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ORIGINAL ARTICLE

Single Stage in Situ Suture Repair of a Multi-Ligament Knee Injury, an Observational Study

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ABSTRACT

Objective: This study aims to observe the clinical outcomes associated with in situ single-stage suture repair for knee dislocation in patients suffering from multiple knee ligament injuries with the use of unabsorbable materials of the suture.

Study design: A retrospective observational study Place and Duration this study was conducted in Gambat Medical College Pir Syed Abdul Qadir Shah Jellani Institute of Medical Science GIMS Gambat from May 2021 to May 2022.

Methodology: In this study35 patients treated surgically with in situ suture repair were recruited. A retrospective analysis was done on 35 patients with a mean follow-up score of 3.8 ± 1.3 years. Patients were undergone in situ surgical procedures for all the ruptured ligaments followed by a proper rehabilitation protocol post-operatively. Outcome variables were assessed by Lysholm score, satisfactory score, Meyers functional rating score, VAS score, and Tegner score.

Results: Results of the study states that the mean follow-up a score of VAS was recorded as 1.98 ± 0.4, Lysholm score was recorded as 82.5 ± 6.7, and the patient satisfaction score was recorded as 7.5 ± 0.9. Statistically, significant differences have been observed between the pre and post-scores of ranges of motion and Tegner activity scores with a p-value of < 0.001 for both activity and ROM scores. Final follow-up of these patients reported that patients were left with no ligament laxity except for two patients who were unable to restore back to work. Among 35 patients, 5 were unable to achieve full ROM and had stiffness whereas two had infections at the surgical site.

Conclusion: In situ suture repair of multiple ligaments had shown significant improvement in terms of ligament repair and early rehabilitation and therefore can be considered an effective treatment approach for the management of multiple ligament injuries.

Keywords: Multiple ligament injuries, in situ repair, knee dislocation, cruciate ligament injury, single-stage repair.

INTRODUCTION

Multiple injuries of the knee ligament incorporate the involvement of two or more cruciate ligaments i.e., anterior, posterior, medial and lateral collateral ligaments however, it is rare but it badly affects the knee resulting in dislocation[1]. The incidence of multiple ligament injuries has been observed to be 0.001 – 0.013 % among different sports injuries[2].It has been observed so far that the incidence of knee dislocation increases owing to poor diagnosis and reduction[3]. The signs and symptoms of knee dislocation include giving away of the knee while walking, being unable to stand on the leg with knee extension and a popping sound while walking in some cases[2].

The management of multiple ligament injuries need skilled surgeons and may be a challenging task in some situation due to the involved vessels and nerves in the surrounding area therefore, its management is of high debate among surgeons[4]. Management can be done conservatively but it has not demonstrated long-term effects in patients therefore, surgical management is usually suggested for proper recovery[5].Non-conservative management involves a variety of techniques including reconstruction and repair. Studies report that the success rate of repair is controversial and so knee reconstruction is usually suggested followed by a proper plan of rehabilitation[3].This study, therefore, provides insight for retrospectively analyzing the outcomes associated with the ligament reconstruction through in situ suture repair following rehabilitation plan[4].

METHODOLOGY

An observational study was carried out by taking the retrospective view of 35 patients from the databases of different hospitals. All patients had undergone the reconstructive surgery of in situ suture repair following the dislocation of the knee joint. The study was being approved by the ethical committee of the research board and all participants were given informed consent[6].Knee dislocation was diagnosed by MRI and clinical signs and symptoms. Patients having any sort of trauma, vascular injury, cerebral injury, vascular surgery, fractures treated with external fixation, or any other knee injury were excluded from the study[7].

Surgical Approach: Patients included in the study had their surgery done after 4-8 days following surgery. Patients lie supine on the treatment table under general anesthesia[8].The uninvolved leg was is in anextension position with the involved hip and knee flexed at 90 º. Patients were screened initially through arthroscopy and physical examination[9].All the involved ligaments such as anterior cruciate, posterior cruciate, medial collateral and posterolateral ligaments were managed by using surgical procedures. Initially, an incision was made at the anterior side allowing for the placement of PCL and ACL tunnel and for removing the blood clots from the particular area[6].Repairing of the involved ligaments was done by using the cross-stitch suturing technique[7]. While flexing the knee, the Arthrex guide was utilized for the creation of four ACL tunnels between the centers of the reattachment bundle along the medial wall of the femoral condyle. For tunneling the PCL, the same technique was utilized for leading towards the tibia tunnels[8].For guiding the lines of the suture, suture passer was used in each tunnel for tightening and knotting the suture line ends. This procedure was done in situ stump. Damage to the meniscus was repaired by trimming and suturing thereby depending upon the injury site[10].

