Research Article
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Surgical versus conservative management of patellar re-dislocation: clinical and radiological results at a mid-term follow-up of 5 years

Abstract

Background: Patellar dislocation accounts for 2–3% of all knee lesions and is the second most common cause of traumatic hemarthrosis of the knee. Proper treatment is essential to minimize long term sequelae, such as recurrent dislocation, painful subluxation, and osteoarthritis.

Aim: The purposes of this perspective randomized study were: 1) to evaluate the mid-term clinical and radiological results of the Elmslie–Trillat procedure for the treatment of traumatic patellar re-dislocation; and 2) to compare the results, especially radiological osteoarthritis development, with those of non-operative management for traumatic patellar re-dislocation.

Methods: From June 2013 to February 2015, 65 patients were admitted to our Emergency Department for a first patellar dislocation episode. All patients were treated non-operatively. When a second episode occurred within two years, patients were randomly assigned in two groups: Group A, patients treated surgically with Elmslie-Trillat procedure, and Group B, patients were further treated non-operatively. The Knee Society Score (KSS), Lysholm scale and Kujala questionnaire were administered immediately after the re-dislocation and at the final follow-up. Tangential patella radiographs were evaluated for patellofemoral osteoarthritis and graded according to Sperner's classification.

Results: The mean follow-up was 6.4±1.7 years (range 5-8) in Group A and 6.3±2.1 years (range 5-9) in Group B. In Group A, the KSS and Lysholm scale showed significant differences between pre- and post-operatively values ($p<0.05$). The mean Kujala score was significantly lower in Group B when compared with the mean value of Group A ($p<0.05$). At the final follow-up of more than 5 five years, the mean grade of patellofemoral osteoarthritis according to Sperner's classification changed in Group A and Group B, with respectively 25% and 29% of patients having a grade greater than or equal to 3.

Conclusion: This study confirms that Elmslie-Trillat is a safe and effective procedure in the treatment of patellar instability, relieving pain and inability, and reducing recurrence risk. However, it cannot avoid the degenerative changes occurring in the natural evolution of patellar dislocation.

Keywords: patellar dislocation, Elmsie-Trillat, conservative, patellofemoral osteoarthritis

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Introduction

Patellar dislocation in children and adolescents is the most frequent cause of misdiagnosis in acute knee evaluation and may determine fearsome long term sequelae in terms of pain, functional impairment and osteoarthritis development.[1,2] The pathogenesis of patellar dislocation is linked to several bony and soft tissues factors: ligamentous laxity, quadriceps dysplasia, patella alta, increased Q-angle, femoral anteversion, trochlear dysplasia, excessive tibial tubercle-trochlear groove distance (TT-TG), and excessive lateral patellar tilt. Non-operative treatment is an appropriate option for first-time dislocation if concurrent loose bodies and osteochondral fractures are not present.[3,4]Acute patellar dislocations can result in patellar instability with recurrence rates of 15% to 44% after non-operative treatment. In the long term, pain, inability to return to sports (reported by up to 55% of patients) and patellofemoral osteoarthritis may occur.[5]

When conservative treatments fail, surgery is the only option to prevent recurrences and related consequences but can be difficult to determine the most appropriate surgical technique to address instability, even though "à la carte" surgical treatment is, nowadays, the mainstay. Numerous proximal and distal realignment procedures have been proposed.[6–8] The Elmslie-Trillat procedure is a distal bony realignment procedure involving medialization of the tibial tuberosity, lateral retinacular release and medial capsular reefing.[9] This technique aims at reducing the patellar lateralization/subluxation. Farr et al.[10] demonstrated that the procedure was associated with several cases of advanced tibiofemoral and patellofemoral osteoarthritis, especially if the procedure was performed late, but no studies compared it with the non-operative treatment.

The purposes of this perspective randomized study were: 1) to evaluate the mid-term clinical and radiological results of the Elmslie–Trillat procedure for the treatment of traumatic patellar re-dislocation; 2) to compare the results, especially radiological osteoarthritis development, with those of non-operative management for traumatic patellar re-dislocation.

