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Atypical Multi-Ligamentous Knee Injury(MLKI) - Binary Injury with one or either Cruciate Avulsion and another Cruciate Tear with or without Collateral Ligament Injury following Road Traffic Accidents (RTA)

Authors:

- *Dr Ramakanth R, Consultant, Dept Of Arthroscopy & Sports Medicine**
- *Dr SR Sundararajan, Dept Chief, Dept Of Arthroscopy & Sports Medicine**
- *Dr Terence Dsouza, Senior Registrar, Dept Of Arthroscopy & Sports Medicine**
- *Dr Suchit Chavan, Assistant Professor, Dept of Orthopaedics***
- *Dr S Rajasekaran, Chairman & Dept Chief, Dept of Orthopedics**

**** Ganga Hospital, Coimbatore, India***

***** GMCH, Mumbai***

Faculty Disclosure Information

- *The authors have no relevant financial or non-financial interests to disclose.*

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aMLKI - definition

- **Atypical MLKI are characterised by the avulsion of one cruciate ligament and the tear of the other cruciate ligament, or the avulsion of both cruciate ligaments; collateral ligament injury may or may not be present.**
- **Lacunae in literature**

- only seven case reports detailing bicruciate binary injuries or atypical MLKI

- Atypical MLKI is a rare injury with no reported case series of these comprehensive injuries; nevertheless, in the present day, these injuries are on the rise because of the rising incidence of RTAs.

- there is no standard way to managing these high velocity atypical MLKIs.

Aims and Objectives

Primary Aim:

- compare the functional and radiological outcomes from a single centre for atypical MLKI patients with and without collateral ligament injury

Secondary aim:

- to estimate the incidence of atypical MLKI among all MLKI.

- identify complications related to management of such injuries

- Assessment of functional outcome of single stage single draping technique

Material & Methods

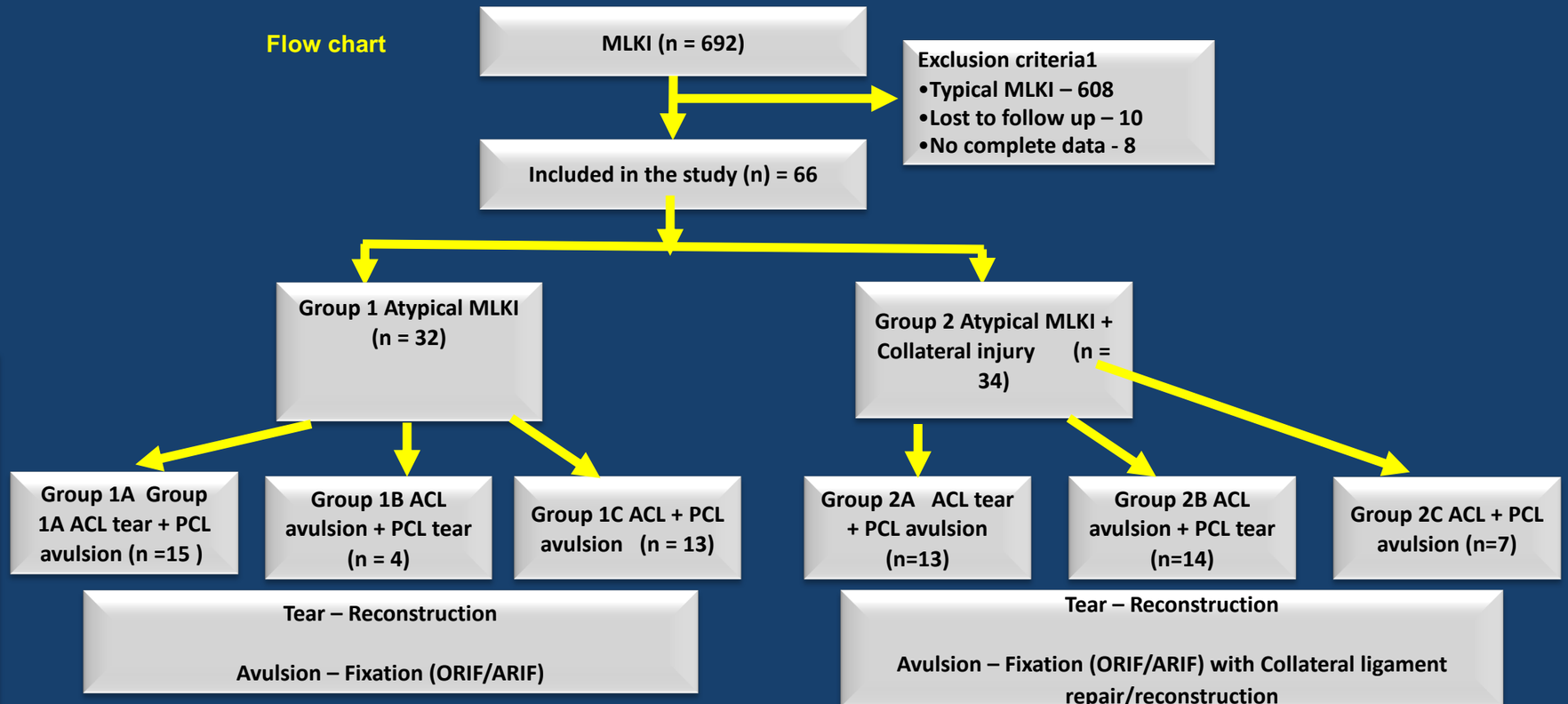
- Retrospective Study
- IRB approval taken
- Study Period: 2010 – 2022; Ganga Hospital, Coimbatore, india

