

Case Report

Simultaneous Medial and Lateral Bucket-handle Meniscus Tears in Chronic ACL Deficiency: A Rare Case of the Triple-PCL Sign



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ABSTRACT

Background: Bucket-handle meniscus tears are a common yet severe knee injury, often associated with anterior cruciate ligament (ACL) damage. While isolated bucket-handle tears (BHT) are well-documented, simultaneous medial and lateral BHTs are rare, particularly in chronic ACL-deficient knees. The term "triple posterior cruciate ligament (PCL) sign" arises due to the lack of overlap between the two BHTs in the coronal plane while positioned in the intercondylar notch, preventing them from aligning within the same sagittal plane.

Case Presentation: In this report, we present a case of triple PCL sign on magnetic resonance imaging (MRI) in a patient with bilateral lateral and medial bucket handle tears and associated chronic ACL rupture. The patient underwent diagnostic and therapeutic arthroscopy, which confirmed bimeniscal bucket handle tears and their fragments' entrapment in the intercondylar notch, along with ACL rupture.

Conclusion: This report highlights the diagnostic importance of the triple PCL sign because it is observed in patients with both compartment meniscus tears adjunct to ACL rupture. It also raises awareness of the need to pay more attention to this sign in patients presented with ACL rupture symptoms because it is crucial for preoperative planning.

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Introduction

Meniscal damage is one of daily practice's most common knee injuries [1]. Knees with a meniscus injury are at a higher risk of cartilage degeneration and the development of early-onset osteoarthritis; therefore, a meniscus injury is detected in up to 75% of patients with symptomatic osteoarthritis [1].

Meniscal tears are diagnosed using magnetic resonance imaging (MRI). Following the availability of high-resolution MRI, the number of invasive arthroscopic diagnoses has considerably reduced [2]. Although the diagnosis of meniscal injuries has significantly improved over the last few decades, many meniscal injuries remain missed during the first inspection [3].

A bucket-handle tear (BHT) is a meniscus injury in which meniscus detachment occurs around the circumference, and meniscus displacement occurs in its inner margin. When BHT concurrently occurs in both the medial and lateral menisci, the two displaced fragments in the intercondylar notch combined with the intact posterior cruciate ligament (PCL) can form a new MRI sign on sagittal view, called the triple PCL sign. This is crucial to optimal surgical planning [4].

To date, the triple PCL sign has only been reported in a small number of studies. In this study, we report a case of double BHT associated with an anterior cruciate ligament (ACL) tear that created a triple PCL sign on sagittal MRI.

Case Presentation

An 18-year-old man was referred to our orthopedic subspecialty hospital following giving out and locking in the right knee. The patient had a history of giving out and swelling from seven months before the present referral following a soccer trauma. After the initial trauma, the giving way was almost resolved in daily activities, but the patient still experienced knee pain. The patient had a locked knee and increased pain due to a new pivot mechanism.

A physical examination revealed severe pain during walking and knee flexion. Tenderness is evident in the medial and lateral knee joints. Stability tests, including the Lachman and anterior drawer tests, were positive and a 10-degree flexion contracture. The patient underwent an MRI with a diagnosis of ACL tear. Axial MRI revealed concurrent lateral and medial meniscal tears (Figure 1). Coronal MRI revealed double BHT (Figure 2). A triple PCL sign was observed in the sagittal MRI view, corresponding to the entrapment of the two detached