Materials and methods

From June 2013 to February 2015, 65 patients were admitted to our Emergency Department for first patellar dislocation and were treated non-operatively with immobilization in a full extension brace and

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following rehabilitation program. The diagnosis of primary patellar dislocation was based on the history of a laterally displaced patella and physical examination: tenderness of the medial retinaculum, a positive apprehension test, and hemarthrosis of the knee joint. When a second episode occurred within two years, patients were randomly assigned in two groups based on the treatment carried out: patients underwent surgical treatment, Elmslie-Trillat technique, in Group A; patients received non-operatively treatment in Group B. Ethical approval was obtained from our institution's ethics committee. Patients were provided with information sheets and gave informed consent to enter this study.

Inclusion and exclusion criteria

The inclusion criteria were: a second episode of patellar dislocation within two years; a tibial tubercle-trochlear groove (TT-TG) distance > 20 mm, evaluated with knee MRI; a minimum follow-up time of 25 months; the absence of large osteochondral fragments (diameter < 15 mm) requiring fixation; the absence of previous or concurrent knee ligament lesions.

The exclusion criteria were: previous surgery of the injured knee; severe neuromuscular or congenital diseases; a Beighton score > 5; severe trochlear dysplasia (Dejour type D); severe patella alta (Insall-Salvati index > 1.4); open growth-plate; inability to comply with the treatment protocol.

Surgical technique

All surgeries were performed by the same surgeon. An anterolateral approach was chosen as the access point for the Elmslie-Trillat procedure. The tibial tuberosity was detached at three points (medial, lateral, proximal), resulting in a distally bony bridge being left intact. After medializing the tibial tuberosity of 10-15 mm (depending on the position of the patella) it was fixed with a four-pronged staple. In addition, a release of the lateral retinaculum and a medial capsular plication were performed.

The knee was immobilized in a full extension brace for 4 weeks. Isometric quadriceps exercises were allowed during this period. Weight-bearing started after the second week. After 4 weeks, the knee brace was progressively given up and range of motion recovery was encouraged. Quadriceps strengthening exercises were allowed after 6 weeks. Return to sport was permitted after 5 months from the surgery.

Non-operative group

In the non-operative treatment group, the patients were immobilized in a full extension knee brace for 4 weeks. Isometric quadriceps exercises were allowed during this period. Weight-bearing started after the second week. After 4 weeks, the rehabilitation program focused on range of motion recovery and quadriceps strengthening. Return to sport was allowed after 3 months from the injury.

Clinical and radiological evaluation

The Knee Society Score (KSS), Lysholm scale were administered pre-operatively or before conservative treatment and at the final follow-up of at least five years in both groups. The Kujala questionnaire[11] was applied in both groups to assess patients' pain and quality of life. Recurrence was defined as a further episode of patellar dislocation after treatment. Patellar instability was defined as recurrence and/or the subjective sensation of subluxation.

Radiographic evaluation included anteroposterior (AP) and lateral (20° of flexion) weight-bearing radiographs of both knees, as well as tangential patella radiographs (30° knee flexion). Tangential patella radiographs were evaluated for patellofemoral osteoarthritis and graded according to Sperner's classification[12]. The Insall-Salvati index for patellar height, the patellar congruence angle as index of subluxation and the sulcus angle for the femoral groove shape were assessed.

TT-TG distance was measured by using 1.5 tesla MRI scan. TT-TG distance was calculated as the horizontal distance between the vertical line passing through the apex of the tibial tuberosity and the vertical line passing through the apex of the trochlear groove as described by Wittstein et al.[13]

All measurements were performed using the ruler application in the Centricity Enterprise Web V2.1 PACS viewing system (GE Healthcare, Chalfont St. Giles, Buckinghamshire, United Kingdom), by the same expert radiologist.

Statistical analysis

An a priori sample size calculation for a binary outcome superiority trial was performed based on the primary outcome measure of Kujala score using an online tool (sealedenvelope.com). Using the Kujala score evaluation of the conservative and surgical groups reported by Petri et al.[14], it was determined that 34 patients (17 in each group) were required to have an 80% chance of detecting an elevation in the Kujala score, at the 5% level.

Before treatment, patients were randomized into two groups through computer-generated blocked-randomization numbers (http://www.randomizer.org). All the patients were informed about the advantages and disadvantages of both treatments. Statistical analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS Statistics 19.0, IBM Corporation., Somers, NY, USA). Statistical significance was defined as $p < 0.05$. Continuous variables were expressed as medians and standard deviations while categorical variables were reported as frequencies and percentages. T-Test and Chi-square Test were used to assess clinical and radiological results respectively.

