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Comparison of medial patellofemoral ligament reconstruction associated with lateral retinacular release vs conservative treatment for first-time acute patellar dislocation: clinical outcomes and recurrence risk

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Summary. Purpose. The present study aimed to compare medial patellofemoral ligament (MPFL) reconstruction associated with lateral retinacular release (LRR) and conservative treatment for patients with first-time acute patellar dislocation in absence of the underlying anatomical high-risk factors for further patellar dislocations. **Methods.** We enrolled 39 consecutive patients who were treated with MPFL reconstruction associated with LRR for first-time acute patellar dislocation at our institution from August 2018 and August 2021. To compare the treatment results between the MPFL reconstruction associated with LRR and conservative treatment, a consecutive series of 84 first-time acute patellar dislocation patients with conservative treatment without underlying anatomical high-risk factors were included as a control group, and demographics and clinical characteristics of patients in different groups were compared. **Results**. Notably, nearly all postoperative complications occurred in the control group, and no recurrent instability was found in the MPFL group, compared with 11.9% in the control group ($p<0.05$). All the patients had functional outcome scores available at a mean of 23.7 ±5.7 months, and there was a statistically significant improvement in the international knee documentation committee (IKDC) score, Lvsholm score and visual analogue scale (VAS) score at the final follow-up ($p<0.001$, respectively). Furthermore, the IKDC score, Lvsholm score and VAS score were significantly improved in the MPFL group patients than those in the controls group patients ($p<0.05$, respectively). **Conclusions**. Based on the available evidence, the surgical MPFL reconstruction associated with LRR of first-time acute patella dislocation in absence of the underlying anatomical high-risk factors are associated with better clinical outcomes and a lower risk of recurrent dislocation compared with non-surgical treatment. Surgery should be considered as the better choice for these specific patients.

Key words. Acute patellar dislocation, medial patellofemoral ligament reconstruction, lateral release, functional outcome, patellofemoral instability.

Confronto tra la ricostruzione del legamento femoro-rotuleo mediale associata al release retinacolare laterale e il trattamento conservativo per la prima lussazione acuta della rotula: risultati clinici e rischio di recidiva

Riassunto. Scopo. Il presente studio ha l'obiettivo di confrontare la ricostruzione del legamento patellofemorale mediale (MPFL) associata al rilascio del retinacolo laterale (LRR) con il trattamento conservativo nei pazienti con prima lussazione acuta della rotula, in assenza di fattori anatomici predisponenti ad alto rischio di recidiva. **Metodi.** Sono stati arruolati 39 pazienti consecutivi trattati con ricostruzione del MPFL associata a LRR per una prima lussazione acuta della rotula presso la nostra struttura tra agosto 2018 e agosto 2021. Al fine di confrontare i risultati del trattamento chirurgico con quelli del trattamento conservativo, è stato incluso un gruppo di controllo composto da 84 pazienti consecutivi con prima lussazione acuta della rotula trattati in modo conservativo, anch'essi senza fattori anatomici predisponenti ad alto rischio. Sono state quindi confrontate le caratteristiche demografiche e cliniche dei pazienti nei due gruppi. **Risultati.** È stato osservato che quasi tutte le complicanze post-operatorie si sono verificate nel gruppo di controllo e non sono stati rilevati episodi di instabilità recidivante nel gruppo MPFL, rispetto all'11,9% del gruppo di controllo ($p<0,05$). Tutti i pazienti hanno fornito i punteggi di esito funzionale a un follow-up medio di 23,7 ± 5,7 mesi, evidenziando un miglioramento statisticamente significativo nei punteggi dell'International Knee Documentation Committee (IKDC), del punteggio di Lysholm e della scala analogica visiva (VAS) al follow-up finale ($p<0,001$ per ciascuno). Inoltre, i punteggi IKDC, Lysholm e VAS erano significativamente superiori nei pazienti del gruppo MPFL rispetto a quelli del gruppo di controllo ($p<0,05$ per ciascuno). **Conclusioni.** In base ai dati disponibili, la ricostruzione chirurgica del MPFL associata a LRR, in caso di prima lussazione acuta della rotula senza fattori anatomici predisponenti, è associata a migliori risultati clinici e a un minor rischio di recidiva rispetto al trattamento non chirurgico. L'intervento chirurgico dovrebbe essere considerato l'opzione preferibile per questi pazienti selezionati.

Parole chiave. Lussazione acuta della rotula, ricostruzione del legamento patellofemorale mediale, rilascio laterale, esito funzionale, instabilità patellofemorale.

