

Demography and Complications of Multiligament Knee Reconstruction Surgery in a Tertiary Center - 7 Years' Experience

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Abstract: ***Background:** Multiligament knee injury (MLKI) is a complex knee ligament injury usually resulting from high-velocity trauma. Due to its low incidence rate, consensus for MLKI management is still lacking in the literature. The main purpose of this study was to identify patient demographics, mode of injury, type of reconstruction and complications, collected retrospectively. **Methods:** Medical records of MLKI patients were manually retrieved. Data collection was done retrospectively by tracing medical records from the years 2015 to 2022. Patients presenting with comorbidities were excluded. Demographic information, symptoms, and complications reported pre- and post-operatively during follow-up were collected. Data was cross-checked, and outcomes were evaluated. **Results:** Sixty-six patients were included. The average age of patients was 29.6 years, with 80.3% being male. Three modes of injury were reported: motor vehicle accidents (81.8%), sports-related injuries (9.1%), and falls (9.1%). The most common type of reconstruction performed was ACL and PCL combination (63.6%). The most common symptom reported was instability (68.2%), followed by pain, swelling, and deformity. Post-operative complications mainly reported were pain and instability. About 32% of patients experienced no complications. Other complications noted included stiffness, infection, and numbness. **Conclusion:** The vast majority of patients sustaining MLKI were male, while the predominant mode of injury was motor vehicle accident. Common symptoms reported pre-operatively was knee instability and pain. Persistent instability was the most common complication noted postoperatively.*

Keywords: multiligament knee injury, orthopedic, reconstruction surgery, post-operative complication

1. Introduction

The human knee is a complex joint that relies on multiple ligaments for stability and function [1]. Four of the major knee ligaments are: i) anterior cruciate ligament (ACL), ii) posterior cruciate ligament (PCL), iii) medial collateral ligament (MCL), and iv) posterolateral corner (PLC). Damage or injury to at least two of these ligaments results in a complex orthopedic problem known as multiligament knee injury (MLKI).

The incidence of MLKI is reported to be approximately 0.02% to 0.2% of all orthopedic-related injuries [2]. Often, MLKI results from a significant traumatic event or high-impact injury, commonly associated with sports injuries, car accidents, or falls. The severity of MLKI can vary depending on severity of trauma-the ligaments may be stretched, partially torn, or completely torn. The effects of these injuries include knee instability, pain, swelling, and difficulty with weight-bearing.

The heterogeneity of MLKI results in diverse treatment approaches, depending on the severity of MLKI and the combination of affected ligaments involved. Definitive management of MLKI rarely involves conservative measures. Surgical intervention aimed at reconstructing the damaged ligaments, restoring knee stability, and preventing long-term joint damage is the mainstay of treatment for MLKI. However, a consensus is needed to determine whether performing a single-stage or two-stage MLKI reconstruction is preferable. The disadvantages of the single-stage reconstruction approach may include complex surgery and prolonged recovery period. Meanwhile, the disadvantages of the two-stage approach include a longer

waiting gap, multiple surgeries, and possible difficulties in restoring near-normal joint function.

The incidence of postoperative complications of MLKI ranges from 6% to 75% [3]. Complications frequently reported following MLKI reconstruction include pain, recurrent instability, arthrofibrosis, wound complications, infection, popliteal artery injury, common peroneal nerve injury, compartment syndrome, deep venous thrombosis, and heterotrophic ossification [4]. Several factors, such as the timing of surgery, associated injuries or infections, and the patient's medical comorbidities, are key factors contributing to post-operative complications following MLKI reconstruction.

The Orthopedic Department of Hospital Kuala Lumpur conducts highly specialized orthopedic surgery, including MLK reconstruction. Therefore, this study aims to describe patient demographic characteristics, mode of injury, and post-operative complications among patients who underwent multiligament knee injury reconstruction. The findings of this study will be used as guidance to improve and possibly prevent complications following post-MLKI reconstruction in future practice.

2. Literature Survey

Multiligament knee injury (MLKI) is recognized as an orthopedic issue involving ligament injury that predominantly affects the male population. The common cause of this injury is high-velocity trauma such as road traffic accidents. Definitive treatment for MLKI varies depending on the severity of damage to the affected ligaments. It is important to highlight that this injury has a

low incidence rate, with only 0.02% of the population experiencing it; hence, evidence-based studies on the management of this injury are still lacking. The main focus at this point is to establish a guide that can assist healthcare practitioners in determining the management of this injury.

3. Methods

3.1 Study design and population

A descriptive retrospective cross-sectional study was conducted between January 2015 and December 2022. The authors manually reviewed and extracted information from paper-based patients' medical records who underwent multiligament reconstruction knee surgery at Hospital Kuala Lumpur, Malaysia. In this study, patients aged 55 years old and younger without comorbidities were included. The descriptive variables were i) patients' demographics, ii) clinical presentations (signs or symptoms), iii) work status post-operatively, and iv) proportion and type of post-operative complications.