Results

From the initial 65 patients, 11 patients were excluded from the study. Of them, two patients refused to participate, four presented open growth-plate, one had a large osteochondral fragment, four a Beighton score > 5. In Group A, the Elmslie-Trillat procedure group, 20 patients were assigned, and in Group B, the non-operatively group, 21 patients were enrolled. During the follow-up, one patient for Group A was lost, remaining 19 patients (20 knees), and four patients for Group B, remaining 17 patients (17 knees) (Figure 1). All demographics data, that were similar for the two Groups, were shown in Table 1.

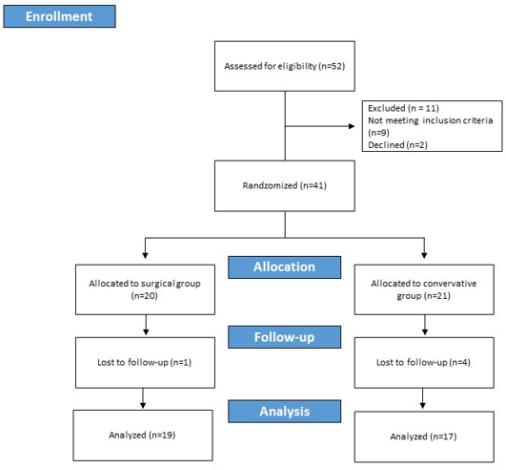

Figure 1 Consort.

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The mean follow-up was 6.4±1.7 years (range 5-8) in Group A and 6.3±2.1 years (range 5-9) in Group B. Table 2 and Table 3 summarize pre- and post-treatment results, respectively. No clinical and radiological differences (p>0.05) between groups were present prior to conservative or surgical treatment (Table 2). At the final follow-up, in Group B a 29.4% rate of recurrence (4 patients) or subluxation (1 patients) was found. Conversely in Group A, only one case (5%) of subluxation was reported. The difference was statistically significance (p<0.05).

Table 1 Demographics data

	Group A	Group B	p-value
Sex, male, n Sex, female, n	10 9	8 9	>0.05
Affected knee, left, n Affected knee, right, n	9 10	8 9	>0.05
Weight, kg	68.7±7.3 (range 54-81)	69.7±8.9 (range 56-84)	>0.05
Age at procedure, y	23.9±8.2 (range 15-40)	24.1 ±6.3(range 17-38)	>0.05
Follow-up period, y	6.4±1.7 (range 3-8)	6.3±2.1 (range 3-9)	>0.05

The two groups resulted homogeneous. No statistically significant differences were present.

Table 2 Clinical and radiological data at the time of the second episode of patellar dislocation, prior to conservative or surgical treatment. No statistical differences were found between groups

	Group A	Group B	p-value
Recurrence/Subluxation	1 patient (5%)	5 patients (29.4%)	<0.05
KSS	86.3±14.5 (range 60-100)	84.7±14.9(range 60-100)	>0.05
Lysholm	91.7±9.2 (range 69-100)	89.7±12 (range 54-100)	>0.05
Kujala	85.5±9.4 (range 76-94)	76.8±8.2 (range 51-94)	<0.05
Sperner (all cases)	1.5±1.1 (range 0-3)	1.9±1 (range 0-4)	>0.05
Grade 0, n	4	1	
Grade 1, n	6	5	
Grade 2, n	5	6	
Grade 3, n	5	4	
Grade 4, n	0	1	

Table 3 Post-treatment data

	Group A	Group B	p-value
Insall-Salvati index	0.83 (range 0.8-1.4)	0.90 (range 0.7-1.3)	>0.05
Sulcus angle	133.6±9.1 (range 116-150)	135.1±6.3 (range 127-143)	>0.05
KSS	65.6±20.1 (range 28-85)	66.3±20.4 (range 28-85)	>0.05
Lysholm	65.1±23.8 (range 23-95)	67.4±21.1 (range 23-90)	>0.05
Kujala	72.6±15.7 (range 41-94)	73.2±17.1 (range 41-91)	>0.05
Sperner	1.1±0.7 (range 0-2)	1.3±0.7 (range 0-2)	
Grade 0, n	5	3	
Grade 1, n	8	6	>0.05
Grade 2, n	7	8	
Grade 3, n	0	0	
Grade 4, n	0	0	

Clinical and radiological data at the final follow-up after the conservative or surgical treatment. Significantly lower recurrence rate and significantly higher mean Kujala score was found in Group A. No other significant differences in clinical and radiological outcomes were found.

