



# Clinical outcome of primary medial collateral ligament-posteromedial corner repair with or without staged anterior cruciate ligament reconstruction



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## ABSTRACT

**Introduction:** Medial collateral ligament (MCL) is a prime valgus stabilizer of the knee, and MCL tears are currently managed conservatively. However, posteromedial corner (PMC) injury along with MCL tear is not same as isolated MCL tear and the former is more serious injury and requires operative attention. However, literature is scarce about the management and outcome of PMC-MCL tear alongside anterior cruciate ligament (ACL) tear. The purpose of this study is to report the clinical outcome of primary repair of MCL and PMC with or without staged ACL reconstruction.

**Methods:** A retrospective evaluation was performed on patients with MCL-PMC complex injury with ACL tear who underwent primary repair of MCL-PMC tear followed by rehabilitation. Further, several of them chose to undergo ACL reconstruction whereas rest opted conservative treatment for the ACL tear. A total of 35 patients of two groups [Group 1 (n = 15): MCL-PMC repaired and ACL conserved; Group 2 (n = 20): MCL-PMC repaired and ACL reconstructed] met the inclusion criteria with a minimum follow-up of two years. Clinical outcome measures included grade of valgus medial opening (0° extension and 30° flexion), Lysholm and International knee documentation committee (IKDC) scores, KT-1000 measurement, subjective feeling of instability, range of motion (ROM) assessment and complications.

**Results:** While comparing group 2 versus group 1, mean Lysholm (94.6 vs. 91.06; p = 0.017) and IKDC scores (86.3 vs. 77.6; p = 0.011) of group 2 were significantly higher than group 1. 60% patients of group 1 complained of instability against none in the group 2 (p < 0.0001). All the knees of both the groups were valgus stable with none requiring late reconstruction. The mean loss of flexion ROM in group 1 and 2 was 12° and 9° respectively which was not statistically different (p = 0.41). However while considering the loss of motion, two groups did not show any significant difference in clinical scores.

**Conclusions:** Primary MCL-PMC repair renders the knee stable in coronal plane in both the groups and further ACL reconstruction adds on to the stability of the knee providing a superior clinical outcome. Minor knee stiffness remains a concern after primary MCL-PMC repair but without any unfavorable clinical effect.

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## Introduction

Injury to the cruciate-medial ligament complex of the knee is quite frequent in sports and road traffic accidents (RTA). Low velocity or sports related injuries are mostly limited to varying degree of injury to the medial collateral ligament (MCL) with or without cruciate ligament tear whereas high-velocity injuries, or RTA involves injury to MCL along with varying degree of damage to the structures behind the superficial MCL known as posteromedial

corner (PMC) alongside cruciate(s) ligament tear [1–3]. Since initial work on medial side anatomy and injury laid more emphasis on the superficial medial collateral ligament [4,5], unfortunately, “medial-side knee injury” became synonymous with an MCL tear alone and PMC injury remained ignored [2]. Anatomically, PMC comprises of structures which are posterior to MCL including posterior oblique ligament (POL), posterior capsule, posterior third and horn of medial meniscus, oblique popliteal ligament and Semimembranosus tendon along with its expansions [2,6,7]. Functionally, MCL remains the primary valgus restraint in 15°–90° flexion and external rotation stabilizer [8,9] whereas PMC provides valgus restraint in an extended knee; a load bearing state of the knee along with primary internal rotation stability at all

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flexion angles and prevents posterior tibial translation. [10–15] Furthermore, the posteromedial part of medial meniscus along with its horn acts like a “brake stop” providing anterior restraint in the absence of ACL [16,17]. Lastly, the semimembranosus by virtue of its attachment to the POL and tibia provides dynamic stabilization of PMC by retracting the medial meniscus during flexion [17,18]. Consequently, an injury to the posteromedial corner (PMC) of the knee alongside MCL is significantly different and serious than MCL tear alone and renders the knee unstable in valgus and rotations [15,19]. While MCL tears are mostly managed conservatively whether it is an isolated tear [20,21] or in combination with ACL tear [22,23], the literature is still scant and controversial about the optimal management and outcome of combined MCL-PMC and ACL injuries. Anderson et al. recommended repair of MCL-PMC complex and ACL reconstruction for superior results whereas Houston et al. concluded that the lone repair of MCL-PMC complex without ACL reconstruction is sufficient for excellent long term results [24,25].

This study comprises of patients who underwent primary anatomic MCL-PMC repair. Later depending upon patient's choice, a group of patient underwent ACL reconstruction and another group refused ACL reconstruction creating a natural cohort of two comparative group. Hence, the purpose of the present study was twofold. Firstly, whether primary repair of the MCL-PMC complex can render valgus stability to the knee while avoiding any future medial side reconstruction and secondly, for superior clinical results whether MCL-PMC-ACL together needs to be addressed, or only MCL-PMC repair would suffice. The null hypothesis assumed that primary repair alone of medial side alone may not provide valgus stability and secondly, there would be no difference between clinical outcomes of two groups.

