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Results of Medial Collateral Ligament percutaneous fenestration versus Arthroscopic release in arthroscopic partial medial meniscectomy

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Abstract

Background: The posterior horn of the medial meniscus is still the single greatest source of errors in knee arthroscopy, despite the great advancement in arthroscopic techniques and instruments. Most errors occur in tight knees that have hidden lesions at the periphery of the posterior horn of the medial meniscus. In knee joints with a narrow medial joint space, there is a risk that cartilage may be damaged by the resection instruments, even by an arthroscopy specialist. Even superficial cartilaginous lesions due to hits or scratches caused by instruments and affecting the cartilage of the posterior femoral condyle and the tibial plateau do not heal with normal hyaline cartilage. They may predispose to osteoarthritis of the knee joint, especially if extensive partial menisectomy is performed simultaneously. This work aimed to compare the efficacy of percutaneous release of the MCL versus arthroscopic release using 3 mm special knife in widening medial joint space and the complications of both techniques when implicated in arthroscopy of the knee in partial medial menisectomy in knees with tight medial compartment. **Methods:** A prospective randomized analytical clinical study. The material of this study includes thirty (30) patients with torn posterior horn of the medial meniscus with tight medial compartment of the knee. **Results:** Both techniques provided good visualization and instrumentation of the PHMM. Pre-operative lyshom score in group A was 50.6 (between 35- 65) while in group B, it was 52 (between 36- 68). Post-operative lyshom score in group A was 85.4 (between 75- 95) while in group B, it was 87 (between 79- 96). On comparing both groups' pre and post operatively according to lyshom score, it was found that, there was no statistical difference between them. Post-operative valgus stress test in complete extension was the same in both groups and was the same comparing was that tested pre operatively. Post-operative valgus stress test in 30 degree flextion was affected more in group A than group B but without statistical significant difference. (P- Value = 0.483). Two patients (13.3%) were affected in group A and no patient (0.0%) was affected in group B. Saphenous nerve injury and hematoma formation were more in group A than group B but without statistical significant difference. **Conclusion:** In cases with tight knees, the Pie-crusting technique and arthroscopic deep MCL release technique are safe and efficient for visualization of the posterior horn of the medial meniscus. It allows the avoidance of causing iatrogenic chondral damage or fracture of the medial femoral condyle. MCL laxity, saphenous nerve injury and hematoma formation were more in Pie crusting technique without significant statistical difference.

Key words: Medial Collateral Ligament percutaneous fenestration, Arthroscopic release, arthroscopic partial medial meniscectomy

1. Introduction

The posterior horn of the medial meniscus is a common site of meniscal tears. Unrestricted arthroscopic visualization of the posterior horn of the medial meniscus is essential to perform adequate menisectomy. In patients with tight knees, the medial femoral condyle makes the visualization of the posterior horn of the medial meniscus and the usage of instruments very difficult. So in tight knees, this area is reported to be one of the most common sources of diagnostic errors in knee arthroscopy [1,2]

Vigorous manipulations with the instruments in cases with tight knees may cause iatrogenic chondral damage which may lead to degeneration of the articular cartilage and osteoarthritis [3,4]. Also this inadequate visualization may lead to insufficient menisectomy, with the left meniscal fragment might result in continued symptoms and reoperation [5, 6]. Meniscal pathologies may be missed as a result of this inadequate visualization. Moreover this vigorous manipulation to open the medial compartment, may result in rupture of the medial collateral ligament (MCL) or even fracture of the femur [7, 8]

Agneskirchner and Lobenhoffer [9], Bosch [10], Park et al [11],Fakioglu et al [12] and later Todor et al [6] described a minimally invasive technique to open the medial compartment by puncturing the postero-medial capsulo-ligamentous structures percutaneously with the use of a needle .

While javidan et al [13] described another technique to widen the medial compartment by releasing the deep fibers of the mcl with the use of a slightly curved serrated 3mm banana blade, which was carried out by the same basic arthroscopic portals with no need for new incisions.

This work aimed to compare the efficacy of percutaneous release of the MCL versus arthroscopic release using 3 mm special knife in widening medial joint space and the complications of both techniques when implicated in arthroscopy of the knee in partial medial menisectomy in knees with tight medial compartment.

