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Case Series

Medial patellofemoral ligament reconstruction using autologous hamstring graft for recurrent patellar dislocation: a clinical and functional outcome evaluation

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ABSTRACT

Patellofemoral instability is a painful and often recurring disorder with many negative long-term consequences. Surgical treatment for patellar dislocation has evolved from the initial medial reefing to the present-day anatomical reconstruction of medial patellofemoral ligament (MPFL) which is thought to be the most appropriate treatment. MPFL reconstruction successfully addresses patellofemoral instability by restoring the deficient most important static primary soft tissue restraint. This prospective case series was conducted at a Tertiary care Govt. Hospital in Kolkata between January 2019 to August 2020 on 15 patients who underwent MPFL reconstruction for recurrent patellar dislocation. All patients were followed up at an interval of 2 weeks, 6 weeks, 3 months and 6 months. Kujala score was used to assess the functional outcomes of the patients. Out of 15 patients, 13 (86.7%) showed good to excellent results whereas 2 (13.3%) had Fair outcome and none of the patients demonstrated Poor surgical result. The mean Kujala score improved from 49.6 pre-operatively to 92.7 post-operatively. By the end of 6 months follow-up, 13 (86.7%) patients achieved almost full range of motion. Majority (80%) of patients did not have any complications. Only 2 patients had a post-operative recurrence (13.3%). Reconstruction of MPFL using autologous hamstring graft showed excellent results over the short term with a low re-dislocation rate and acceptable complication rates. It greatly helps in preventing further episodes of patellar subluxations or dislocations and in improving quality of life.

Keywords: Recurrent patellar dislocation, MPFL, Patellofemoral instability, Hamstring tendon

INTRODUCTION

Acute patellar dislocation is a common injury, especially among adolescents, and is usually related to sports and physical activities.[1] Patellofemoral dislocations are commonly seen with a sudden quadriceps contraction in a valgus knee, when the knee is flexed over an externally rotated tibia. The overall recurrence rate after primary patellar dislocation approaches 40%.[2] Patients who have a primary patellar dislocation have a 17% recurrence rate, and patients who sustain repeated patellofemoral joint dislocation have a 49% recurrence rate.

The medial patellofemoral ligament (MPFL) is a vital structure in the knee joint that provides stability to patella during movement of the knee. It acts as a check rein ligament which prevents patellar dislocation during early flexion of the knee before the patella engages in the trochlea.[3]

The MPFL acts as the main ligament restricting lateral displacement of the patella at knee flexion of between 0^0 and 30^0.[4] Because of its biomechanical properties, it is essential for controlling the normal kinematics of the patellofemoral joint.[5] During the first episode of traumatic patellar dislocation, this anatomical structure becomes

partially or totally torn. This injury is considered to be an essential factor enabling development of recurrent dislocation.[6]

A rupture of MPFL always occurs in lateral patellar dislocation because it can undergo a maximum elongation of 20-30% (range: 18 to 20 mm); this is far less than the patellar width, which often exceeds 40 mm.[7]

Those patients who have suffered acute patellar dislocation are prone to subsequent dislocations.[8] Long term complications of acute patellar dislocations are pain, patellar instability, recurrent dislocations, decreased level of sporting activity and patellofemoral arthritis.[2,9] Re-dislocation rates after non-operative management of primary patellar dislocation is around 15-44%.

Studies have shown that the MPFL is the main stabilizer against lateral patella dislocation and its reconstruction will regain patellofemoral stability in patients with recurrent patellar instability.[10-12] The goal of MPFL reconstruction is to reconstitute the medial restraint of the patella, thereby resisting lateral dislocation and restoring stability. MPFL reconstruction is the procedure of choice if the patient experiences patellofemoral dislocation despite adequate, non-surgical rehabilitation following a primary patellofemoral dislocation.

There have been various surgeries done for the structures around the patella which are thought to influence its stability in an attempt to prevent further dislocations. Consensus has been reached that MPFL is the single most important medial stabilizer that needs to be repaired or reconstructed to prevent further dislocation. Surgical treatment for patellar dislocation has evolved from the initial medial reefing to the present-day anatomical reconstruction of MPFL which is thought to be the most appropriate treatment.

The objective of this study was to represent our experience comprising cases of recurrent patellar dislocation which were treated by medial patellofemoral ligament reconstruction and to evaluate efficacy of this surgical method and assess the overall outcome, both clinical and functional, of patients treated by this technique.

CASE SERIES

A prospective case series study was conducted on 15 patients with recurrent patellar dislocation who were treated by MPFL reconstruction in the Department of Orthopedics, IPGMER and SSKM Hospital, Kolkata from January 2019 to August 2020. All the patients were operated by same team of orthopedic surgeons belonging to a specified unit. The patients were subjected to a thorough history, clinical examination and pre-operative routine laboratory investigations, which was supplemented by radiographs in antero-posterior, lateral and skyline view of the knee joint and an MRI.

