Patient demographic and magnetic resonance imaging evaluation of isolated posterolateral corner knee injuries

Joao Pedro de Guimaraes Fernandes Costa[1], Jair Antunes Eleterio Neto[2], Marcelo Bordalo Rodrigues[3], Camilo Partezani Helito[4,5], Paulo Victor Partezani Helito[1,6]

[1]Musculoskeletal Radiology Department, Institute of Orthopaedics and Traumatology of the Hospital das Clínicas of the Faculty of Medicine of the University of Sao Paulo, Sao Paulo, Brazil; [2]Osteomuscular Radiology Department, CUF Hospital, Lisboa, Portugal; [3]Musculoskeletal Radiology Department, Aspetar Orthopaedics and Sports Medicine Hospital, Doha, Catar; [4]Department of Orthopaedics, Institute of Orthopaedics and Traumatology of the Hospital das Clínicas of the Faculty of Medicine of the University of Sao Paulo, Sao Paulo, Brazil; [5]Department of Orthopaedics, Sirio Libanes Hospital, Sao Paulo, Brazil; [6]Department of Radiology, Sirio Libanes Hospital, Sao Paulo, Brazil

Contributions: (I) Conception and design: All authors; (II) Administrative support: JAE Neto, MB Rodrigues, CP Helito, PVP Helito; (III) Provision of study materials or patients: JAE Neto, MB Rodrigues, CP Helito, PVP Helito; (IV) Collection and assembly of data: JPGF Costa, JAE Neto, MB Rodrigues, CP Helito, PVP Helito; (V) Data analysis and interpretation: MB Rodrigues, PVP Helito; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Joao Pedro de Guimaraes Fernandes Costa, MD. Musculoskeletal Radiology Department, Institute of Orthopaedics and Traumatology of the Hospital das Clínicas of the Faculty of Medicine of the University of Sao Paulo, Sao Paulo, Brazil. Email: joaopedrogfc@gmail.com.

Background: Posterolateral stability of the knee is maintained by capsular, ligamentous and tendinous structures, which collectively are known as the posterolateral corner (PLC). Injuries to the PLC of the knee rarely occur without associated anterior (ACL) or posterior cruciate (PCL) ligament tears. The main objectives of our study were to report patient demographics and magnetic resonance imaging (MRI) findings of patients with isolated PLC injuries.

Methods: This study consists of a retrospective analysis of knee MRI from January 2011 to June 2016, in two hospitals in São Paulo, Brazil, where PLC injuries without associated ACL and PCL injuries were identified in MRI by two radiologists specialized in musculoskeletal injuries. Relative and absolute frequencies were used to describe the injuries of each of the PLC structures in the study cases.

Results: A total of 23 cases of PLC injuries without associated cruciate ligament injuries were identified. The mean age of patients was 32.0±8.1 years and 91% patients were male. The main sport associated with isolated PLC injury was Brazilian Jiu-Jitsu (48%), followed by soccer (35%). MRI evaluations of the knees showed lateral collateral ligament (LCL) injuries in 70% of cases, popliteus tendon injuries in 26% of cases and distal biceps tendon injuries in 30% of cases. The popliteofibular ligament (PFL) was damaged in 83% of cases. An associated ALL injury was observed in 43% of cases.

Conclusions: Isolated PLC injuries occurred mainly in young men when practicing Brazilian Jiu-Jitsu and soccer. The LCL was the most frequently injured larger structure in association, and the capsuloligamentous structures (PFL) were the most frequently injured structures overall. ALL injuries occurred in approximately half of the cases, most often concomitantly with LCL injuries.

Keywords: Isolated posterolateral corner; trauma; soccer

Received: 18 July 2022; Accepted: 30 March 2023; Published online: 11 April 2023.
doi: 10.21037/aoj-22-28
View this article at: https://dx.doi.org/10.21037/aoj-22-28

Introduction

Background

Posterolateral stability of the knee is maintained by capsular, ligamentous and tendinous structures, which collectively are known as the posterolateral corner (PLC). The literature is inconsistent regarding the components of this anatomic unit; however, the main stabilizers are the lateral collateral ligament (LCL), distal biceps femoris tendon (BT), popliteus muscle and tendon (PT) and popliteofibular ligament (PFL) (1-3). The PLC is often injured in association with injuries to the anterior cruciate ligament (ACL), posterior cruciate (PCL) and/or the medial collateral ligament (MCL) (4,5). Isolated injuries are considered rare, been reported with an incidence of 27.5% in a cohort by Geeslin and LaPrade (5) and have also been frequently reported in association with contact sports or high energy traumas, in case reports (6-16). Because of its importance to knee stability, PLC injuries are known to be related to instability and chronic knee pain and may predispose the patient to secondary degenerative changes if not treated appropriately (1-3). Physical examination tests for the evaluation of PLC structures are not always easy to perform, and often, these injuries are not diagnosed during the evaluation (17,18).