Similar post-treatment KSS and Lysholm score were found between groups. The mean Kujala score was significantly lower in the Group B than in Group A (85.5±9.4 vs 76.8±8.2; p<0.05). In Group A, KSS and Lysholm score showed significant differences between pre- and post-operatively values (65.6±20.1 and 65.1±23.8 vs 86.3±14.5 and 91.7±9.2, respectively; p<0.05). In group A one case (5%) of painful staple, which needed re-operation for hardware removal, occurred. At the final follow-up, the mean grade of patellofemoral osteoarthritis according to Sperner's classification changed from 1.1±0.7 (range 0-2) to 1.5±1.1 (range 0-3) in group A, with 5 patients (25%) having a grade 3 patellofemoral osteoarthritis. In Group B, the mean post-treatment grade was 1.9±1 (range 0-4), with 4 patients (20%) having a grade 3 and one case a grade 4 (Figure 2). No statistically differences were found between groups at final follow-up (p>0.05).

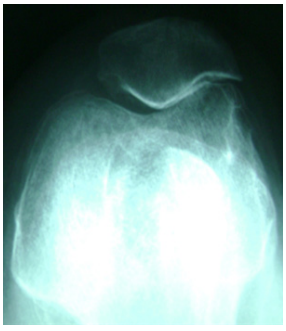

Figure 2 Tangential patella view of a conservative treatment patient, showing a grade IV according to Sperner's classification at 6.9 years of follow-up.

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Discussion

The main finding of this perspective study is that the Elmslie-Trillat procedure is a safe and effective option in patellar re-dislocation treatment, relieving inability and reducing recurrence risk. However, it did not avoid the degenerative changes that normally occur in patellar instability even at a mid-term follow-up.

Even though algorithms based on individual risk factors have been recently proposed[15,16] to decide between surgical or conservative treatment for first time patellar dislocation, conservative management is still considered the mainstay if concurrent loose bodies or osteochondral fracture are not present.[3,4] When re-dislocation occur, surgical treatment represents the option of choice. There are many studies relating to the surgical treatment of patellar dislocations with more than 100 surgical, open, or arthroscopic techniques, but few controlled randomized studies[17] and systematic review[18,19] comparing the non-operative and surgical treatments.

The Elmslie-Trillat procedure is a distal bony realignment procedure involving medialization of the tibial tuberosity, lateral retinacular release and medial capsular reefing. Indications to perform an Elmslie-Trillat procedure for patellar instability consist in the presence of several risk factors for recurrence (precluding the chance that an isolated procedure may work) and almost the concurrent presence of an increased TT-TG. Several studies have documented clinical short- to long-term results of this procedure and its modifications revealing good or excellent functional results.[19–23] Clinical outcomes found in the current study are in line with recent literature, reporting excellent result on the clinical scales at a mean follow- up of 6.4±1.7 years. It is noteworthy that no statistically significant difference was present between surgical and conservative groups, except for the mean Kujala score which was significantly lower in the Group B than in Group A.

The current study enrolled all patients with a TT-TG > 20 mm and excluded patients with a high grade of other recurrence risk factors (e.g., Dejour type D trochlea; severe patella alta; or Beighton score >5). The current study confirmed that in such cases the Emslie-Trillat procedure is associated with a lower recurrence risk than conservative treatment, representing the main advantage of the surgical treatment. Similar results were found by Christensen et al.,[24] who showed a recurrence risk of 36 % in their retrospective study on 584 patients treated conservatively and followed for 12.4 years.

However, the long-term benefit with respect to osteoarthritic changes of the operated knee joint is still unknown. Surgeries performed to address recurrent patellar dislocation may alter the native joint kinematics due to modified and rerouted knee extensor direction. According to a recent meta-analysis,[25] surgical treatment is associated with a higher risk of patellofemoral osteoarthritis. The study concluded that a delay in surgical intervention, allowing recurrent dislocations to cause further chondral damage, might be responsible for the high risk of osteoarthritis observed. However, other studies have pointed out that Elmslie-Trillat procedure changes intra-articular load distribution. A cadaveric study[26] investigating the effects of tibial tuberosity medialization found a significant increase of patellofemoral contact pressure and increased pressure in the medial tibiofemoral joint compartment when over-medialization of the tuberosity was undertaken. The altered joint pressure distribution due to the modified kinematics of the knee was found to negatively influence the applied correction itself obtained with the surgical treatment.