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Introduction

Acute patellar dislocation is the most common injury to the patellofemoral joint, with an annual incidence of 77 per 100,000 and accounting for 2-3% of all knee injuries[1]. Recent epidemiologic studies have shown that the recurrence rate after the first dislocation episode is as high as 17%, and for recurrent dislocations, it can be as high as 49%. Therefore, many studies recommend surgery for patients experiencing their first patellar dislocation[2].

There are various surgical techniques and grafts available that have shown satisfactory outcomes for first-time patellar dislocation patients[3-5]. Among these techniques, medial patellofemoral ligament (MPFL) reconstruction and lateral retinacular release (LRR) are less invasive options that can be performed in patients with open growth plates. Several authors have favored these techniques as they have proven to restore patellofemoral joint stability[2,4,6]. MPFL reconstruction with LRR is considered the primary treatment for recurrent patellar instability in patients without anatomical risk factors such as trochlea dysplasia, patella alta, increased tibal tuberosity trochlear groove (TT-TG) distance, and high lateral patella tilt[7,8].

However, there is limited research comparing surgery to conservative treatment, and most studies do not account for different underlying anatomical risk factors. The aim of this study is to compare the outcomes of MPFL reconstruction and LRR with conservative treatment in first-time acute patellar dislocation patients without underlying anatomical high-risk factors for further dislocations. Also, we hypothesized that patients receiving MPFL reconstruction associated with LRR would experience fewer episodes of patellar instability and have better patient reported outcome scores, compared with conservative treatment patients.

Methods

Patient selection

We enrolled 39 consecutive patients who received MPFL reconstruction associated with LRR for first-time acute patella dislocation at our institution between August 2018 and August 2021. As a control group, we included a consecutive series of 84 first-time acute patellar dislocation patients who received conservative treatment and did not have any underlying anatomical high-risk factors.

The inclusion criteria for the study were as follows: 1) first-time acute patellar dislocation; 2) TT-TG distance < 20 mm on CT; 3) positive apprehension test during clinical examination; 4) patients with a minimum postoperative follow-up of 1 year.

The exclusion criteria for the study were as follows: combined procedures (such as cartilage transplantation, femoral or tibial osteotomy); preoperative knee MRI revealing any other concomitant disease, cartilage or soft tissue injury (such as instability of the cruciate, collateral ligaments, or cartilage injury); previous surgical history of the affected knee; bilateral cases. Additionally, patients with concomitant pathologies (such as significant psychiatric or neuromuscular conditions) that could potentially affect accurate evaluation were also excluded from this study.

Data collection and outcome assessment

The patients' demographics and clinical characteristics were meticulously recorded, which included age, gender, side, and mechanism of injury, comorbidities, as well as preoperative and postoperative IKDC score[9], Lvsholm score, and visual analogue scale (VAS)[10]. Physical examination and radiography of patients were assessed independently by two investigators who were unaware of the patients' information. Regular imaging and knee functional examinations were conducted after surgery (at 1, 3, 6, 12 months, and yearly until the final follow-up).

Surgical techniques

All procedures were performed by same experienced fellowship trained orthopedic surgeons. Following spinal anesthesia, patients were positioned supine and a pneumatic tourniquet was applied. A 2cm longitudinal incision was made over the pes anserinus to harvest the gracilis tendon. The tendon was then dissected and harvested using a tendon stripper. The ends of the tendon were whipstitched with a No. 0 fiber wire (Smith & Nephew). Arthroscopic evaluation and treatment of the intraarticular lesions were performed. Using an electrocautery, we performed LRR starting from the proximal to the distal pole of the patella. The procedure began below the distal end of the vastus lateralis obliquus, near the lateral aspect of the patella to prevent involvement of the iliotibial band. We considered the release to be satisfactory if a patellar tilt of 90 degrees was achievable. After preparing the medial patella edge, a V-shaped tunnel (with an angulation of approximately 120° and a bone bridge >15 mm) was drilled from the superomedial pole to the middle of the medial facet of the patella using two guide pins (figure 1). Subsequently, the tunnel was dilated with a 4.5mm hollow drill and the tendon grafts were passed through the bone tunnel (figure 2). A guide pin was drilled from a 1-cm incision over the area of the femoral insertion, advanced to the opposite cortical bone, and the tunnel was dilated with a 7mm hollow drill. The tendon grafts were then passed through the bone tunnel (figure 3). The tails of the tendon grafts were fixed with an anchor to the femur, and motion with varying degrees of knee