Procedure

All the patients were operated under spinal anesthesia. Patients were positioned supine on an operating table with side post and pneumatic tourniquet was used. Examination under anesthesia was performed, confirming the presence of lateral patellar dislocation in flexion, lateral retinacular tightness, and reduced patellar eversion; medial and the lateral patellar translation (measured in quadrants); and ROM.

Diagnostic arthroscopy was performed to remove any loose osteochondral body from patella or the lateral femoral condyle. Other intra-articular pathologies were addressed, and patellar tracking was assessed. A semitendinosus alone or semitendinosus with gracilis graft was harvested through a 3 cm longitudinal incision 3 cm medial to the inferior portion of the tibial tuberosity. An absorbable Krackow suture was placed in each tail of the graft. A 2 cm longitudinal incision was made along the medial border of patella over the anatomical insertion of MPFL. After the skin and subcutaneous tissue, blunt dissection was done to spread between layers 2 and 3 (between the MPFL and the capsular layer) to expose the patellar medial border. Extraarticular dissection was done. The superomedial border of the patella was freshened creating a longitudinal bony trough at the insertion site of MPFL. Two suture anchors were placed in the superomedial quadrant of patella to the north of the equator, aiming infero-laterally. Both the anchors were inserted in a parallel fashion. Care was taken not to damage the patellar articular cartilage. The prepared graft was placed in the trough on the medial border and was tied down using one set of sutures from the anchor. The second set of sutures was used to transfix the graft to the patellar periosteum for extra strength. The adductor tubercle and medial epicondyle were palpated and a second 2 cm longitudinal incision was put between the two. Dissection was then performed under the vastus medialis obliquus till the medial epicondyle for graft passage between the second (retinacular) and the third (capsular) layer. A 7 mm bony tunnel was then created over a guidewire at a point anterior to the midpoint between adductor tubercle and medial epicondyle, at the isometric point, under fluoroscopy. The isometric point was identified in a coronal plane, proximal to the level of the posterior point of the Blumensaat line, 1 mm anterior to the posterior cortex extension line and 2.5 mm distal to the posterior origin of the medial femoral condyle. The graft was then passed under the vastus medialis obliquus and pulled through the prepared tunnel into the femur. The patella was held at the lateral border of trochlea and under adequate tension, the graft was fixed with a bio-composite interference screw equal to tunnel diameter, with knee in 30^0 flexion and the foot in neutral rotation. Implant positions were confirmed through fluoroscopy. Satisfactory and stable patellar tracking was checked. Surgical wound was closed in layers. Sterile dressings were applied to the surgical incisions and a long knee immobilizer was applied.

Rehabilitation

Postoperatively, long knee brace immobilization was done for 3 weeks. In the brace intermittent passive flexion and extension movement were gradually allowed from 0-90^0. The patients were encouraged to do static quadriceps and hamstring exercises in the knee brace from day 1. After 1 week, toe touch crutch walking with long knee brace was given. After 3 weeks, the knee brace was discarded and active knee ROM exercises with full weight bearing was allowed. After 6 weeks, resistance exercises of quadriceps and hamstring along with all activities of daily living were started. High impact activities were allowed after 3 months and sports activities were allowed after 6 months. The patients were regularly followed up for 6 months (2 weeks, 6 weeks, 3 months and 6 months) for clinical as well as functional evaluation.

Results

Overall, 80% patients were between the age group of 18-25 years. The youngest patient was 18 years old and the eldest patient was 30 years old. The mean age in this study was 22.7 years.

Table 1: Age distribution.

Age (years)	No. of patients	Percentage (%)	P value
18-20	6	40	0.001
21-25	6	40	
26-30	3	20	
Total	15	100.0	

4 patients (26.7%) were male and 11 patients were female (73.3%).

The number of Right knee involvement was 8 (53.3%) which was almost equal in comparison to Left knee involvement which was 7 (46.7%).

Only semitendinosus graft was used in 12 (80%) patients whereas both semitendinosus and gracilis graft was used in 3 (20%) patients. If thickness of semitendinosus was found to be insufficient, then gracilis was also harvested in addition. All these 3 cases were female patients owing to less thickness of tendons in females.

The average time for surgery was 64±11.05 mins with maximum time being 80 mins and minimum being 50 mins.

The maximum blood loss was 95 ml and minimum the blood loss was 80 ml with an average loss of 88.26±1.06 ml.

13 (86.7%) patients achieved >130^0 ROM, and only 2 (13.3%) patients had <130^0 ROM by the end of 6 months.