2. Patients and Methods

Study design:

A prospective randomized analytical clinical study was done to evaluate the effect of percutaneous release of the superficial medial collateral ligament (pie-crusting technique) versus the effect of arthroscopic release of the deep fibers of the medial collateral ligament in patients with tight medial compartment of the knee undergoing partial menisectomy for torn posterior horn of the medial meniscus.

Patient number:

The material of this study includes thirty (30) patients

with torn posterior horn of the medial meniscus with tight medial compartment of the knee.

Inclusion criteria:-

- Age: skeletally mature patients.
- Torn posterior horn of the medial meniscus in a patient with a tight medial compartment of the knee.
- Both sexes were included.

Exclusion criteria:

- Knee malalignment that needs corrective osteotomy.
- Knee ligamentous injuries.
- Knee osteoarthritis.
- Knee articular lesions.

Patients were subjected to the following:

(A) Preoperative evaluation

1. Careful history taking
2. Analysis of patient's complaint
3. Clinical examination includes Lysholm knee score.
4. – Radiographic evaluation: - Includes plain standing X-ray and MRI.

1- History:

Gender, affected side and cause of injury: 23 male patients and 7 female patients were included. Of the thirty patients, 21 patients had torn PHMM of the right knee and 9 patients had torn PHMM of the left knee. In 16 patients the cause of the injury was sports practice, while in the other 14 patients the cause was non-sports injury.

Table (1) Elements of patient's description.

Parameters	Factors	Total number
Gender	**Males**	23
	Females	7
Affected side	**Right**	21
	Left	9
Cause of injury	**Sports injury**	16
	Non sports injury	14

2 - Analysis of patient complaint:

Analysis of patient's complaint was carried according to Lysholm score evaluation.

Table (4) Grading the Tegner Lysholm Knee Scoring Scale.

< 65	Poor	65-83	Fair	84-90	Good	>90	Excellen

3– Clinical examination:

Full clinical examination of the affected knee and the contra-lateral knee was done.

Including:

1) Inspection : to exclude any malalignment or inflammation
2) Special tests: to diagnose meniscal tears and exclude any other ligamentous injuries that might be present.

4-Radiographic evaluation:

A. Standard standing X- rays of both knee (AP, lateral views): To exclude osteoarthritis or malalingment.

B. MRI of the affected knee:
To detect the site & type of the meniscal tear and to detect any other ligamentous injuries or patellar instability.

(B) Operative meniscal procedure:

Indications of surgery:

In this study either percutaneous release of the medial collateral ligament or arthroscopic release of its deep fibers was done for patients with torn posterior horn of the medial meniscus (PHMM) in whom the medial compartment of the knee was tight or if there is evident meniscal tear in the MRI and is not seen by the scope.

Timing of surgery:

In this study, timing of surgery from the onset of symptoms was ranging from 1 month to 4 years.

Operative procedure:

Technique of surgery:

1. Position of the patient:

The patient was laid supine. A tourniquet over soft cotton is applied and elevated to 300 mmHg after administration of the anesthesia. A flat or round, well padded, lateral post is positioned lateral to the tourniquet half way up the thigh.

2. Anesthesia:

22 patients received spinal anesthesia, while the other 8 patients received general anesthesia. Antibiotic was given with induction of anesthesia.

3. Routine knee arthroscopy:

- Standard antero-lateral and low antero-medial portals were used with a 30° viewing scope.
- A fluid pump was used for inflow through arthroscopic sheath.
- Next a quick diagnostic knee examination was done starting with supra-patellar pouch, lateral gutter, patello-femoral joint and medial gutter.
- Next, a probe was inserted through the antero-medial working portal into the medial compartment.
- With the knee in extension to 30o flexion, valgus and external rotation was applied by the assistant to help better visualization of the PHMM.