Inclusion criteria

- bicruciate binary injury with one cruciate avulsion and another cruciate tear or bicruciate avulsion, both of which were combined with or without one collateral ligament injury.
- Min - 12 months follow up

Exclusion criteria

- typical MLKI (KD2, KD3, KD3L, and KD4 according to the Schenck classification)
- arthritis,
- open injuries,
- fractures around the knee
- neurovascular injury
- Previous knee surgery
- Unfit for surgery



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Surgical Technique

- Supine position under CSE

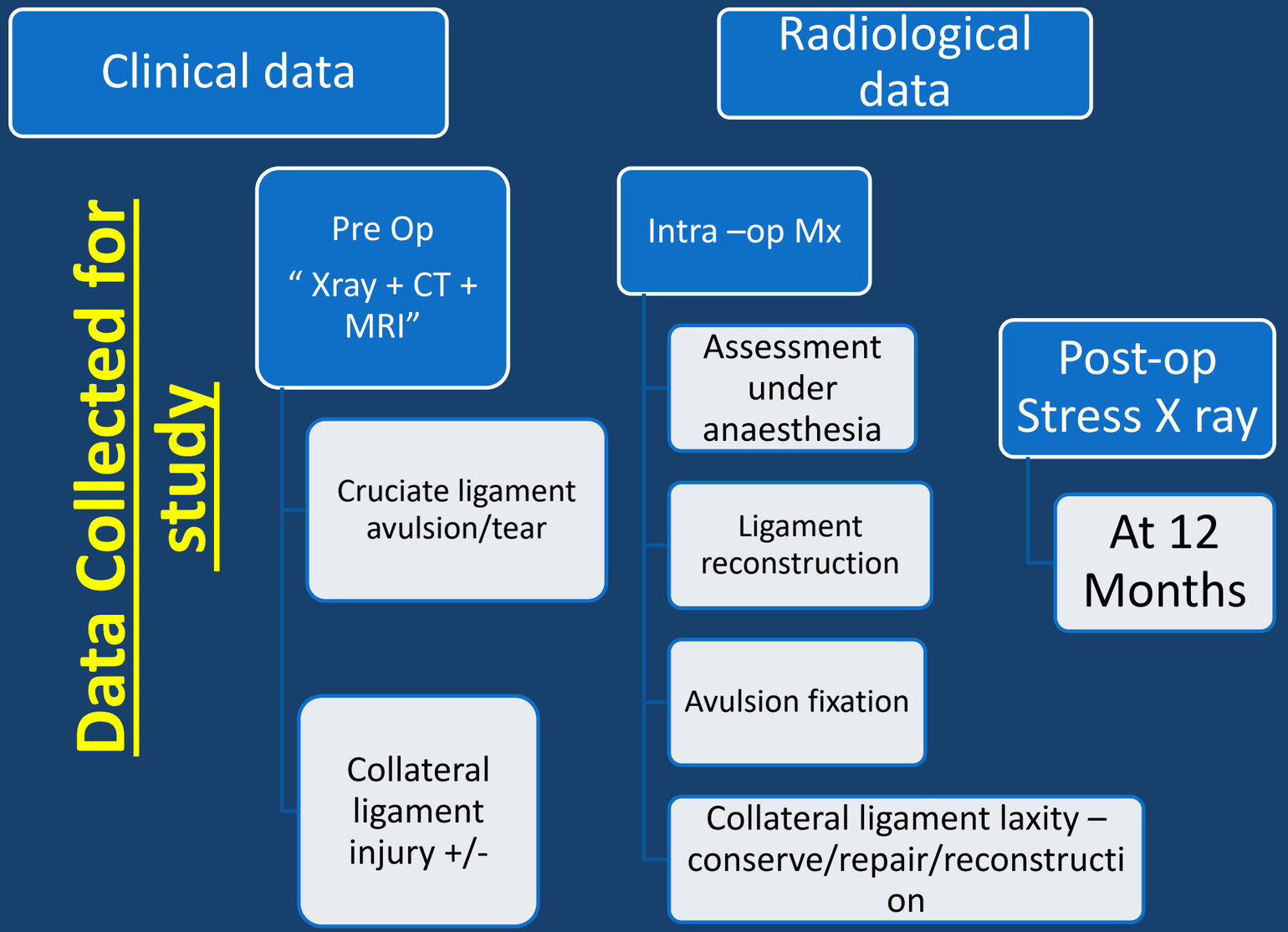
- In group 1 and 2, avulsions of the ACL were treated with arthroscopic staples or arthroscopic suture pull out (SPO) technique.
- Avulsions of the PCL were fixed with a ORIF and 4 mm cannulated cancellous screw or arthroscopic SPO technique.
- Either of the cruciate tears (ACL/ PCL tear) were treated with single bundle reconstruction technique with Hamstring/Peroneus autograft.
- For Collateral management in group 2 - both the severity of the tear and its chronicity played a role in the decision-making process to restore medio-lateral laxity. While Grade I laxity was managed conservatively, Grade III laxity were managed operatively with repair with 5.5 mm metal anchors, and LCL reconstruction was performed using the Modified Larson technique.
- Grade I laxity was managed conservatively.

Post op protocol

- posterior support long knee brace with NWB with walker for 6 weeks
- No knee bending was allowed for the first three weeks
- Prone knee bending exercises were initiated at three weeks with long knee hinged brace
- Partial weight-bearing began at six weeks and was gradually increased to full weight-bearing by eight weeks
- Patients in Group 2 were given the instruction to continue wearing hinged knee braces for an additional 3 months
- Weight-resisted exercises commenced three months post-surgery. The patient was advised to begin squatting, sitting cross-legged, and participating in recreational sports six months postoperatively

Statistical Analysis

- All statistical analyses were conducted using SPSS version 20 software (IBM). The demographic details and factors affecting the outcome are documented and statistically analysed.
- Friedman test was applied to compare the pre-operative and post-operative clinical scores.
- A standard t test was applied to compare clinical outcomes between Group 1 and Group 2 of atypical MLKI.
- Mann Whitney test was used to compare the radiological outcomes between Group 1 and 2.
- Multiple linear regression was carried out for the variables like method of fixation (suture pull out/staples/CC screws) and associated meniscal injury that were found to have an association with outcomes.