Highlight box

Key findings

- Isolated posterolateral corner (PLC) injuries occurred mainly in young men practicing Brazilian Jiu-Jitsu and soccer. The popliteofibular ligament and lateral collateral ligament were the most frequently injured structures associated. Lesions in the anterolateral ligament occurred in approximately half of the cases.

What is known and what is new?

- PLC is the set of capsular, ligamentous and tendinous structures responsible for posterolateral stability of the knee. PLC injuries rarely occur without associated anterior or posterior cruciate ligament tears.
- This manuscript reports patient demographics and MRI findings of patients with isolated PLC injuries.

What is the implication, and what should change now?

- Radiologists should be suspicious about PCL injuries without concomitant cruciate ligament injuries in patients who have engaged in sports activities involving atypical varus stresses and hyperextension mechanisms. Our description of the most frequently injured structures may serve as a guide in screening for abnormalities in these cases.

Magnetic resonance imaging (MRI) is the method of choice for the evaluation of knee ligaments (19,20). MRI is a recommended evaluation method of the LCL, with increased sensitivity in acute tears and varus stress radiographies being a more sensitive alternative in chronic tears (21). MRI can visualize the LCL, PT and BT (18). Due to its small size, the PFL is visible in *in vivo* MRI studies in only 8–53% and 10–46% of patients (22), respectively. Another lateral structure that has gained importance recently is the anterolateral knee ligament (ALL), despite having been described more than 100 years ago by Segond (23). It originates in the lateral femoral condyle and has a meniscal and a tibial insertion (24-26). The ALL has been found in virtually all anatomical dissections of the knee and can be visualized in 75–100% of MRI examinations (27-31).

Due to the high frequency of association between PLC injuries and cruciate ligament ruptures, few radiological studies are dedicated to isolated PLC injuries. A study with only two cases was recently published, showing the low incidence of this injury in the medical literature (16).

Objectives

The objective of this study was to describe the appearance of isolated PLC injuries in MRI examinations and to identify which of the ligaments composing this group were more frequently damaged. In particular, we observed whether concomitant ALL injury was present, as this structure also plays an important role in rotational knee stability and has an intimate relationship with the LCL origin and PT insertion. Additionally, the trauma mechanisms associated with this type of injury were reported in the studied sample.

We present the following article in accordance with the STROBE reporting checklist (available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-28/rc).

Methods

This study consists of a retrospective analysis of knee MRI examinations performed at the Sirio Libanes Hospital between January 2011 and June 2016 and at the Institute of Orthopaedics and Traumatology of the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo from January 2014 to June 2016. Inclusion criteria were patients with PLC injuries without associated ACL and PCL injuries were identified. Exclusion criteria were artifacts due to motion, previous knee surgery or other knee

Table 1 Parameters used in the MRI sequences in the study

Parameters	Sagittal proton density	Sagittal T2 FATSAT	Coronal T2 FATSAT	Coronal T1	Axial T2 FATSAT
Field of view (mm)	150–160	150–160	150–160	150–160	150–160
Time of repetition (ms)	2,150–2,900	2,900–5,900	2,200–3,000	340–740	2,900–4,300
Time of echo (ms)	30–40	40–50	40–50	9–12	38–45
Thickness (mm)	3.0–3.5	3.0–3.5	3.0–3.5	3.0–3.5	3.0–3.5
Spacing (mm)	0.3–0.4	0.3–0.4	0.3–0.4	0.3–0.4	0.3–0.5

MRI, magnetic resonance imaging; FATSAT, fat saturated.

pathologies such as infections.

MRI examinations

The MRI examinations were performed on 1.5T (Aera, Siemens Medical Solutions, Erlangen, Germany; Espree, Siemens Medical Solutions, Erlangen, Germany; Avanto, Siemens Medical Solutions, Erlangen, Germany; GE Optima 450W, GE Healthcare, Milwaukee, United States) and 3.0 T (Achieva, Philips Medical Systems, Best, the Netherlands; Skyra, Siemens Medical Solutions, Erlangen, Germany; GE HDX, GE Healthcare, Milwaukee, United States) devices. All protocols were performed according to *Table 1*.