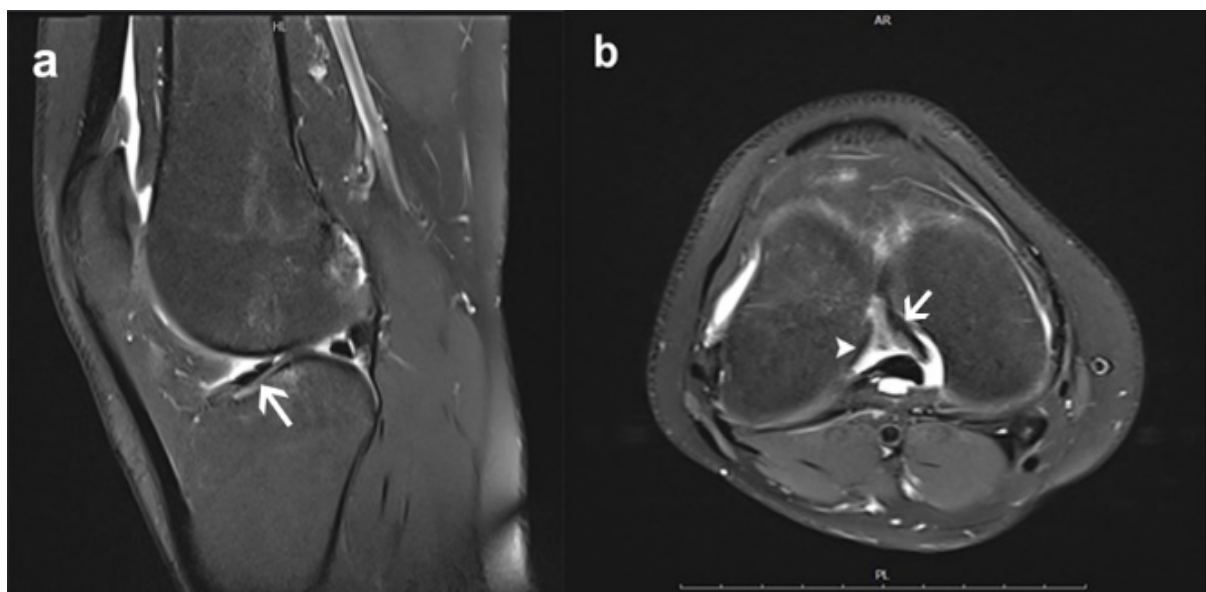


Figure 1. MRI results

a) Sgittal MRI view showing the bucket handle tear of the lateral meniscus (arrow), b) Axial MRI view showing the medial (arrow) and lateral (arrow head) meniscus tear

MRI: Magnetic resonance imaging.



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Figure 2. Coronal MRI view showing bucket handle tear in the lateral (arrow head) and medial (arrow) meniscus and their entrapment in the intercondylar notch, along with PCL (curved arrow)

MRI: Magnetic resonance imaging; PCL: Posterior cruciate ligament.

meniscal fragments in the intercondylar notch (Figure 3) and diagrammatic image triple PCL sign (Figure 4).

standard anterolateral and accessory anteromedial portals. On diagnostic arthroscopy, BHTs and ruptured ACL were identifiable (Figure 5).

The patient underwent arthroscopic surgery for meniscal repair and ACL tears. Arthroscopy was done with



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Figure 3. Sagittal MRI view showing the triple PCL sign composed of lateral meniscus tear (arrow head), medial meniscus tear (arrow), and PCL (curved arrow)

MRI: Magnetic resonance imaging; PCL: Posterior cruciate ligament.



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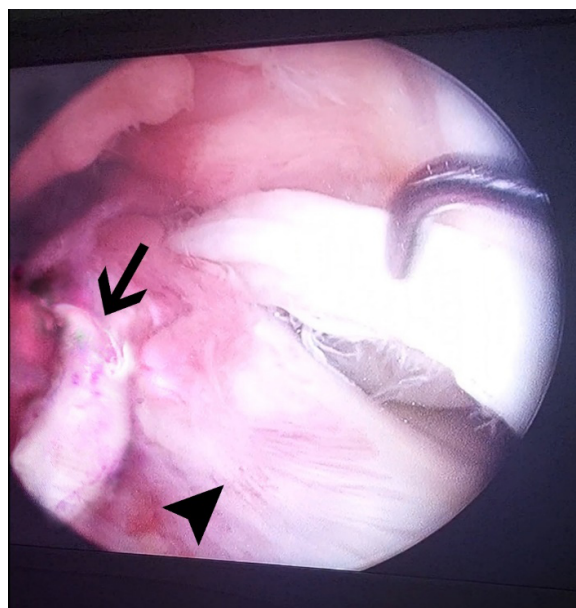
Figure 4. Diagrammatic image triple PCL sign: Lateral meniscus tear (arrow head), medial meniscus tear (arrow), and PCL (curved arrow)

PCL: Posterior cruciate ligament.