RESULTS

Table 1 - Method of fixation and reconstruction for cruciate avulsion and cruciate tear respectively in both the groups.(ACL- Anterior cruciate ligament; PCL - Posterior cruciate ligament; MCL/PMC – Medial collateral ligament / Posteromedial corner; LCL/PLC – Lateral collateral ligament / Posterolateral corner; CC- Cannulated cancellous; SPO- Suture pull out)

Group 1	Subgroup	ACL	PCL	MCL (PMC) (n = 18)	LCL (PLC) (n = 16)
	1A – ACL tear + PCL avulsion (n = 15)	Reconstruction – 15	CC screws – 6 SPO - 9		
	1B – ACL avulsion + PCL tear (n = 4)	Staples – 3 SPO – 1	Reconstruction- 4		
	1C – Bicruciate avulsion (n= 13)	Staples – 5 SPO - 8	CC screws – 9 SPO - 4		
Group 2	2A – ACL tear + PCL avulsion (n = 13)	Reconstruction - 13	CC screws – 5 SPO - 8	Cons – 4 Repair – 3	Cons – 3 Repair - 3
	2B – ACL avulsion + PCL tear (n = 14)	Staples – 5 SPO - 9	Reconstruction - 14	Cons – 5 Repair – 3	Cons – 2 Repair - 4
	2C – Bicruciate avulsion (n= 7)	Staples – 2 SPO - 5	CC screws – 2 SPO - 5	Cons – 2 Repair - 1	Cons – 1 Repair - 3

Clinical outcome (n=66)

		Group 1 Atypical MLKI			Group 2 Atypical MLKI + Collateral			P value
Subgroup		1A	1B	1C	2A	2B	2C	
		ACL tear PCL avulsion	ACL avulsion PCL tear	Bicruciate avulsion	ACL tear PCL avulsion	ACL avulsion PCL tear	Bicruciate avulsion	
ROM (degrees°)	Final Follow up	116.10 ± 11.89	122.5 ± 9.57	119.23 ± 8.62	116.15 +/- 6.50	118.33 +/- 7.52	118.33 +/- 9.83	**0.314**
	Pre-operative	29.07 ± 4.88	35.75 ± 6.23	31.38 ± 7.67	33.23 +/- 6.28	35.33 +/- 11.62	34.33+/- 7.84	**0.093**
	Final Follow up	63.8 ± 6.01	72.5 ±5.80	72.15 ± 6.05	75.15 +/-3.33	72.33 +/- 6.28	71.16+/- 7.11	**0.154**
Lysholm's Score	Pre-operative	39.33 ± 6.78	47.75 ± 5.67	39.92 ± 8.87	42.30 +/- 6.10	45.33+/- 8.71	45.16+/- 4.26	**0.051**
	Final Follow up	74.47 ± 6.35	85.25 ± 2.75	83.53 ± 3.45	83.76 +/- 3.98	83.83 +/- 4.57	85.83+/- 5.34	**0.387**

All patients had significant improvement post op clinical scores.

No significant difference in clinical outcome of patients with collateral injury as compared to ones without collateral injury

Radiological outcome

Table 4: Comparison of Radiological outcomes							
	Group 1 Atypical KD3M			Group 2 Atypical KD3M + Collateral			P VALUE
	ACL tear PCL avulsion	ACL avulsion PCL tear	Both avulsion	ACL tear PCL avulsion	ACL avulsion PCL tear	Both avulsion	
Anterior Tibial Translation	2.3+/- 2.2	3.08 +/- 1.7	3.6 +/- 1.1	3.37+/- 1.2	3.76 +/- 0.849	3.25+/-1.193	**0.108**
Posterior Tibial Translation	4.7 +/- 3.08	3.5 +/- 0.548	3.02 +/- 0.9	2.32+/- 1.27	12.38 +/- 3.88	4.25+/- 2.54	**0.449**
valgus Opening at 0°				4.35+/- 1.77	4.25+/- 0.66	5.075+/- 1.199	
valgus Opening at 30°				5.54+/- 1.62	5.25+/- 0.1	6.32+/- 1.541	
Varus Opening at 0°				3.85+/- 0.49	5.9+/- 4.6893	3.967+/-0.551	
Varus Opening at 30°				5.2+/- 0.2	6.86+/- 4.875	4.73+/- 0.569	