Assessment of MRI examinations

The studies were evaluated by two radiologists specialized in musculoskeletal injuries. The main observer's evaluation was used for the statistical analysis, while the second observer's evaluation was used to determine interobserver agreement. The observers dichotomically signed the presence or absence of injuries in the following structures: the LCL, distal BT, PT, PFL and the ALL. The arcuate ligament and PFL were grouped together due to the inconsistency of these structures in the anatomical and radiological evaluations (22).

The observers considered the LCL and the distal BT and PT injured when a signal change and fiber thickening, along with partial or complete structural discontinuities, were observed. The PT was also considered to be injured when interstitial edema and tears were observed in its muscle belly. The PFL was considered injured when periligamentous edema was associated with thickening or thinning of these ligaments or when clear discontinuity of these structures was observed. The ALL was considered abnormal when periligamentous edema and/or clear discontinuity of fibers, proximal or distal detachment or irregularity of its contours were observed. The MRI sequence most useful to identify the PLC structural injury was signed by each observer.

For each patient meeting the inclusions criteria, the observers searched in the local hospital database for age, gender and mechanism of trauma or sports associated with the PLC injury.

Statistical analysis

Relative and absolute frequencies were used to describe the injuries in each of the PLC structures and the ALL in the studied cases. Cohen's Kappa (*k*) test was used to evaluate interobserver agreement. The observers used R to calculate frequencies and correlation measures.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional ethics committee of Sirio Libanes Hospital (No. 112) and individual consent for this retrospective analysis was waived.

Results

A total of 248 cases of PLC injuries were identified, 225 of which had combined cruciate ligament injuries. No patient was discarded due to the exclusion criteria (artifacts due to motion, previous knee surgery or other knee pathologies such as infections).

The resulting 23 cases of PLC injuries without associated cruciate ligament injuries were identified. The knee laterality was right in 10 cases and left in 13 cases.

Table 2 Absolute number and percentage of each activity related to trauma

Sport	Absolute number of cases	Percentage of cases (%)
Jiu-Jitsu	11	48
Soccer	8	35
Walking accident	1	4
Motorcycle accident	1	4
Judo	1	4
"Zumba" dancing	1	4

Table 4 Interobserver correlations for posterolateral corner structure and anterolateral ligament injuries

Structure	Kappa index (k)
Capsuloligamentous structures	0.84
Lateral collateral ligament	0.91
Anterolateral ligament	0.70
Distal biceps femoris tendon	0.82
Popliteal tendon	0.68
Fibular head avulsion fracture	1.0

Table 3 Absolute number and percentage of each injured posterolateral corner structure, in order of frequency

Structure	Absolute number of injuries	Percentage of cases with injury (%)
Capsuloligamentous structures	19	83
Lateral collateral ligament	16	70
Anterolateral ligament	10	43
Distal biceps femoris tendon	7	30
Popliteal tendon	6	26
Fibular head avulsion fracture	2	9

The mean age of patients was 32.0±8.1 years (range, 16 to 57 years); 21 (91%) patients were male, and 2 (9%) patients were female. There was no missing data on the variables of interest. 21 of the 23 cases were performed on 1.5T magnet and the remaining 2 cases on the 3.0T magnet.

The main sport associated with isolated PLC injury was Brazilian Jiu-Jitsu (11/23, 48%), which accounted for almost half of the cases evaluated, followed by soccer (8/23, 35%). The four other cases were due to a sprain when walking, a motorcycle fall due to an automobile accident, judo and "*Zumba*" dancing (*Table 2*).

MRI evaluations of the knees showed LCL injuries in 16/23 (70%) cases, PT injuries in 6/23 (26%) cases and BT injuries in 7/23 (30%) cases. The PFL was damaged in 19/23 (83%) cases and were the structures most affected by this type of injury. Bone avulsion of the fibular head was found in 9% of all patients. Only four cases (17%) in which injuries to the PFL were identified showed no injuries to larger ligament structures. An associated ALL injury was observed in 10/23 (43%) cases. Of the cases with ALL injuries, nine also presented LCL injury (*Table 3*). Additionally, an anteromedial femoral condyle associated or not to posteromedial tibial plateau bone bruise pattern was identified in 5/23 (22%) cases. No common peroneal nerve injurie was observed among the cases in this study.

