises the question of whether surgical stabilisation should be considered after first-time patellar dislocation in some high-risk groups, most respondents to this survey indicated they would generally consider patellar stabilisation surgery only after at least two recurrences. This was reinforced by the responses to the first clinical scenario which was of a first-time dislocation in a young woman with open growth plates and trochlear dysplasia but no J-tracking, patella alta or increased TT-TG distance. According to the study by Lewallen et al.,3 this patient has a >60% risk of recurrence. Yet three quarters of the respondents replied that they would manage this patient non-operatively. This reluctance to offer surgical stabilisation to patients with first-time patellar dislocation is nonetheless consistent with the results of a survey of the International Patellofemoral Study Group (IPSG) in 2018.12

Interestingly, in response to the second part of this scenario in which the same patient had suffered two further dislocations, 95% of surgeons replied that they would offer the patient a surgical stabilisation. Thus, the decision to intervene surgically seems to be based more on the number of recurrences, rather than the risk of recurrence. This is in spite of evidence that non-operatively managed first-time dislocators have impaired functional outcomes regardless of whether there is recurrent patellar instability.13 Furthermore, 43% of respondents had previously indicated that they felt there may be a place for surgery after a first-time patellar dislocation, although not necessarily a stabilisation procedure. This openness to surgical intervention is in contrast to the modified Delphi consensus statement of the IPSG in 2018, which reported 100% agreement that a first-time dislocation should be treated non-operatively regardless of age or anatomy.12 This discrepancy in approach may be attributable to the increasing body of evidence regarding risk with multiple factors that has emerged since the aforementioned study was conducted.3 4 8 It may also reflect the wording of the question which did not confine the definition of surgical intervention to patellar stabilisation. Nevertheless, the reservations around patellar stabilisation after a single patellar dislocation do warrant further investigation to identify the most important factors behind this stance, although it could be speculated that skeletal immaturity might be an important factor.

For this group of specialist knee surgeons, MPFL reconstruction appeared to be the mainstay of patellar stabilisation surgery, either in isolation or combined with another procedure, most commonly a tibial tuberosity transfer. It was uncommon for a tibial tuberosity transfer to be suggested without a concomitant MPFL reconstruction. There was, however, considerable variation with regard to the thresholds used for radiological indices of tibial tuberosity lateralisation and patella alta in determining when to perform a medial or distal tibial tuberosity transfer. The majority of surgeons considered tibial tuberosity medialisation in the setting of an elevated TT-TG distance, as well as in the presence of J-tracking, patella alta and lateral patellofemoral chondral damage. There was also a small group of surgeons (8%) who stated that they never perform a tibial tuberosity medialisation. An increased TT-TG distance is an established risk factor for recurrent dislocation,9 and typically, a TT-TG distance of greater than 20 mm has been regarded as an indication for tibial tuberosity medialisation. However, a recent study reported that in the USA only 11% of patellar stabilising surgeries include tibial tuberosity osteotomies, despite an elevated TT-TG distance being present in over 50% of cases.11 This is consistent with the findings of Matsushita et al.6 who reported similar outcomes and an absence of redislocation following isolated MPFL reconstruction regardless of whether the TT-TG distance was greater or less than 20 mm.14 Feller et al.15 also reported on a cohort of patients in whom an isolated MPFL reconstruction was performed if the TT-TG was <22 mm and the Insall-Salvati index was <1.5. There were no recurrent dislocations in 31 patients at a mean follow-up of 3.1 years. It therefore appears that the role of tibial tuberosity medialisation, or at least the threshold for its use, may warrant reassessment. It has been suggested that that the measurement of the TT-TG distance can be personalised,16 but only one respondent to the survey reported using the ‘personalised’ measures proposed. Most surgeons used either CT-based or MRI-based measurements. Although they did use slightly different thresholds for MRI-based measurements compared with CT-based measurements. The threshold for MRI-based measurements was approximately 1 mm less than for CT-based measurements. This is consistent with the findings of Camp et al.17 that MRI tends to result in lower values of the TT-TG distance compared with CT. Similarly, the thresholds used for patella alta varied depending on the measurement technique used. A Caton-Deschamps index of greater than 1.3 and an Insall-Salvati index greater than 1.5 were regarded as indicative of excessive patella alta sufficient to warrant tibial tuberosity distalisation, although a wide variation between surgeons was noted. No distinction was made between measurements made on MRI or plain radiographs. Overall, this suggests that the current indications for medialisation or distalisation of the tibial tuberosity are surgeon-dependent. As such, they remain a topic for further research.