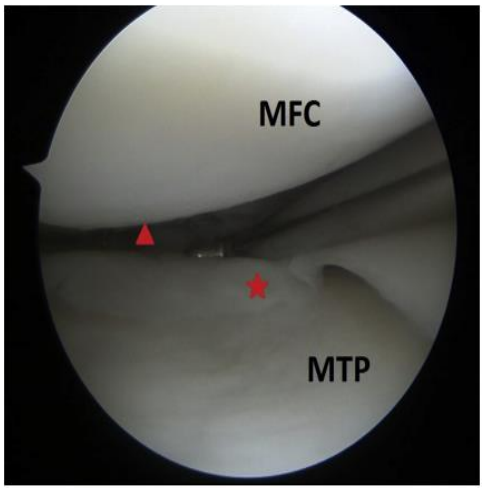

Fig. (1) A probe introduced through the anteromedial portal evaluating the tear in the posterior horn of the medial meniscus. Part of the tear (star) can be seen and palpated. Note the poor visualization in the posterior horn (triangle). Camera in the standard anterolateral viewing portal. Right knee. Standard valgus-extension stress position. (MFC, medial femoral condyle; MTP, medial tibial plateau).

1. Percutaneous release:

A standard 18-gauge needle was used for the release. Maintaining the valgus-extension position, the needle is introduced percutaneously at the level of femoral origin of the medial collateral ligamentat at its posterior third. When this position is found, the needle is not redrawn out the skin anymore, and multiple perforations are performed until the medial joint space increases. This is usually accompanied by a popping sound and feel. After the first 3 to 4 punctures in the desired location, the probe is reinserted through the AM portal to evaluate the degree of opening obtained. If this is insufficient, the punctures are continued until the space is widened enough. At approximately 6 to 8 mm, a complete visualization of the posterior horn of the medial meniscus was obtained and proper instruments can be introduced and manipulated without obstruction or risk of iatrogenic cartilage injury.

2. Arthroscopic release :

The deep MCL is released using the medial working portal under direct visualization from the anterolateral portal. A special knife blade is inserted for the release. The proximal third of the medial meniscus is visualized, and the blade is slid under femoral condyle with care taken not to cause iatrogenic injury. With valgus stress still being applied, the blade is then used to release the deep MCL from its femoral origin. During the release, it is important to keep a constant valgus stress on the knee to hold the deep MCL and its meniscocapsular attachments taut. The blade is then pushed into the ligament until medial widening is achieved, often accompanied by an audible sound indicating ligament release. Generally, a pushing motion into the ligament is preferred over a sliding motion because the latter precludes the surgeon from noticing how deep into the blade has advanced. The release is continued posteriorly only as much as is required to adequately visualize the posterior structures. Immediate opening of the compartment is noted, and sufficient visualization is used as the guide to determining whether the release is adequate. Once the release is complete, minimal valgus stress is needed for excellent medial knee visual exposure, and the appropriate meniscus evaluation and treatment are then carried out with standard arthroscopic technique.

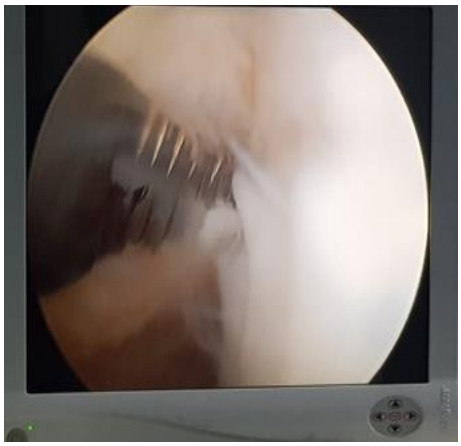

Fig. (2) aspecial knife blade is used to release the deep part of MCL.

(C): Follow up evaluation:

Includes:-

1 - Clinical evaluation of the joint space tenderness and medial collateral ligament stability.

2 - Postoperative rating scale:

- Lysholm knee score was measured 3 months post operatively.

3 - Statistical analysis.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0**. (**Armonk, NY: IBM Corp**)** Qualitative data were described using number and percent. The Shapiro-Wilk test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the 5% level.

3.Results

Pre-operative lyshom score in group A was 50.6 (between 35- 65) while in group B, it was 52 (between 36- 68). Post-operative lyshom score in group A was 85.4 (between 75- 95) while in group B, it was 87 (between 79- 96).

On comparing both groups' pre and post operatively according to lyshom score, it was found that, there was no statistical difference between them.

On comparing post and pre-operative lyshom score in group A and B, there were statistical significant difference between post and pre-operative lyshom score in both groups. (Table 1-2)

Table (1) Comparison between pre and postoperative Lyshlom score in group A.