The posterolateral incision was made for PLC by carefully maintaining a 6-8 cm pathway between the two incisions[7].The structures such as the lateral collateral ligament, popliteus, capsule, iliotibial band, popliteo-fibular ligament, and biceps femoris were reconstructed to the head of the fibula, condyles of the femur, and lateral tibia depending upon the injury site[9].

Rehabilitation plan of care: The rehabilitation process usually starts after the first post-operative day. Initially, a hinged brace locked at a flexion range of 30 º was utilized for protecting the stability of the involved knee with the standard protocol of rehabilitation[10]. On the first post-operative day, patients were advised to do only straight leg raise and knee isometrics. For patients who had undergone PCL and ACL repair, it was

necessary to avoid any valgus and varus pressure applied on the knee[11].Physical therapy started after a period of seven days in an outpatient setting, in which braces were removed during the session to regain the range by performing slight ROM exercises to the point of toleration. Rehabilitation protocol was continued and after a period of 4 weeks, passive exercises along with non-weight bearing activities were advised from a range of 0-120 ^{o}[12].Progression was made to closed chain exercises along with co-contraction of hamstring muscles at the post-operative third month[10].Open chain exercises were performed after 4-5 months including partial weight-bearing exercises, an increase in ROM and walking. After a period of six months, patients can return to partial activities of daily living along with theprogression of resistive exercises. After seven months, patients can resume their normal activities with full weight bearing without any mobility aid[12].

Patient's follow-up: Assessment of the patients was done under the supervision of a senior orthopedic surgeon. Outcome measures were assessed by using several scales using Visual analogue scale, 36 items health survey form, Tegner score, Meyers functional rating score and Lysholm score[10].A physical examination was done to evaluate the stability of the knee and range of motion. Goniometer was used to evaluate the range of flexion and extension in the involved as well as uninvolved knee. In addition, Arthrometer was used for the evaluation of PCL and ACL laxity through the posterior draw test, anterior draw test and Lachman test. Varus and valgus stress tests were applied to evaluate the laxity of collateral ligaments[11].

The associated complications recorded among all the patients receiving reconstructive surgery after knee dislocation was palsy of the common peroneal nerve, deep vein thrombosis, granuloma of suture, infection, formation of heterotrophic bone, fibrosis and re-rupture[8].

Statistical analysis: Data analysis was done by using the SPSS version 24. All the data was recorded in tabulated form by mean ± standard deviation. Analysis of the results was done by applying at-test with the significance level being recorded as $p < 0.005$ and CI 95 %[9].

RESULTS

A total of 46 patients were reviewed for the study, among them 35 patients (30 males and 15 females) with amean age of 35.5 ± 10.3 years met the inclusion criteria of the study while 5 patients lost the follow-up treatment due to their distance from the hospital.All the patients selected for the treatment had closed injuries, 10 patients had ligamentous injuries on the left knee whereas the others have ligamentous injuries on the right side. The majority have injuries as a result of the motor vehicle whereas some patients were athletes. A total of20 patients demonstrated to have a direct hit; 12 patients had fallen from a height whereas 3 patients were athletes who got ligamentous injuries from football. Patients were classified on the basis of ligamentous injuries through the utilization of a modified Schenck system with subdivisions into KD III-L (n = 10), KD III-M (n = 11), KD IV (n = 13) and KD V (n = 2).

Among all the cases, 15 patients had affected the common peroneal nerve secondary to ligamentous injury,5 patients demonstrated loss of sensation due to affected knees, and7 patients demonstrated to have thepartial motor and sensory loss, however, only 2 patients demonstrated severe symptoms with complete motor and sensory loss. Owing to multiple ligament injuries, some patients also demonstrated to have meniscus injuries with ipsilateral fracture of the tibial plateau.

Outcome measures taken at the final follow-up demonstrated that the VAS score was calculated out to be 1.98 ± 0.4 with a significant reduction of pain to a level of < 3 on the VAS rating scale. Patient satisfaction score was recorded as 7.5 ± 0.9 with only 2 patients recorded to have a satisfaction level of < 7. SF-36 score at the final follow-up was recorded as 80.4 ± 9.8. Lysholm score was recorded as 82.5 ± 6.7. None of the patients demonstrated to have a score lower than 75. Tegner score was recorded as 4.9 ± 1.0. On the basis of different scores of 35 patients, 25 were able to return successfully to their normal activities of daily living, 8 patients were able to return to work with mild modifications, 1 wasn't able to return to normal life due to bilateral dislocation whereas the remaining one had difficulty to return to normal life due to some complications.