Although trochleoplasty has been shown to be effective in reducing redislocation rates and to have good clinical outcomes,18 most surgeons in this survey indicated they do not perform the procedure. Of those who do, just under one half consider it to be a salvage procedure and reserve it for revision cases. Similarly, just under 50% of respondents consider trochleoplasty only in the setting of high-grade dysplasia. This is consistent with a systematic review by Zaffagnini et al.19 who reported the addition of trochleoplasty to MPFL reconstruction to reduce dislocation rate only in the setting of advanced dysplastic disease and often result in a poorer complication profile.

The current study was a survey of specialist knee surgeons. What can the generalist orthopaedic surgeon take out of it? Despite the presence of multiple risk factors increasing the risk of recurrent patellar dislocation following a first patellar dislocation,2 4 9 most of the respondents would not advise surgical stabilisation until multiple dislocation events have occurred. When performing a patellar stabilisation procedure, the majority of respondents use an MPFL reconstruction. Some use an isolated MPFL reconstruction in the presence of patella alta on radiological criteria. When MPFL reconstruction is combined with a bony procedure, the most common additional procedures are medial or distal tibial tuberosity transfer. The majority of


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surgeons would not address a dysplastic trochlea in a primary patellar stabilisation procedure, despite this being a significant risk factor for those with open physes (<30% recurrence-free survival at 5 years for patients with trochlear dysplasia and open physes).12

This study has its limitations. It is based on expert opinion only and being an online survey, respondents were limited in their choice of responses and had no opportunity to discuss their responses in greater detail. However, given the logistical challenge of face-to-face discussions, and considering the often low response rates of survey studies,21 it was decided that an online survey would yield the highest response rate. The satisfactory response rate of 77% appears to vindicate this decision. Second, this study is a survey of a specific group of specialist knee surgeons around the globe, as evidenced by the discrepancy between the results of the present study and those of the IPSG.12 However, many of the respondents are actively involved in international surgical associations and study groups, and thus their responses are likely to have incorporated their exposure to international trends. Nonetheless, the external validity of the present study should be considered when reviewing the results, and it should be noted that surgical practice can be influenced by many factors which vary from one country to another.

CONCLUSION

Australian specialist knee surgeons identified a large number of factors that they use to assess the risk of recurrence following first-time patellar dislocation, many of which are not supported by the literature. Only three (trochlear dysplasia, patella alta and younger age) of six factors regarded as significantly increasing the risk of recurrent patellar dislocation are supported by synthesised literature. Furthermore, the two highest ranked factors (history of contralateral recurrent patellar dislocation and an atraumatic injury mechanism) are without a significant evidence base. Almost all surgeons treat first-time patellar dislocation non-operatively. Like risk assessment, there is considerable variation in the criteria used to make the decision to perform a patellar stabilisation procedure. MPFL reconstruction and tibial tuberosity transfers are the most commonly used procedures; however, there was no consensus regarding indications for tibial tuberosity transfer. Trochleoplasty is only considered by a minority in the primary stabilisation setting. Ultimately, the results of this study suggest that risk assessment after primary patellar dislocation is multifactorial, and decision making is complicated and focused on factors specific to each patient. As such, further characterisation of the decision-making approach is a topic that warrants future research.

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ORCID iD Lachlan S Huntington http://orcid.org/0000-0002-5393-9738

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