Lesions were best appreciated in T2 weighted with fat saturation sequences. Although all structures were evaluated in the three planes, coronal and axial sequences proved to be more useful to evaluate the LCL, BT, PT tendon and ALL injuries. Sagittal sequences proved to be useful to access PT muscle belly injuries while PFL tears were better evaluated in the axial plane.

Excellent interobserver agreement was observed for LCL and BT injuries, fibular avulsions and PFL injuries, and good interobserver correlation was observed for ALL and PT injuries (*Table 4*).

Discussion

The PLC injuries without associated cruciate ligament tears were more frequent related to sports practices, Jiu-Jitsu followed by soccer, in young men. The most frequently injured components of the affected PLC complex were the PFL, followed by the LCL.

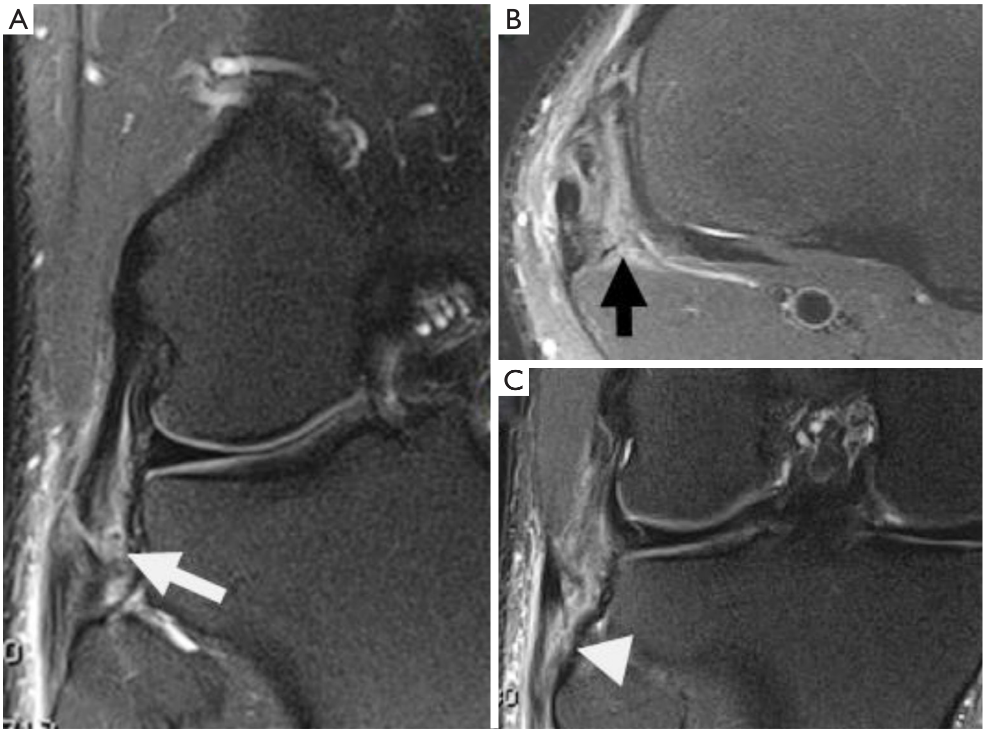

Figure 1 A 25-year-old man with a knee injury sustained while playing soccer. Magnetic resonance images in the coronal (A,C) and axial (B) planes with T2 weighted sequences with fat saturation. The images show high-grade injuries in the distal third of the lateral collateral ligament (white arrow) and in the distal biceps femoris tendon insertion (white arrowhead) and a capsuloligamentous injury of the posterolateral corner with popliteofibular ligament rupture (black arrow).

The PLC consists of a set of posterolateral knee ligament structures, and injuries to this structure promote instability for varus stresses, posterior translations and external rotational forces (1-3). The main trauma mechanisms related to PLC injuries are varus stress in an extended knee, followed by external rotation associated with hyperextension or partial flexion and posterolateral trauma in the extended knee (1). Injuries to these structures are often related to cruciate ligament injuries, with an incidence of combined injuries of the PLC with ACL, PCL or the MCL of 75.5% in the cohort by Geeslin and LaPrade (5). An anteromedial femoral condyle associated or not to posteromedial tibial plateau bone bruise pattern found in 22% of the cases should increase the suspicion on PLC corner injuries (5).