Lyshlom score Group A (n = 15)	**Preoperative**	**Postoperative**	**p**
Min. – Max.	35.0 – 65.0	75.0 – 95.0	
Mean ± SD.	50.60 ± 8.20	85.40 ± 6.03	**<0.001***
Median (IQR)	50.0 (45.5 – 56.5)	86.0 (81 - 90)	

p: p value for **t –paired test** for comparing between **Preoperative and Postoperative**

*: Statistically significant at $p \leq 0.05$

Table (2) Comparison between pre and postoperative Lyshlom score in group B.

Lyshlom score Group B (n = 15)	**Preoperative**	**Postoperative**	**p**
Min. – Max.	36.0 – 68.0	79.0 – 96.0	
Mean ± SD.	52.0 ± 9.43	87.07 ± 5.55	**<0.001***
Median (IQR)	52.0 (44.5 – 59.5)	87.0 (83 - 91)	

p: p value for **t –paired test** for comparing between **Preoperative and Postoperative**

*: Statistically significant at $p \leq 0.05$

SD: Standard deviation , IQR: Inter Quartilr Range

Saphenous nerve was affected more in group A than group B but without statistical significant difference. One patient (6.7%) was affected in group A and no patient (0.0%) was affected in group B (P- Value = 1). (Table 3)

Post-operative valgus stress test in complete extension was the same in both groups and was the same comparing with that tested pre operatively. Post-operative valgus stress test in 30 degree flextion was affected more in group A than group B but without statistical significant difference. (P- Value = 0.483). Two patients (13.3%) were affected in group A and no patient (0.0%) was affected in group B. (Table 4)

Table (3) Comparison between the two studied groups according to stress valgus in 30 degree flexion.

Stress valgus in 30 flexion	**Group A (n = 15)**		**Group B (n = 15)**		**^{FE}p**
	No.	**%**	**No.**	**%**	
Negative	13	86.7	15	100.0	0.483
Positive	2	13.3	0	0.0	

χ^2: **Chi square test** **FE: Fisher Exact test**

p: p value for comparing between the two groups

Table (4) Comparison between the two studied groups according to saphenous nerve injury.

Saphenous nerve	Group A (n = 15)		Group B (n = 15)		FEp
	No.	%	No.	%	
Negative	14	93.3	15	100.0	1.000
Positive	1	6.7	0	0.0	

χ^2: **Chi square test** **FE: Fisher Exact test**

p: p value for comparing between the two groups

Post-operative hematoma was found more in group A than group B but without statistical significant difference. Two patient (13.3%) was affected in group A and no patient (0.0%) was affected in group B (P- Value = 1). (Table 5)

Table (5) Comparison between the two studied groups according to hematoma formation.

Hematoma	Group A (n = 15)		Group B (n = 15)		FEp
	No.	%	No.	%	
Negative	13	86.7	15	100.0	0.483
Positive	2	13.3	0	0.0	

χ^2: **Chi square test** **FE: Fisher Exact test**

p: p value for comparing between the two groups

Cases

41 years old male presented with right sided knee pain. He was medically free.

On examination:

He had right sided knee pain with tenderness over the medial joint space with negative MCL laxity. His pre-operative Lyshlom score was 42.

Management plan

MRI scan was done and it was found posterior horn medial meniscal degeneration and knee arthroscope was planned for partial menscicteomy. (Figure 3)

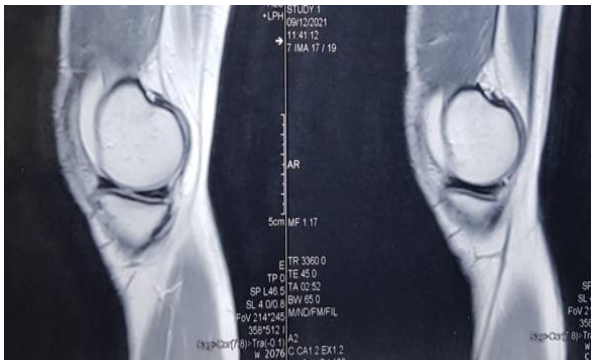

Fig. (3) Case one: pre-operative knee MRI scan coronal cuts.