The mean Kujala score of 15 patients at the end of 6 months follow-up was 92.7 with a significant improvement from pre-operative score which was 49.6 (Range: 0-100).

Table 2: Post-operative final range of motion distribution.

Final ROM (degree)	No. of patients	Percentage (%)	P value
<130	2	13.3	0.001
130-145	7	46.7	
>145	6	40	
Total	15	100.0	

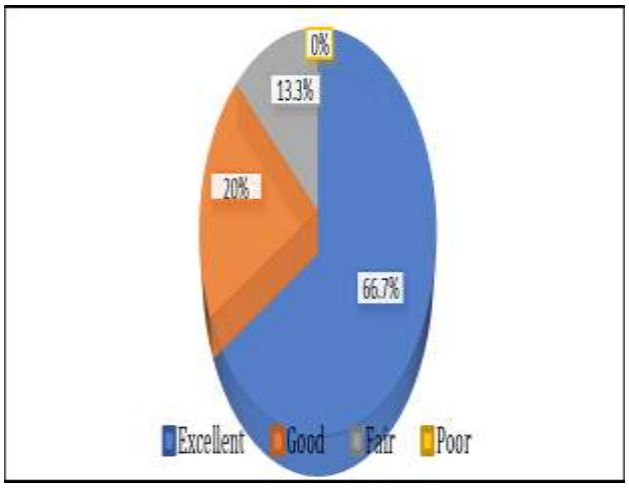

Figure 1: Final Kujala score outcome.

Among 15 patients, 10 (66.7%) patients showed excellent and 3 (20%) patients had good results at the end of 6 months follow-up, whereas 2 (13.3%) patients had Fair outcome and none of the patients demonstrated Poor surgical result (Excellent: 95-100, Good: 80-94, Fair: 60-79, Poor: <60).

Out of 15 patients, 12 (80%) patients did not have any complications. 1 (6.7%) patient developed a superficial wound infection which subsided with a course of intravenous and oral antibiotic for 14 days. 2 of the patients (13.3%) developed post-operative subluxation of patella.

All patients had a positive apprehension test before surgery. Minor complications such as pain, swelling, knee stiffness were observed initially during the course of the study but most of them finally settled by the end of final follow-up. 13 (86.7%) patients achieved almost full range of knee movement by the end of 6 months.

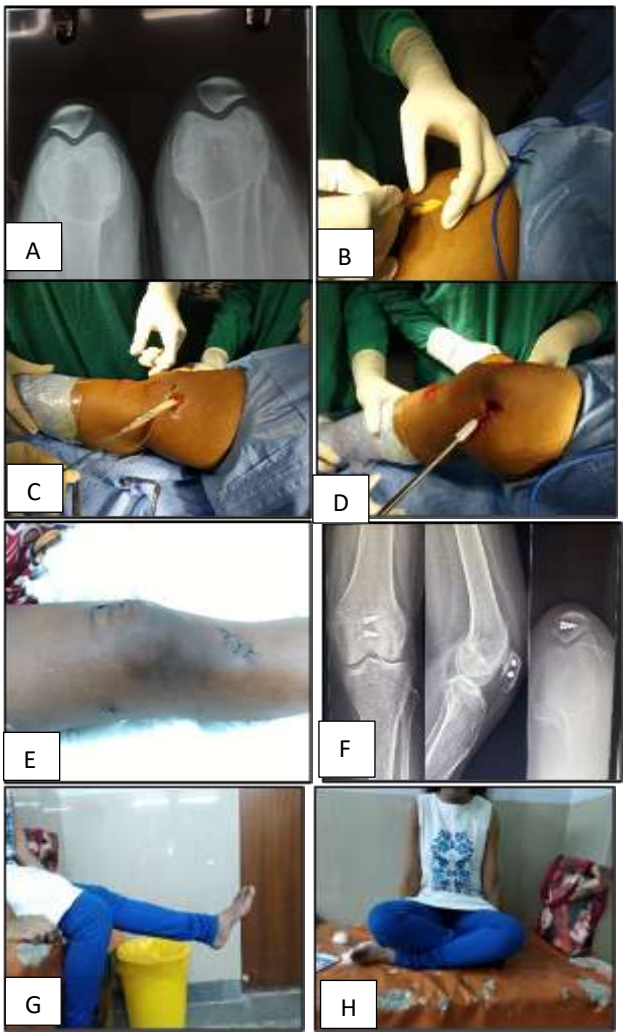

Figure 2: (A) Pre-op X-ray; (B) Incision along medial border of patella; (C) Passage of semitendinosus graft; (D) Fixation with bio-composite interference screw; (E) Post-op wound dressing; (F) Post-op X-ray; (G) 6 months follow-up knee extension; (H) Cross legged sitting.