## Methods

Approved by the institutional review board, the study initially included 43 adult patients (18–55 years) who were operated from January 2007 to January 2014 and presented within three weeks of injury to the MCL-PMC-ACL complex. Later, eight patients were excluded from the study as they were lost to the follow up keeping the final count of 35 patients in the study with a minimum follow up of two years. After clinical examination and assessment of the knee confirming the damage to the anteromedial side of the knee, plain radiograph (anteroposterior and lateral view) and magnetic resonance imaging (MRI) of the knee were performed to assess the damage to the intra- and extra-articular structures. Once MRI revealed extensive damage to the medial side and ACL tear, patients were subjected to examination under anaesthesia (EUA) to assess the grade of the medial side injury. The EUA was performed within few days of admission once skin of medial side appeared to be normal as skin is often extensively bruised in extensive medial side injury. The most significant inclusion criteria for MCL-PMC repair was based upon the observation of LaPrade et al. who confirmed that more than 6.5 mm medial opening in extension upon manual stress radiography as compared to the intact knee is suggestive of MCL-PMC injury whereas lone MCL tear will lead to opening upto 3 mm in excess as compared to the normal knee [26]. Only those patients whose knees had medial opening with manual valgus stress more than 7 mm in extension under EUA were included for primary MCL-PMC repair. Anything less than 7 mm medial opening were managed conservatively for medial side injury and were excluded from the study. All included patients had medial opening in extension exceeding 8 mm (range, 8–17 mm) as compared to the normal knee upon giving manual valgus stress under anaesthesia. Remaining inclusion and exclusion criterion are summarized in Table 1. After confirmation of the

**Table 1**

Inclusion and exclusion criterion of the study. MCL, medial collateral ligament; PMC, posteromedial corner; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament.

Inclusion criteria	
1.	Grade II and above ( $\geq 6$ mm) valgus opening of medial side of the knee in extension and grade III opening in flexion under anaesthesia
2.	Presence of positive Lachman test
3.	All patients who underwent PMC and MCL repair with or without staged ACL reconstruction
Exclusion criteria	
1.	Less than Grade II Valgus opening of medial side ( $<$ or $= 6$ mm) of the knee in extension
2.	Associated fracture of tibial or femoral condyle
3.	Open injuries or associated compartment syndrome requiring fasciotomy
4.	Injuries more than four weeks
5.	If associated primary reconstruction of MCL or PMC was performed
6.	Associated PCL tear
7.	Major upper limb injuries interfering with rehabilitation
8.	Failure to return for assessment at two years

valgus instability, primary repair of MCL-PMC was performed. Fig. 1 illustrates the entire study process.

## Surgical treatment

The surgical repair of injured medial structures was performed under the tourniquet control after standard aseptic preparation of the index limb. A curvilinear incision was made between the medial epicondyle and proximal tibia. Skin and subcutaneous tissue were incised. After careful separation from the subcutaneous layer, the layer 1 was incised vertically along the lines of the skin incision. In most cases, layer 1 was intact but few cases had rent in the layer 1 especially anteriorly and inferiorly through which MCL fibers were seen to be pouting out. The two flaps of layer 1 were carefully retracted anteriorly and posteriorly. Thorough inspection was done to assess the damage to the various structures of layer 2 and 3 of Warren; superficial MCL (its level of injury- femoral end, mid-substance, tibial end avulsion and occasional bifocal tear), deep MCL (menisiofemoral and menisio-tibial component), POL, posterior capsule, femoral end of medial patellofemoral ligament (MPFL), avulsion of meniscus horn and semimembranosus insertion. Tables 2 and 3 summarize the injury to the various structures in 35 patients of both groups.

Apart from the superficial MCL, POL was found to be torn in all the cases. The posteromedial capsule was also torn up to varying degree in all the cases, often extending quite posteriorly. Regarding deep MCL, MF component was more frequently torn as compared to MT. Some cases revealed a tear in the femoral attachment of

**Table 2**

Structures injured in 35 patients. MCL, medial collateral ligament; MT, Menisio-tibial; MF, Menisiofemoral; MM, medial meniscus; PH, posterior horn; MPFL, medial patellofemoral ligament.

Structures injured	Total patients (%)
Anterior cruciate ligament	35 (100%)
Medial collateral ligament	35 (100%)
Posterior oblique ligament	35 (100%)
Deep MCL (MT or MF) ligament	35 (100%)
MM PH avulsion	02 (5%)
MPFL (femoral end)	08 (23%)
Semimembranosus avulsion from tibia	01 (3%)
Lateral meniscus tear	03 (8%)

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