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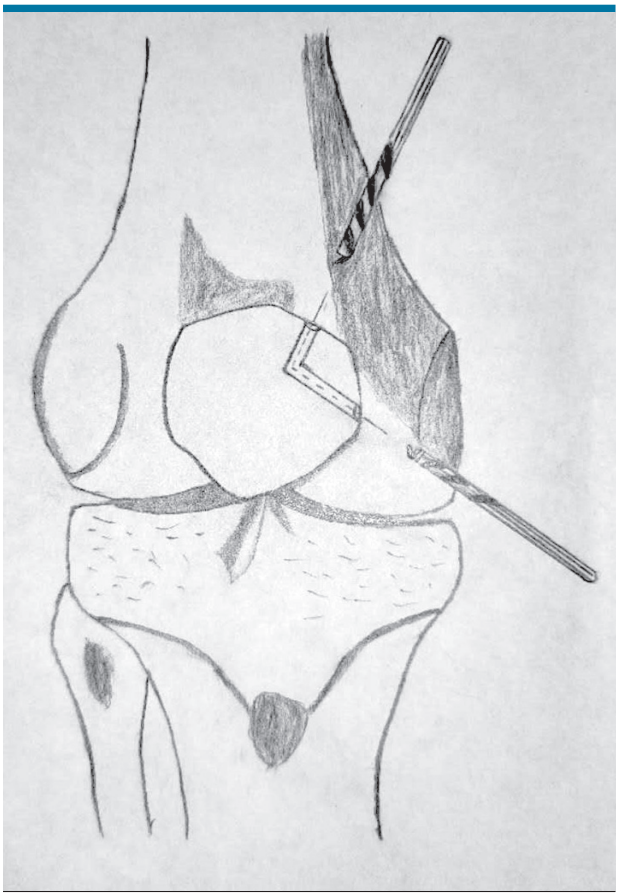

Figure 1. a V-shaped tunnel (with an angulation of approximately 120° and a bone bridge >15 mm) was drilled from the superomedial pole to the middle of the medial facet of the patella using two guide pins.

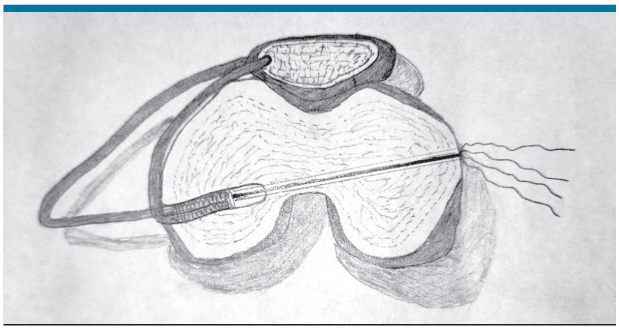

Figure 2. the tunnel was dilated with a 4.5mm hollow drill and the tendon grafts were passed through the bone tunnel.

Figure 3. The drawing illustrates the graft extending from the patella to the femoral bone tunnel. The armed ends of the graft are inserted into the blind-ending bone tunnel located at the medial femoral condyle.

flexion was used to maintain the appropriate position and tension of the graft.

Postoperative management

Regarding the MPFL reconstruction associated with LRR patients, the rehabilitation protocol involved initiating active circum-movements of the ankle and quadriceps strengthening exercises within the first 24 hours post-operation. In the initial 6 weeks, an adjustable knee brace was used to mobilize the knee joint. Patients were allowed to walk non-weight-bearing with two crutches for the first postoperative 4 weeks. Patients were advised to gradually begin partial weight-bearing with crutches after 4 weeks and were encouraged to engage in strengthening exercises for the vastus medialis muscle. At 6-8 weeks postoperatively, patients could bear full weight without any limitations. It was recommended to undergo a rehabilitation period of 10-12 weeks before resuming sporting activities.

In the conservative treatment group, patients undergo knee joint puncture to eliminate hemarthrosis and relieve pain. Isometric quadriceps muscle training is initiated within the first 6 weeks, as soon as the patient can tolerate it. The knee joint is mobilized using an adjustable knee brace, and partial weight bearing with crutches is allowed based on the patient's tolerance. At 6-8 weeks postoperatively, the knee brace can be removed, and full-weight bearing without limitation is permitted. It is recommended to undergo 10-12 weeks of rehabilitation before engaging in sporting activities.

Statistical analysis

Mean values ± standard deviation (SD) were used to present quantitative variables. Continuous data were examined for normality with the Shapiro–Wilk test, and group comparison was done using the student's t-test. Count variables were reported as numbers and percentages and analyzed with the Chi-square test. Statistical significance was considered for P values below 0.05. Data analysis was conducted using SPSS Version 22 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp).