Most of the studied injuries were suffered by men during Jiu-Jitsu practice, and the next most frequent cause was soccer practice. Soccer is the most practiced sport in many countries, with frequent high energy traumas and a substantial association with knee ligament injuries due to pivoting, twisting and quick changing of direction on running (32). Jiu-Jitsu is a martial art in which the focus is control of the fighting opponent on the ground, and the fighters can employ a variety of leg braces, including some that result in varus stresses and hyperextension, as well as rotation components that work against the resistance and stability generated by the PLC structures (1-3). These atypical trauma mechanisms may be possible explanations for why these injuries were more prevalent in Jiu-Jitsu fighters, a sport with a much smaller number of participants than soccer in our country.

In our series, the PFL was the most frequently injured (83%), and these injuries were sustained without concomitant injuries to larger structures (LCL, PT and BT) in 17% of cases (*Figure 1*). However, isolated injuries to these structures have a lower clinical importance, and instability with functional impairment of the PLC is related to injuries to larger structures, especially the LCL for varus instability and the PT for external rotation instability (33).

With regard to the larger structures, LCL injuries were the most frequent, occurring in 70% of cases (*Figure 2*).

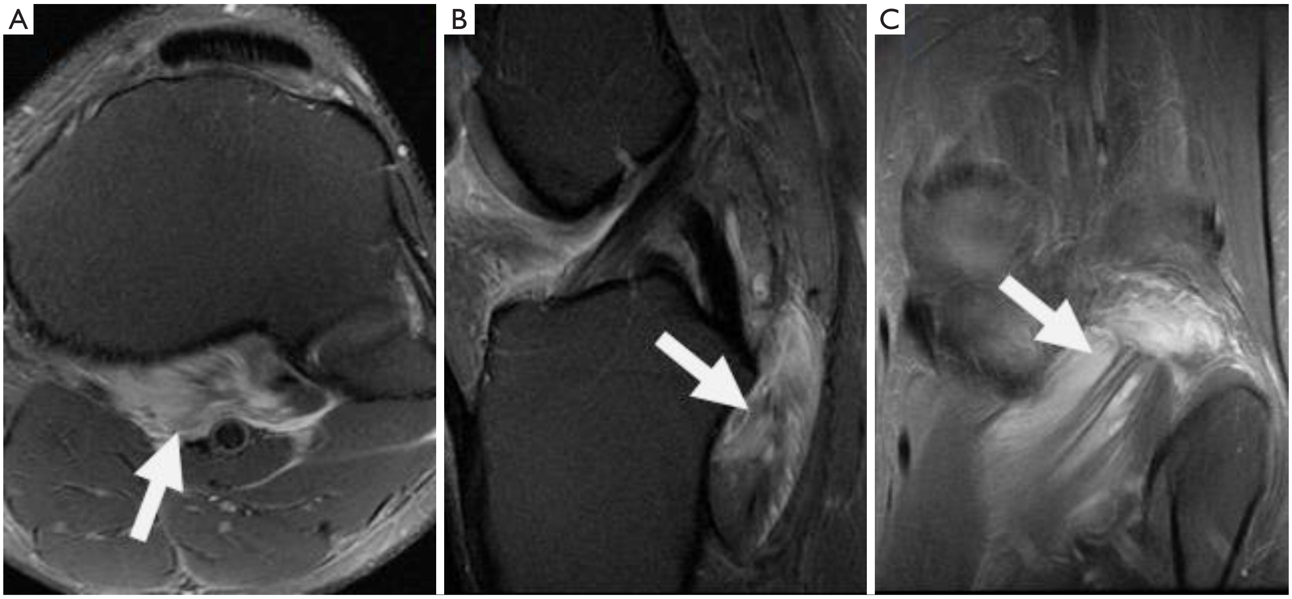

Figure 2 A 33-year-old man with a knee injury sustained while playing soccer. Magnetic resonance image in the axial plane (A), sagittal plane (B) and coronal plane (C) with T2 weighted sequences with fat saturation. The images show an injury at the myotendinous junction of the popliteus muscle (arrows).

Collins *et al.* reported that the LCL was the most frequently injured structure in cases of PLC injury associated with cruciate ligament injury (33), and this was believed to be because its rigid bone insertions make it more vulnerable. In addition, we believe that trauma mechanisms with varus stress but without a rotational component may impose a greater load on the LCL, as this is the major varus stress stabilizer, and thus save the central pivot structures from injury, justifying the greater number of cases with LCL injuries in our series. In contrast, the PT, which is responsible for rotational control, had an almost three times lower injury rate and was the ligament structure least often injured in isolated PLC injury cases.