DISCUSSION

Recurrent patellar instability is a disabling condition that primarily affects young patients and often leads to cartilage injury, limiting patients' participation in sports and potentially compromising their ability to carry out daily activities.[13-15]

Patellar dislocation is usually multifactorial, and it is important to address the underlying pathology to achieve good outcomes. The MPFL contributes approximately 50-70% of the restriction on lateral translation of the patella. Thus, it is the most important stabilizer of the patella and its reconstruction is the primary procedure in cases of recurrent subluxation.[16] The reconstruction of the MPFL gives better results in recurrent patellar dislocations than with non-anatomical reconstruction, which would alter the biomechanics of the patellofemoral joint.[17-20]

Schöttle et al assessed the clinical and radiological outcome after a follow-up of 4 years after linear MPFL reconstruction using an ipsilateral Semitendinosus tendon autograft for recurrent patellar dislocation. 15 knees in 12 patients were examined with a mean of 47 months at a mean age of 30 years. Postoperatively, 1 patient reported a recurrent bilateral re-dislocation. 3 knees presented with persistent patellar apprehension. 13 knees had improved subjectively after surgery. The mean Kujala score improved significantly from 55.0 to 85.7 points.[21]

Mikashima et al retrospectively reviewed 24 randomized patients (10 male and 14 female) with recurrent patellar dislocation or subluxation, who had undergone MPFL reconstruction using an autogenous tendon as an isolated procedure. The mean age at the time of operation was 21.8±4.9 years. The mean Kujala score was 95.2±12.9 points compared to 30.5±6.7 points before surgery. 17 (70.8%) patients were involved in recreational sports activities prior to injury. After surgery, 13 of the 17 patients (76.5%) resumed sport activities at the previous level, and 4 (23.5%) at a reduced level. None complained of patella apprehension or knee joint pain postoperatively.[22]

Bitar et al performed a randomized controlled trial on 41 knees having mean age of 24.2 years with acute patellar dislocation who were divided into 2 groups-one nonoperative and the other treated surgically with MPFL reconstruction; evaluated with minimum follow-up of 2 years. The mean Kujala score was significantly lower in the nonoperative group (70.8), when compared with the mean value of the surgical group (88.9). The surgical group presented a higher percentage of good to excellent results (71.43%) when compared with the nonoperative group (25%). The nonoperative group presented a large number of recurrences and subluxations (7 patients; 35%), whereas there were no reports of recurrences or subluxations in the surgical group.[23]

Mishra et al conducted a prospective study on 12 patients (15 knees) with mean duration of follow up of 42 months who underwent MPFL reconstruction with doubled semitendinosus tendon graft for chronic patellar instability. The mean age of the patients was 29.2 years. After the operative procedure 10 knees showed excellent results, 3 knees gave good results and 2 knees had a fair result. The average preoperative Kujala functional score was 44.8 and the average postoperative score was 91.9.[24]

Enderlein et al reported a large consecutive, prospective, single-clinic series of patients treated with MPFL reconstruction for recurrent patellar instability. The study included 224 patients (240 knees) with a follow-up of 12-60 months. MPFL reconstruction with gracilis tendon autograft consistently normalized patellar stability and improved knee function. The Kujala score improved from 62.5 to 80.4 at 1-year follow-up. Moderate medial pain was seen in 30% of the patients. The revision rate was 2.8%.[25]

Sappey-Marinier et al conducted a retrospective analysis of prospectively collected data of 211 cases of isolated MPFL reconstruction with a mean follow-up of 5.8 years. The mean age at surgery was 20.6 years, and 55% of patients were male. They were able to show an improvement in Kujala scores (56.1 pre-operatively to 88.8 post-operatively). 10 failures were reported that required surgical revision for recurrent patellar instability.[26]

Several surgical techniques have been described, with different types of grafts (artificial ligament, patellar tendon, quadriceps tendon or flexor tendons) and fixation methods (bone tunnel in patella and screw in the femur; suturing in patella and endobutton in femur; and anchor in patella and screw in femur) among others.[27]

Recent systematic reviews have shown that reconstruction of the MPFL is an effective procedure with a low rate of recurrence of patellar instability and good functional and subjective results, independent of the surgical technique.[28]

CONCLUSION

In properly selected patients with recurrent patellar instability, MPFL reconstruction using autologous hamstring graft appears to be a simple, safe, efficient and easily reproducible surgical procedure for the stabilization of patella, with a low failure rate and encouraging outcomes. It also has low morbidity with good clinical and functional results over the short term. It is a useful adjunction to the treatment of recurrent patellar dislocation which greatly helps in preventing further episodes of patellar subluxations or dislocations and in improving quality of life.

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