There were no associated complications with the ligamentous injuries such as infections, compartment syndrome, deep vein thrombosis and neurovascular compromise. However, some patients demonstrated to have infections at the site of the wound including liquefaction of the fata and infections [7]. Heterotrophic formation of the bone was developed in some patients having type III fracture of the tibial plateau and in cases of bilateral dislocations of the knee [6].

Table 1: Characteristics of injury.

Age	Gender	Mechanism of injury.	VAS score		Lysholm score	Tegner score	SF-36 score	Complications
34	M	Football	7	3	90	6	85	Wound infection
32	F	Vehicle	6	2	92	7	87	Wound infection
36	F	Vehicle	8	2	95	6	86	Wound infection
35	F	Hit	7	3	94	5	83	Fat liquefication
35	M	Vehicle	8	2	93	6	82	Fat liquefication
29	F	Hit	6	1	93	5	81	Wound infection.
26	M	Foot ball	7	1	97	7	80	Fat liquefication
34	M	Vehicle	8	2	96	5	78	Common peroneal nerve.
31	M	Vehicle	7	3	96	6	88	Common peroneal nerve.
33	F	Vehicle	7	2	94	5	87	Wound infection.
37	M	Hit	6	3	93	6	76	Fat liquefication
29	F	Hit	8	2	92	5	83	Fat liquefication
26	F	Hit	9	2	90	7	82	Fat liquefication
33	M	Vehicle	7	2	89	6	80	Wound infection
28	M	Vehicle	8	1	93	5	78	Wound infection
33	F	Vehicle	8	3	93	6	89	Wound infection
34	M	Vehicle	8	2	93	7	88	Wound infection
39	F	Hit	7	2	92	6	83	Wound infection
37	F	Vehicle	8	2	91	5	83	Wound infection
33	M	Hit	7	1	90	6	82	-
31	F	Vehicle	6	1	89	6	81	-
37	F	Hit	7	2	97	7	85	-
40	M	Hit	8	2	96	5	87	-
42	F	Hit	6	2	97	6	84	Fat liquefication
44	M	Hit	7	2	97	7	83	Fat liquefication
35	M	Hit	8	3	98	7	86	Wound infection
33	F	Vehicle	6	3	95	6	90	Wound infection
37	M	Vehicle	8	2	95	5	82	Wound infection
30	F	Vehicle	8	2	94	5	81	Wound infection.

DISCUSSION

Multiple injuries of the ligament are a complicated condition which needs skilled orthopedic advice and treatment. The current study has highlighted the advantages and rate of success associated with the in-situ suture repair of multiple injuries of the ligament in case of knee dislocation. Some patients had demonstrated post-surgical complications like infections at the site of thewound and common peroneal nerve injury.Ligament reconstruction is usually avoided in the initial days post-injury due to having risk factors of arthrofibrosis and compartment syndrome. However, limited literature is available to support this complication[10].

The time period of three weeks post-surgery has been characterized as the threshold period between chronic and acute injury[6].After three weeks, the formation of granulation tissue and ascar along with retraction begins. Literature has been carried on the management of knee ligaments which suggests that ligamentous injuries such as that of PCL, ACL and MCL should be treated with reconstruction rather than repair to have better and more effective results[7]. A study carried out by Frosch et al (2013) showed that limitations in the range of flexion, instability of PCL and low rate of return to sports activities have been observed in patients who get ligamentous repair as compared to ligament reconstruction. However, this study has its limitation due to the limited amount of literature available on the topic[10].

Ishibashi et al (2020) carried out a study which showed good functional outcomes and themajority of the patients were able to return to their normal living after the reconstruction surgery[11].Another meta-analysis was carried which had shown that the patients who had undergone suture repair demonstrated to have good clinical outcomes as compared to patients who had undergone reconstruction surgery for multiple ligament injuries of knee[12]. In thecurrent study, 35 patients were analyzed retrospectively and their results were compared with other studies mentioned in this section. It has been shown that single stage In-situ suture repair had shown more statistically significant effects as compared to the other comparative studies demonstrating it to be a good surgical approach.

The study has some limitations including; a small number of patients available for the study due to the rarity of the disease. There was the absence of a control group within the study due to the selection of a retrospective study design therefore, it is recommended to conduct an RCT on the present topic. However, the study has demonstrated statistically significant results for single-stage in-situ suture repair.

CONCLUSION

In situ suture repair of the multiple ligament injuries of the knee through the use of baseballcross-stitching suture technique has provided statistically significant results in terms of functional outcomes, stability of knee and range of movement. This significance has been associated with the rehabilitation protocol following reconstructive surgery and therefore has been considered an effective management option. It is an effective and alternate option in knee dislocation associated with multiple injuries of the ligament.

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