Discussion

MRI signs have been introduced for various meniscal injuries, such as the absence of bow tie, double ACL, double PCL, and coronal truncation signs. In this study, we report a case of a triple PCL sign on MRI in an 18-year-old man who presented with lateral and medial BHT associated with an ACL tear.

The triple PCL sign is rarely reported in the literature, mainly due to the lack of overlap between the lateral and medial BHT in the coronal plane. For this reason, a triple



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Figure 5. Diagnostic arthroscopy showing the bucket handle tear in the lateral meniscus (black arrow) and ACL rupture (arrow head)

ACL: Anterior cruciate ligament.

PCL sign is not noticed in most earlier reports that mention bimeniscal BHT in association with ACL injury [4].

Concurrent ACL tears may make it easier to visualize the lateral meniscal BHT in the same sagittal plane as the PCL because the more laterally located ACL acts as a barrier for the visualization of lateral meniscal fragments in sagittal plane MRI [4]. Therefore, most triple PCL signs have been reported in the context of ACL tears. Accordingly, observing a triple PCL sign can favor double BHT in association with ACL tears.

Table 1. Triple-PCL sign expression in previous articles

| No. | Authors | Onset of Injury | Gender/Age (y) | Associated Injury | Imaging/Specific Signs |
|-----|-----------------------------|-----------------|----------------|--|--|
| 1 | Kakel et al. (2010) [4] | 8 weeks | Male/16 | ACL tear | MRI/triple-PCL sign, quadruple cruciate sign |
| 2 | Guillaume et al. (2021) [5] | Unknown | Female/37 | ACL tear | CT arthrography/triple-PCL sign |
| 3 | Sales et al. (2021) [6] | 10 months | Male/16 | ACL tear, femoral condyle chondromalacia | MRI/triple-PCL sign |
| 4 | Santoso et al. (2021) [7] | 12 months | Male/21 | ACL tear | MRI/triple-PCL sign |
| 5 | Present case | 7 months | Male/18 | ACL tear | MRI/triple-PCL sign |

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Abbreviations: PCL: Posterior cruciate ligament; MRI: Magnetic resonance imaging; ACL: Anterior cruciate ligament; CT: Computed tomography.

The first triple PCL sign was reported in 2010. In this report, Kekel et al. presented a case of triple PCL sign in a 16-year-old male knee with bilateral compartment BHT and acute ACL injury [4]. Subsequent studies also reported triple PCL signs in patients with both compartment BHT and ACL injury, either as acute or chronic [5, 6]. Likewise, the present study reported a triple PCL sign in the MRI of a patient with double BHT, together with the ACL rupture. The articles are reported in Table 1. In addition to MRI, the triple PCL sign can be detected using computed tomography (CT) arthrography [5].

Conclusion

Regardless of the imaging modality, the triple PCL sign is of diagnostic and therapeutic importance because it can be used for preoperative diagnosis and surgical planning. Therefore, sagittal MRIs of patients presenting with ACL tear symptoms should be thoroughly inspected for triple PCL signs and other MRI signs, such as triple cruciate and double PCL signs.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

Conceptualization and supervision: Hooman Yahyazadeh; Methodology: Mohammadamin Haghbin; Data collection: All authors; Investigation, and writing: Mohammadamin Haghbin and Omid Elahifar.

Conflict of interest

The authors declared no conflict of interest.

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