The ALL presented abnormalities in 10 cases (42%), which is similar to its injury incidence in acute ACL injuries (34,35) and more than the injury incidence of structures such as the PT and BT but less than the incidence of LCL and capsuloligamentous structure injuries. This number of associated injuries may indicate that during the physical examination, attention should be focused on possible anterolateral instability associated with posterolateral instability in cases of PLC injuries considered "isolated". Ninety percent of ALL injuries had an associated LCL injury (*Figure 3*). The anatomical evaluation of the ALL demonstrated that its origin in the lateral epicondyle shows close proximity to the LCL origin (24-26,36), which could explain the concomitance of injuries to these ligaments. Helito *et al.* (37) also failed to distinguish a separation between the origin of these two structures in a series of anatomical dissections. Davis *et al.* (16) included the ALL in a group that has been called the LCL complex, reinforcing the anatomical proximity of these two structures. Another possible explanation would be that the ALL plays some role in the genesis of varus stability in the absence of an intact LCL, but this role has not yet been proven biomechanically.

This study had some limitations. The study of PLC injuries without associated cruciate ligament injuries is limited by the low frequency of such injuries. Both 1.5 tesla and 3.0 tesla MRI were used in this study which may act as a confounding variable as the image quality may have affected the diagnostic interpretations. Furthermore, the MRI findings were not correlated with surgical data to confirm any eventual injuries, but the literature shows that MRI exhibits good accuracy in evaluating these structures (19-22), and many of these patients did not undergo any ligament repair or reconstruction procedure. Another limitation was that this was a descriptive study with no correlation with clinical data regarding instability. Although jiu-jitsu and soccer are sports practiced worldwide, their popularity in Brazil, where we conducted the present study, is undeniable,

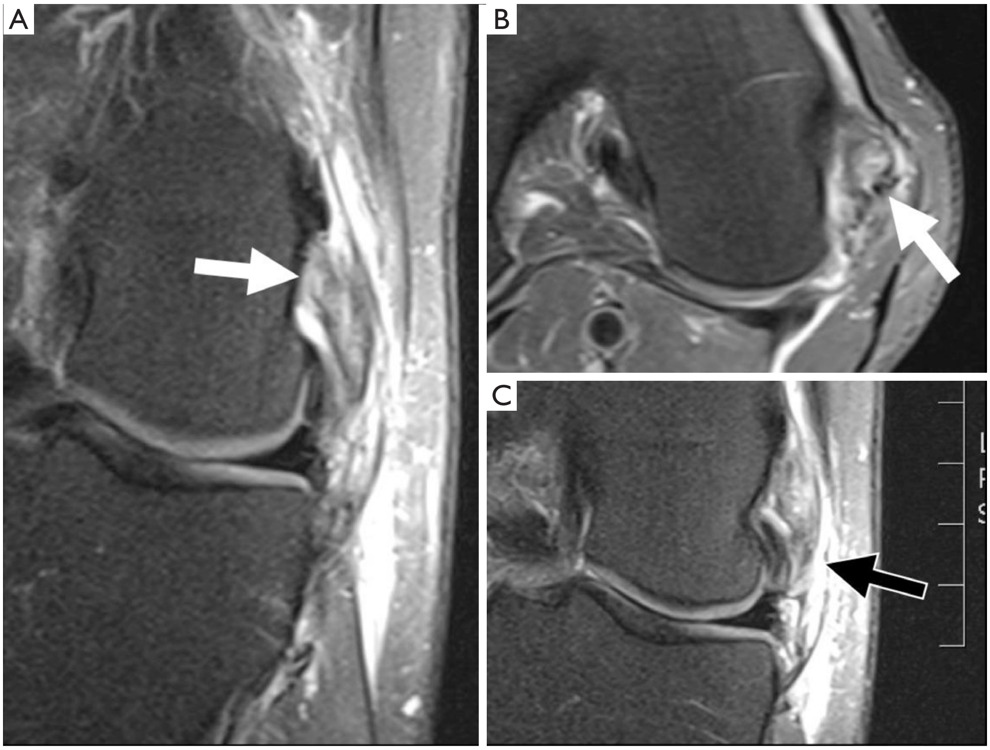

Figure 3 A 38-year-old man with a knee injury sustained while practicing Jiu-Jitsu. Magnetic resonance images in the coronal (A, B and C) plane with T2 weighted sequences with fat saturation. The images show high-grade injuries at the lateral collateral ligament origin (white arrows) and in the femoral portion of the anterolateral ligament (black arrow).

and this data should be taken into account when generalizing the results in addition to the sample obtained from this low frequency injury. Regarding future work, we suggest an evaluation of which types of isolated PLC injuries progress with residual instability and functional impairment in day-to-day or sports activities, which could affect the clinical or surgical management of these patients.