During knee arthroscope: medial joint space was narrow with poor visualization of the posterior horn of medial meniscus (figure 4)

Fig. (4) narrow medial joint space measured with probe.

Percutaneous medial pie- crusting was done to release MCL and widen the medial joint space (figures 5-6)

Fig. (5) Percutaneous medial pie- crusting using 18 g needle.

Fig. (6) post percutaneous pie- crusting medial joint space winding.

3 months post – operative evaluation was done and it is found that:

- No medial joint line tenderness.
- Negative valgus stress test on full extension and 30 degree flextion that indicate no MCL laxity. (figure 7- 8)
- Post-operative Lyshlom score: 91.

Fig. (7) Negative valgus stress test on full extension.

Fig. (8) Negative valgus stress test on 30 degree flextion.

4. Discussion

In our study, we used Lysholm score as a scoring system. In group A, The mean Lysholm score preoperatively was 50 (35-65). The mean Lysholm score had increased at the end of the follow up period to 85.4 (75-95) with P value < 0.001 which was statistically significant. In group B, The mean Lysholm score preoperatively was 52 (36-68). The mean Lysholm score had increased at the end of the follow up period to 87 (79-96) with P value < 0.001 which was statistically significant. On comparing post and pre-operative lyshom score in group A and B, there were statistical significant difference between post and pre-operative lyshom score in both groups.

In Fakioglu et al [12], Lyshlom score was also used as a scoring system. The median Lyshlom knee score, which was 42 points (24–64 points) before the operation and had increased to 94 points (88–100 points) at the final follow up with P value < 0.0002 which was statistically significant.

Alnahas, M [14] reported that The median Lyshlom knee score, which was 50 points (35–65 points) before the operation and had increased to 92.4 points (86–98 points) at the final follow up with P value < 0.0001 which was statistically significant.

For all patients in the study of Han et al [15], Lyshlom score was 80.08 ± 3.74 (70- 85), showing significant differences compared with the preoperative score 48.17 ± 4.22 (40-55), (P value < 0.01)

In our study, we did not encounter any intra-operative complications such as MCL rupture or fracture of the MFC. All the patients have post-operative pain (grade I MCL sprain) that lasted for 1-2 weeks except two patients in group A had residual MCL laxity that needed brace. All patients were capable of weight bearing either alone or assisted by crutches.

Fakioglu et al [12] reported no intraoperative complications. In the postoperative period, all patients reported mild pain at the medial needle tract lasting for 15 days. In the final follow-up, there was no pain on palpation within this area. A short- hinged knee brace was worn postoperatively for 4 weeks without restriction in joint motion and with full weight-bearing.

Bosch et al [10] stated that there was no need to change postoperative rehabilitation program.

Park et al [11] reported little postoperative instability in arthroscopic medial release to approach the posterior horn of medial meniscus in the tight knees. The normal knee structures, particularly the ACL, compensates for the functional deficit of the transected MCL [11].

Atoun et al [16] recommend inside-out technique because MCL pie crusting is painful to the patients because of multiple puncturing of the skin.

Javidan et al reported no intraoperative complications. All patients were capable of weight bearing either alone or assisted by crutches. No brace was used.

The most important result of this study is that controlled release of the MCL by both techniques is safe for adequate visualization of tears in the posterior horn of the medial meniscus in tight knees. It is also safe for proper handling of the instruments without causing iatrogenic chondral injury.

In group A in our study, one patient (6.7%) had saphenous nerve injury. Two patients (13.3%) had hematoma formation. No patients in group B reported the same complications.

In the studies of Han et al [15], Alnahas [14] and Fakioglu et al [12], no patients reported MCL laxity, saphenous nerve injury or hematoma formation.

5. Conclusion

Adequate visualization of the posterior horn of the medial meniscus is crucial for the performance of proper menisectomy. In cases with tight knees, the Pie-crusting technique and arthroscopic deep MCL release technique are safe and efficient for visualization of the posterior horn of the medial meniscus. It allows the avoidance of causing iatrogenic chondral damage or fracture of the medial femoral condyle. MCL laxity, saphenous nerve injury and hematoma formation were more in Pie crusting technique without significant statistical difference.

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