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Results

Patient demographics

The patients' demographics were displayed in table 1. Specifically, there were no notable disparities in demographic data, injured side, comorbidities, and mechanism of injury between the two surgical groups (p>0.05, respectively). The average follow-up period was 24.1±6.0 months in the MPFL group and 23.5±5.6 months in the control group, with no significant distinction observed in the follow-up duration between the two groups (P > 0.05).

Complications

The study observed that the controls group experienced almost all postoperative complications, resulting in an overall complication rate of 2.6% in the MPFL group and 16.7% in the controls group. Additionally, recurrent instability was not observed in the MPFL group, whereas the controls group had a complication rate of 11.9% (p<0.05).

Functional results of the study groups

The clinical outcomes of the patients are presented in table 2. All patients had functional outcome scores available at an average of 23.7 ±5.7 months. There was a significant improvement in the IKDC score, Lvsholm score, and VAS score at final follow-up (p<0.05, respectively). However, the MPFL group patients demonstrated significantly better improvement in the IKDC score (MPFL group: 87.7±6.3 vs. controls group: 78.2±11.9), Lvsholm score (88.6±7.3 vs. 77.9±12.4), and VAS score (1.3±0.9 vs. 1.5±1.1) compared to the control group patients (p<0.05, respectively).

Table 1. Patient demographics in different groups.

Characteristic	MPFL group (39)	Controls group (84)	P
Age (y)	21.3±12.1	22.5±7.8	0.508
Gender: male n (%)	17 (43.6%)	54 (64.2%)	0.250
Mechanism of injury			
Running	18	31	0.527
Traffic accident	10	21	0.953
Basketball	8	19	0.833
Other	3	13	0.391
Comorbidities			
Diabetes mellitus	1	0	0.323
High blood pressure	2	1	0.247
Smoking status	3	11	0.550
Alcohol consumption status	5	9	0.768
Postoperative complications			
Recurrent instability		10	0.030
Stiffness	1	2	1
Hematoma	0	1	1
Deep-vein thrombosis	0	1	1
Injured side: right n (%)	26(66.6%)	46(54.7%)	0.533
Follow-up time (month)	24.1±6.0	23.5±5.6	0.627

MPFL: medial patellofemoral ligament.

Table 2. Functional and clinical result of the study groups.

Characteristic	MPFL group (39)	Controls group (84)	P
Preoperative VAS score	5.3±1.2	5.2±1.3	0.861
Preoperative Lvsholm score	56.4±8.5	57.6±6.0	0.453
Preoperative IKDC score	57.4±8.3	58.1±6.3	0.603
Postoperative VAS score	1.3±0.9 a	1.5±1.1 a	0.337
Postoperative Lvsholm score	88.6±7.3 a	77.9±12.4 a	< 0.001
Postoperative IKDC score	87.7±6.3 a	78.2±11.9 a	< 0.001

MPFL: medial patellofemoral ligament; VAS: visual analogue scale; IKDC: international knee documentation committee; a significant improvement in the Lysholm score, IKDC score and VAS score (P < 0.001).

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Discussion

The main finding of this study is that MPFL reconstruction associated with LRR yielded better outcomes than conservative treatment for first-time acute patella dislocation patients without underlying anatomical high-risk factors for further dislocations.

Recent epidemiologic studies have shown that the recurrence rate after the first dislocation episode is as high as 17%, and for recurrent dislocations, it can be as high as 49%. Therefore, many studies recommend surgery for patients experiencing their first patellar dislocation[2]. Compared to the conventional procedures for stabilizing the patellofemoral joint, MPFL reconstruction associated with LRR offer a less invasive alternative that can be performed in patients with open growth plates. These procedures have been shown to effectively restore stability[11]. In cases where patellar instability occurs without any underlying anatomical risk factors, MPFL reconstruction associated with LRR can successfully restore stability during knee joint motion and are now considered the primary treatment for recurrent patellar instability[11,12]. Some studies have suggested that if a primary patellar dislocation occurs and an underlying anatomical factor is identified, surgical intervention is preferred over conservative treatment[2,13]. Therefore, it is necessary to compare the effectiveness of MPFL reconstruction with conservative treatment in patients with patellar instability, in the absence of underlying anatomical high-risk factors, to prevent further patellar dislocations.