No significant difference in radiological outcome of patients with collateral injury as compared to ones without collateral injury

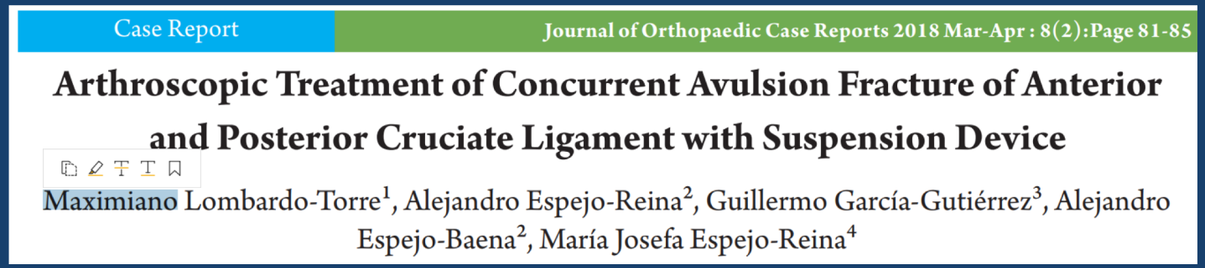
Discussion

- The most important finding from our study is atypical MLKI injury with various combination of avulsion, tear and collateral injury that occurs following RTAs needs systematic approach and can be dealt with single stage reconstruction.
- Establishing a methodical approach and a proper management guidelines is crucial for addressing atypical MLKI. We advocate for a single-stage, single-drape approach, prioritizing the management of cruciate injuries first, followed by collateral ligaments.
- The management of collateral ligament is to be determined by grade of laxity after cruciate injury fixation or reconstruction. The chronicity of injury and tissue integrity of collateral ligaments should also be taken into consideration.

Complications

- The primary post-operative complication in our study was knee stiffness(12.12%) at the 6-week follow-up.
- This can be attributed to a combination of extensive soft-tissue injury leading to subsequent arthrofibrosis and inadequate physiotherapy.
- All patients attained full range of motion (ROM) with manipulation under anaesthesia.
- Therefore, immediate intervention is recommended to achieve satisfactory outcomes.

Maximiano etal Vs Our Study



Case Report | Journal of Orthopaedic Case Reports 2018 Mar-Apr : 8(2):Page 81-85

Arthroscopic Treatment of Concurrent Avulsion Fracture of Anterior and Posterior Cruciate Ligament with Suspension Device

Maximiano Lombardo-Torre[1], Alejandro Espejo-Reina[2], Guillermo García-Gutiérrez[3], Alejandro Espejo-Baena[2], María Josefa Espejo-Reina[4]

No collateral ligament injury

OUR STUDY

N = 66

20 - bicruciate avulsion

11 – open fixation of PCL avulsion

9 – arthroscopic PCL avulsion fixation

N=1

ACL + PCL avulsion

Arthroscopic fixation

No collateral ligament injury

Yoshida etal Vs Our Study

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CASE REPORT

Surgical treatment for a combined anterior cruciate ligament and posterior cruciate ligament avulsion fracture: A case report

Katsuhiro Yoshida, Michiyuki Hakozaki, Hideo Kobayashi, Masashi Kimura, Shinichi Konno

Double draping single stage management was done

OUR STUDY

N = 66

Double draping – 22

Single draping - 44

N = 1

ACL + PCL avulsion with MCL tear

Double draping done

MCL repair done

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CONCLUSION

- There was found to be no significant difference in the outcomes of atypical MLKI with or without collateral ligament injury.
- Incidence of atypical MLKI out of all multi-ligamentous injury was found to be 9.53% (66/692) in our study.
- The single stage single drape management of atypical MLKI with cruciate avulsion dealt with ARIF and cruciate tears with reconstruction yields satisfactory clinical and radiological results.

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