3.2 Inclusion and exclusion criteria

Patients below the age of 55 without comorbidities and with two or more ligament injuries were included. Patients with multiple comorbidities, aged over 55, with single ligament injuries, or with prior surgeries such as external fixation on the affected limb or vascular surgery were excluded.

3.3 Data extraction

Since this study was based solely on patients' medical records, informed consent was not obtained. Any identifiers of patients were encoded before proceeding to analysis in order to maintain patients' privacy and confidentiality. Patients who underwent arthroscopically assisted MLKI reconstruction for their ACL, PCL, PLC, and MCL were identified. The data collected were divided into two main groups: 1) demographics of patients presenting with MLKI and 2) complications faced by patients post-MLK surgery. Patient demographic characteristics such as age, gender, mode of injury, chief complaints, and return-to-work status were retrieved from folders.

Patients who defaulted on follow-up or had ongoing follow-up were also noted. Next, the complications resulting from post-MLK surgery were obtained from the patients' folders. Initially, patients were followed up every two weeks for a total duration of six weeks. This was followed by monthly follow-ups for three months, every three months for a period of two years, and yearly follow-ups for five years.

All MLKI patients typically underwent magnetic resonance imaging (MRI) to detect all possible injuries. Stress views were performed to further assess the type of surgery. Our team relied on clinical findings such as physical examination and correlated them with the MRI findings and stress views. All cases identified were chronic MLKI, where patients were more than three weeks post-injury. All multiligament reconstructions were performed using the same technique by sports consultants or surgeons who underwent subspecialty training under the Ministry of Health Malaysia program. MLKI reconstruction was performed using Achilles

allograft. Only single-stage MLKI reconstruction was performed in all patients.

3.4 Statistical analysis

Demographic characteristics of patients in this study population, mode of injuries, and types of reconstructions were described. Patient demographics, including age and gender, were presented as means and percentages, respectively. Modes of injury were subdivided into motor vehicle accidents, sports injuries, and falls, presented as percentages. Types of reconstruction were categorized into combinations of: i) anterior cruciate ligament (ACL), ii) posterior cruciate ligament (PCL), iii) medial collateral ligament (MCL), iv) posterolateral corner (PLC). Combinations of reconstructions included: 1) PCL & ACL, 2) PCL & PLC, 3) ACL, MCL & PCL, 4) ACL, PCL & PLC, 5) PCL & MCL, 6) ACL & MCL, and 7) PCL, ACL, MCL.

Statistical analyses were performed using IBM SPSS (Statistical Package for the Social Sciences) version 27. All categorical data were reported as frequencies and percentages. For continuous data, means and standard deviations were presented if normally distributed, whereas medians and interquartile ranges were presented if not normally distributed.

3.5 Ethical approval

This study has obtained ethical approval from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia [NMRR ID – 23 – 02563 – 0QC (IIR)].

4. Results and Discussion

4.1 Results

Demographic aspects of MLKI patients and complications experienced by them post-reconstruction surgery were the main focus of this study. A total of 66 patients seen in the Department of Orthopaedics from January 2025 until December 2022 were included in our study. The average age of all included patients was 29.6 years (SD 8.81); 80.3% were male (see Table 1).

Table 1: Demographic characteristics (N = 66)

Demography	n (%)
Age (Mean ± SD)	29.6 ± 8.81
Gender	
Male	53 (80.3)
Female	13 (19.7)

Table 2 shows the mode of injury experienced by the included patients. The vast majority of our patients, about 81.8%, had multiligament injuries due to motor vehicle accidents. Following this, six patients (9.1%) reported sports-related injuries, and a similar percentage of patients (9.1%) reported falls.

Table 2: Mode of injury (N = 66)

Mode of Injury	n (%)
Motor	
Vehicle Accident	54 (81.8)
Sports Injury	6 (9.1)
Fall	6 (9.1)

Regarding the type of reconstruction, a total of 42 patients presented with PCL and ACL injuries (63.6% of the total). About 19.7% of the patients had PCL & PLC injuries. Then, a similar percentage of patients (4.6%) were involved in: i) ACL, MCL, and PCL injuries and ii) ACL, PCL, and PLC injuries, respectively. Subsequent types of reconstructions included only 2 patients reporting PCL and MCL injuries, and two patients reporting ACL and MCL injuries. The least common type of reconstruction was PCL, ACL, and MCL, which was found in only one patient (see Table 3).

Table 3: Type of reconstruction (N = 66)

Type of Reconstruction	n (%)
PCL & ACL	42 (63.6)
PCL & PLC	13 (19.7)
ACL, MCL & PCL	3 (4.6)
ACL, PCL & PLC	3 (4.6)
PCL & MCL	2 (3.0)
ACL & MCL	2 (3.0)
PCL, ACL, MCL	1 (1.5)

Regarding symptoms and signs complained of by the patients and documented in the medical notes, these included instability, pain, swelling, and deformity. Table 4 shows the number and percentage of symptoms presented by patients. About 68.2% of patients complained of instability, followed by complaints of pain from 11 patients. Swelling was reported by 9 patients (13.6%). The least observed symptom was knee deformity, with only one patient reporting this symptom.