Various complications, such as anterior knee pain, knee stiffness, recurrent dislocation, and patellar fracture, have been described in the literature regarding MPFL reconstruction. In a systematic review and meta-analysis conducted by Cohen et al.[8], the results of 19 studies and 1,165 patients were investigated. The study found that the incidence of re-dislocation was 7% in the MPFL reconstruction group compared to 30% in the rehabilitation group. Additionally, the MPFL reconstruction group showed higher knee functional scores compared to the rehabilitation group. Another study by Rueth et al.[14] examined the treatment results of MPFL reconstruction in 101 patients with acute patellofemoral dislocation. The study reported a complication rate of 2.9% and a re-dislocation rate of 0.9%. The study also found that MPFL reconstruction effectively improved Kujala scores from 47.1 preoperatively to 85.3 postoperatively at a mean follow-up of 32.0 ± 12.1 months. Previous studies have also shown that isolated MPFL provides good protection against new lateral patellar dislocations in patients with few anatomical risk factors. A systematic review comparing MPFL repair and reconstruction for patella instability revealed that repair had a repeat dislocation rate of 26.9%, while reconstruction had a rate of 6.6%[15]. In our study, recurrent instability was not observed in the MPFL group, compared to a 11.9% complication rate in the control group. This information can assist surgeons in making decisions regarding the early use of MPFL reconstruction and LRR versus conservative treatment for patients experiencing first-time patellar dislocations.

Regalado et al.[16] specifically commented on the outcome of their study, noting that 80% of surgically treated patients achieved excellent outcomes in terms of returning to sport, while only 47% of conservatively treated patients achieved a similar outcome. In a prospective study by Pradyuma et al.[4], the results of 76 patients with acute first-time patellar dislocation adolescents were investigated. The study found that performing MPFL reconstruction resulted in a 5-fold reduction in recurrent instability and improved patients' ability to return to sports compared to not treating the MPFL. In the systematic review conducted by Migliorini et al.[1], the role of synthetic graft for primary MPFL reconstruction in patients with recurrent patellofemoral instability was investigated. Data from 199 patients were collected, and it was observed that all the scores of interests showed improvement at the last follow-up. The Kujala score increased by 24.8 (P=0.0002), the Lysholm score increased by 42.0 (P=0.02), the Tegner score increased by 1.2 (P=0.03), and the IKDC score increased by 20.9 (P=0.02). Malatray et al.[17] conducted a study involving 33 patients who underwent MPFL reconstruction with arthroscopic LRR. The patients were evaluated for a minimum of 12 months, and the study found that MPFL reconstruction with LRR is an effective method for improving knee function, as indicated by the postoperative IKDC scores of 86±20 at the final follow-up period. Consistent with previous studies, our findings also showed significant improvements in the IKDC score (MPFL group: 87.7±6.3 vs. controls group: 78.2±11.9), Lvsholm score (88.6±7.3 vs. 77.9±12.4), and VAS score (1.3±0.9 vs. 1.5±1.1) in the MPFL reconstruction and LRR group patients compared to the controls group patients.

Several limitations were identified in this study. Firstly, it should be noted that our study is a single-center non-randomized retrospective study, which may introduce bias into the results due to the relatively small number of acute first-time patellar dislocation patients treated with MPFL reconstruction and LRR, fortunately, almost all patients had a CT scan on admission or outpatient service. Secondly, our observations were limited to the physical examination and radiography of patients who underwent operative treatment, with an average follow-up period of 24.1±6.0 months. Therefore, a prospective study with long-term follow-up is needed to further investigate these findings.

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Conclusions

Based on the available evidence, surgical MPFL reconstruction associated with LRR is found to have better clinical outcomes and a lower risk of recurrent dislocation compared to conservative treatment for first-time acute patella dislocation in patients without underlying anatomical high-risk factors. Therefore, surgery should be considered as the preferred choice for these specific patients.

Conflicts of interest. The authors declare that there is no conflict of interest.

*Ethics approval and consent to participate***.** This study was approved by the ethics committee of the Jiangxi Provincial People's Hospital (The First Affiliated Hospital of Nanchang Medical College). All procedures performed in this study involving human participants were in accordance with the bioethical standards of the institutional and national research committees and with the 1964 Declaration of Helsinki and its later amendments. Written informed consent was obtained from individual or guardian participants.
*Consent for publication***.** Not applicable.

*Availability of data and materials***.** The datasets generated and/or analyzed during the current study are not publicly available due to data containing information that could compromise research participant privacy/consent but are available from the corresponding author on reasonable request.

*Competing interest statement***.** No benefits in any form have been or will be received from any commercial party related directly and indirectly to the subject of this manuscript. And all authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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*Authors' contribution***.** LM contributed to the study conception and design. Material preparation, data collection, analysis, and the first draft of the manuscript was written by BG, NS and LH. BG, and LM were responsible for reviewing and revising the manuscript, and all authors commented on previous versions of the manuscript. All authors have read and approved the final manuscript.

*Acknowledgments***.** All the authors contributed equally to this study and share first authorship.

Levels of Evidence. III, Case-control study Retrospective comparative study.

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