The description of demographic data on isolated PLC injuries in this study showed atypical varus stresses and hyperextension mechanisms associated with these lesions. These mechanisms may vary according to the sports practiced in a given country or region and also play a key role in determining the most frequent injuries patterns observed, as was the Jiu-Jitsu practice associated with LCL tears. Also the description of an incidence of 42% ALL injuries associated with PLC should call attention to anterolateral instability associated to PLC injuries.

Conclusions

Isolated PLC injuries occurred mainly in young men when practicing Brazilian Jiu-Jitsu and soccer. The LCL was the most frequently injured larger structure in association, and the capsuloligamentous structures, mainly the PFL, were the most frequently injured structures overall. ALL injuries occurred in approximately half of the cases, most often concomitantly with LCL injuries.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-28/rc

Data Sharing Statement: Available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-28/dss

Conflicts of Interest: All authors have completed the ICMJE

uniform disclosure form (available at https://aoj.amegroups.com/article/view/10.21037/aoj-22-28/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional ethics committee of Sirio Libanes Hospital (No. 112) and individual consent for this retrospective analysis was waived.

References

1. Bolog N, Hodler J. MR imaging of the posterolateral corner of the knee. Skeletal Radiol 2007;36:715-28.
2. Crespo B, James EW, Metsavaht L, et al. Injuries to posterolateral corner of the knee: a comprehensive review from anatomy to surgical treatment. Rev Bras Ortop 2014;50:363-70.
3. Davies H, Unwin A, Aichroth P. The posterolateral corner of the knee. Anatomy, biomechanics and management of injuries. Injury 2004;35:68-75.
4. LaPrade RF, Wentorf FA, Fritts H, et al. A prospective magnetic resonance imaging study of the incidence of posterolateral and multiple ligament injuries in acute knee injuries presenting with a hemarthrosis. Arthroscopy 2007;23:1341-7.
5. Geeslin AG, LaPrade RF. Location of bone bruises and other osseous injuries associated with acute grade III isolated and combined posterolateral knee injuries. Am J Sports Med 2010;38:2502-8.
6. Burstein DB, Fischer DA. Isolated rupture of the popliteus tendon in a professional athlete. Arthroscopy 1990;6:238-41.
7. Geissler WB, Corso SR, Caspari RB. Isolated rupture of the popliteus with posterior tibial nerve palsy. J Bone Joint Surg Br 1992;74:811-3.
8. Guha AR, Gorgees KA, Walker DI. Popliteus tendon rupture: a case report and review of the literature. Br J Sports Med 2003;37:358-60.
9. Conroy J, King D, Gibbon A. Isolated rupture of the popliteus tendon in a professional soccer player. Knee 2004;11:67-9.
10. Quinlan JF, Webb S, McDonald K, et al. Isolated popliteus rupture at the musculo-tendinous junction. J Knee Surg 2011;24:137-40.
11. Winge S, Phadke P. Isolated popliteus muscle rupture in polo players. Knee Surg Sports Traumatol Arthrosc 1996;4:89-91.
12. Geronikolakis S, Best R. Die isolierte Ruptur der distalen Biceps-femoris-Sehne beim Sportkletterer: eine seltene Verletzung. Sportverletz Sportschaden 2012;26:114-6.
13. Rehm O, Linke R, Schweigkofler U, et al. Isolated ruptures of the tendon of the biceps femoris muscle. Unfallchirurg 2009;112:332-6.
14. David A, Buchholz J, Muhr G. Tear of the biceps femoris tendon. Arch Orthop Trauma Surg 1994;113:351-2.
15. Bushnell BD, Bitting SS, Crain JM, et al. Treatment of magnetic resonance imaging-documented isolated grade III lateral collateral ligament injuries in National Football League athletes. Am J Sports Med 2010;38:86-91.
16. Davis BA, Hiller LP, Imbesi SG, et al. Isolated lateral collateral ligament complex injury in rock climbing and Brazilian Jiu-jitsu. Skeletal Radiol 2015;44:1175-9.
17. Bonadio MB, Helito CP, Gury LA, et al. Correlation between magnetic resonance imaging and physical exam in assessment of injuries to posterolateral corner of the knee. Acta Ortop Bras 2014;22:124-6.
18. Pacheco RJ, Ayre CA, Bollen SR. Posterolateral corner injuries of the knee: a serious injury commonly missed. J Bone Joint Surg Br 2011;93:194-7.
19. LaPrade RF, Gilbert TJ, Bollom TS, et al. The magnetic resonance imaging appearance of individual structures of the posterolateral knee. A prospective study of normal knees and knees with surgically verified grade III injuries. Am J Sports Med 2000;28:191-9.
20. Derby E, Imrecke J, Henckel J, et al. How sensitive and specific is 1.5 Tesla MRI for diagnosing injuries in patients with knee dislocation? Knee Surg Sports Traumatol Arthrosc 2017;25:517-23.
21. Kane PW, DePhillipo NN, Cinque ME, et al. Increased Accuracy of Varus Stress Radiographs Versus Magnetic Resonance Imaging in Diagnosing Fibular Collateral Ligament Grade III Tears. Arthroscopy 2018;34:2230-5.