Table 4: Presentation of symptoms (N = 66)

Symptoms	n (%)
Instability	45 (68.2)
Pain	11 (16.7)
Swelling	9 (13.6)
Deformity	1 (1.5)

Following reconstruction and during follow-up, almost 47% of the MLKI patients reported experiencing pain and instability (see Table 5). The least common complication experienced was numbness, which only one patient complained of. Knee stiffness was reported by 9 patients, with limited range of motion. Additionally, about 6% of MLKI patients disclosed that they had an infection. Twenty-one patients had no complications post-reconstruction surgery.

Table 5: Post-reconstruction surgery complications (N = 66)

Complications	n (%)
No Complications	21 (31.8)
Pain & Instability	31 (46.9)
Stiffness	9 (13.7)
Infection	4 (6.1)
Numbness	1 (1.5)

4.2 Discussion

This study aims to comprehensively explore patient demographics, injury characteristics, and post-operative outcomes following multiligament knee injuries (MLKI) reconstruction. Our findings in this study highlighted several key aspects which will help improve the understanding and management of MLKI.

Firstly, our data revealed a striking male predominance in MLKI cases, consistent with prior research [5],[6]. This observation underscores the potential influence of gender-specific factors in MLKI occurrence and warrants further investigation. The predominance of the male population in our study aligns with existing literature on MLKI epidemiology, suggesting a gender-specific vulnerability to such injuries.

Symptomatology among MLKI patients, while diverse, showed that pain and instability were the most commonly reported complaints. Additionally, a subset of patients presented with knee deformity and swelling, which, although subsided in some cases, persisted intermittently in others. These findings corroborated those reported by Gagnier et al. [7], highlighting the complex and multifaceted nature of post-MLKI symptomatology.

Road traffic accidents emerged as the primary mode of injury in our study cohort, particularly involving two-wheeler vehicles, consistent with the transportation patterns observed in the region [8],[9]. Conversely, sports-related injuries accounted for a smaller proportion of MLKI cases, primarily caused by hyperextension knee mechanisms in athletes such as soccer and rugby players. Understanding the etiology and mechanisms of MLKI is crucial for developing targeted preventive strategies and enhancing injury management protocols.

In terms of injury patterns, our study identified two primary multiligament injury configurations: ACL, PCL injury combination, and PCL, PLC injury combination. These findings mirror those reported by Raghu et al. [8] and Robertson et al. [9], underscoring the consistency of injury patterns across different populations. Notably, the prevalence of medial-sided injury with cruciate involvement was lower in our cohort, suggesting potential variations in injury mechanisms or anatomical factors [10].

Post-surgery, approximately 65% of patients successfully returned to work, indicating favorable functional outcomes following MLKI reconstruction. These findings are consistent with previous studies by Raghu et al. [8] and Karataglis et al. [11].

However, our study encountered challenges in follow-up, with approximately 30% of patients defaulting, primarily due to logistical and financial constraints. This highlights the importance of implementing strategies to improve follow-up compliance and ensure comprehensive post-operative monitoring, particularly in tertiary care settings.

Complications post-surgery primarily manifested as recurrent instability and pain, affecting a substantial proportion of patients. These findings align with those

reported by Rodríguez-Merchán et al. [12]. Factors contributing to these complications include the severity of initial trauma, pre-existing cartilage and meniscal injuries, technical errors in surgical technique, and inadequate postoperative rehabilitation [13],[14].

Additionally, infection and stiffness were identified as notable complications post-surgery, emphasizing the importance of meticulous surgical technique and postoperative protocols. Our surgical technique includes rigorous infection preventive measures, resulting in a low incidence of infection-related complications, consistent with prior research [15], [16], [17]. However, the management of postoperative stiffness remains a clinical challenge, requiring a tailored rehabilitation strategy.

In conclusion, while our study provides valuable insights into MLKI demographics, injury characteristics, and post-operative outcomes, several limitations warrant consideration. These include the retrospective study design, relatively small sample size, and challenges in follow-up compliance. Future prospective studies with a larger cohort are necessary to further elucidate the complex nature of MLKI and optimize treatment strategies.

5. Conclusion

We found that the MLKI patients who underwent reconstruction surgical procedure were mostly men and involved in motor vehicle accidents. Most postoperative complaints can be addressed if early and appropriate treatment were rendered. In accordance with previous studies, our findings aligned well and showed a similar pattern of postoperative complications. These results may serve as valuable reference for sports surgeons in identifying and managing the complications reported by patients. It also helps to provide insights into the demographic profile of MLK injuries.

6. Future Scope

A larger prospective study is necessary to gather more data, which can further strengthen the study. Sufficient evidence of long-term adverse events post-MLKI surgery can be collected such an endeavor. With adequate financial support and human resources, we could contribute to establishing guidelines for the management of MLKI patients in Malaysia.

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