However, according to our knowledge the long-term effects of tuberosity medialization on potential development of osteoarthritis in vivo are still unknown. Farr et al.[10] re-evaluated 26 patients at a mean follow-up of 20 years. The authors concluded that the Elmslie-Trillat procedure was associated with several cases of advanced tibiofemoral and patellofemoral osteoarthritis in the long term. However, two limitations of their study need to be mentioned. Firstly, all but one patient in the cohort were of female gender and it is well known that women are k at the highest risk of recurrent patellar dislocation. Secondly, the authors did not report the number of patellar re-dislocations episodes and the pre-operative condition of osteoarthritis.

In the current study the mean grade of patellofemoral osteoarthritis changed from 1.1±0.7 (range 0-2) to 1.5±1.1 (range 0-3) in surgical group; but in conservative group it changed from 1.3±0.7 (range 0-2) to1.9±1 (range 0-4). The difference was not statistically significant, suggesting that surgical treatment could not be able to avoid the degenerative changes due to the natural evolution of patellar dislocation.

Nikku et al.[27] compared non-operative treatment and lateral proximal realignment surgery in their randomized prospective study on 125 patients over an average period of 7 years. Their clinical results were very similar between groups, but they did not recommend proximal realignment surgery for the treatment of primary patellar dislocations. To the best our knowledge, this paper represents the first prospective randomized study comparing clinical and radiological results with Elmslie-Trillat procedure or non-operative treatment in the management of second episode of patellar dislocation and this is the main strength of the study.

The current study also has some drawbacks: firstly, the follow-up period is relatively short to deeply evaluate the recurrence rate and the degenerative changes. Secondly, the study population is not so big in comparison with other studies present in the literature. However, we believe that our statistical analysis presented power of comparison in relation to the score used, since it was necessary for the sample size to be at least 16 patients per study group and with a power of 80 % and type I error (a) of 0.05.

Conclusion

This study confirms that Elmslie-Trillat is a safe and effective procedure in the treatment of patellar instability. Even though excellent clinical results and lower re-dislocation rate are present, it does not seem to be able to avoid the degenerative changes occurring in the natural evolution of patellar dislocation even at a mid-term follow-up.

Article highlights

Research background

Patellar dislocations may cause long term functional impairments, knee pain and osteoarthritis. The recurrence rate after non-operative treatment of patellar dislocation is 15 to 44%. Non-operative treatment is an appropriate option for first time dislocation.

Research motivation

When conservative management fails, surgery is indicated to prevent recurrences and related sequelae. Numerous surgical procedures have been proposed. The Elmslie-Trillat procedure is a distal bony realignment procedure involving medialization of the tibial tuberosity, lateral retinacular release and medial capsular reefing. No studies compared this procedure with non-operative management.

Research objectives

This study aims to compare the mid-term clinical and radiological results between surgical and conservative treatment in traumatic patellar re-dislocation.

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Research methods

36 patients with patellar re-dislocation were randomly divided in two groups. Nineteen received an Elmslie-Trillat procedure (Group A), and 17 were treated non-operatively (Group B). Clinical outcomes were collected preoperatively and at the final follow-up using the Knee Society Score (KSS), the Lysholm scale, and the Kujala questionnaire. Tangential patella radiographs were evaluated for patellofemoral osteoarthritis and graded according to Sperner's classification.

Research results

The mean follow-up was 6.4 years in Group A and 6.3 in Group B. In Group A, the KSS and Lysholm scale showed significant differences between baseline and final follow-up values ($p<0.05$). The mean Kujala score was significantly lower in Group B than in Group A (76.8±8.2 vs 85.1±9.4; $p<0.05$). The mean grade of osteoarthritis according to Sperner's classification at the final follow-up was lower in Group A (1.5), than in Group B (1.9).

Research conclusions

Although the Elmslie-Trillat procedure is safe and effective in the treatment of patellar instability, it does not seem to be able to avoid the degenerative changes due to the evolution of patellar dislocation.

Research perspectives

Further studies with longer follow-ups and larger samples are needed to compare the clinical and radiol radiological results of these two procedures.

Acknowledgments

None.

Conflicts of interest

The authors declare no conflicts of interest.

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