22. Vasilevska Nikodinovska V, Gimber LH, Hardy JC, et al. The Collateral Ligaments and Posterolateral Corner: What Radiologists Should Know. Semin Musculoskelet Radiol 2016;20:52-64.
23. Segond P. Clinical and experimental research on sprained knee. ProgMed 1879;7:297-9, 319-21, 340-1.
24. Claes S, Vereecke E, Maes M, et al. Anatomy of the anterolateral ligament of the knee. J Anat 2013;223:321-8.
25. Vincent JP, Magnussen RA, Gezmez F, et al. The anterolateral ligament of the human knee: an anatomic and histologic study. Knee Surg Sports Traumatol Arthrosc 2012;20:147-52.
26. Helito CP, Demange MK, Bonadio MB, et al. Anatomy and Histology of the Knee Anterolateral Ligament. Orthop J Sports Med 2013;1:2325967113513546.
27. Macchi V, Porzionato A, Morra A, et al. The anterolateral ligament of the knee: a radiologic and histotopographic study. Surg Radiol Anat 2016;38:341-8.
28. Helito CP, Helito PV, Bonadio MB, et al. Correlation of Magnetic Resonance Imaging With Knee Anterolateral Ligament Anatomy: A Cadaveric Study. Orthop J Sports Med 2015;3:2325967115621024.
29. Helito CP, Demange MK, Helito PV, et al. Evaluation of the anterolateral ligament of the knee by means of magnetic resonance examination. Rev Bras Ortop 2015;50:214-9.
30. Helito CP, Helito PV, Costa HP, et al. MRI evaluation of the anterolateral ligament of the knee: assessment in routine 1.5-T scans. Skeletal Radiol 2014;43:1421-7.
31. Kosy JD, Mandalia VI, Anaspure R. Characterization of the anatomy of the anterolateral ligament of the knee using magnetic resonance imaging. Skeletal Radiol 2015;44:1647-53.
32. Astur DC, Xerez M, Rozas J, et al. Anterior cruciate ligament and meniscal injuries in sports: incidence, time of practice until injury, and limitations caused after trauma. Rev Bras Ortop 2016;51:652-6.
33. Collins MS, Bond JR, Crush AB, et al. MRI injury patterns in surgically confirmed and reconstructed posterolateral corner knee injuries. Knee Surg Sports Traumatol Arthrosc 2015;23:2943-9.
34. Helito CP, Helito PVP, Costa HP, et al. Assessment of the Anterolateral Ligament of the Knee by Magnetic Resonance Imaging in Acute Injuries of the Anterior Cruciate Ligament. Arthroscopy 2017;33:140-6.
35. Helito CP, Helito PVP, Leão RV, et al. Anterolateral ligament abnormalities are associated with peripheral ligament and osseous injuries in acute ruptures of the anterior cruciate ligament. Knee Surg Sports Traumatol Arthrosc 2017;25:1140-8.
36. Kennedy MI, Claes S, Fuso FA, et al. The Anterolateral Ligament: An Anatomic, Radiographic, and Biomechanical Analysis. Am J Sports Med 2015;43:1606-15.
37. Helito CP, Bonadio MB, Gobbi RG, et al. Is it safe to reconstruct the knee Anterolateral Ligament with a femoral tunnel? Frequency of Lateral Collateral Ligament and Popliteus Tendon injury. Int Orthop 2016;40:821-5.

doi: 10.21037/aoj-22-28
Cite this article as: Costa JPGF, Neto JAE, Rodrigues MB, Helito CP, Helito PVP. Patient demographic and magnetic resonance imaging evaluation of isolated posterolateral corner knee injuries. Ann Joint 2023;8:13.

