CASE REPORT – OPEN ACCESS

International Journal of Surgery Case Reports 75 (2020) 193–197

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

The influence of a meniscal bucket handle tear on the Posterior Cruciate Ligament Angle in Anterior Cruciate Ligament Rupture – A case report

Philippe M. Tscholl[a,b,*], Oscar Vazquez[a,1], Sana Boudabbous[c], Julien Billieres[a], Amine M. Korchi[d]

[a] Division of Orthopedics and Trauma Surgery, Geneva University Hospitals, Geneva, Switzerland
[b] ReFORM (Reseau Francophone Olympique de la Recherche en Médecine du Sport), IOC Research Centre for Prevention of Injury and Protection of Athlete Health
[c] Department of Diagnostic and Interventional Radiology, Geneva University Hospitals, Geneva, Switzerland
[d] Imaging Center Onex, Geneva, Switzerland

ARTICLE INFO

Article history:
Received 1 April 2020
Received in revised form 1 September 2020
Accepted 1 September 2020
Available online 8 September 2020

Keywords:
PCL
ACL
Clinical exam
Locked knee
Kinking
Chronic knee instability

ABSTRACT

INTRODUCTION: Chronic anterior cruciate ligament (ACL) tear might be difficult to diagnose on MRI. Indirect signs might be a typical meniscal or cartilage lesion, or a spontaneous anterior drawer visualized by a decreased angle of the posterior cruciate ligament (PCL).
PRESENTATION OF CASE: A 27-year-old former ballet dancer was admitted to the emergency department for a locked left knee, without never having experienced previous symptoms of giving way or locking. The MRI performed revealed a medial meniscus bucket handle tear, without traumatic bone marrow oedema or ligament injury. The PCL angle was 130°. A former MRI of her left knee performed 1 year previously to investigate on the recurrent catching of her left knee showed a grade III medial meniscal tear of the posterior horn, and buckling of the PCL angle of 100°, as a sign of chronic ACL rupture. During arthroscopy and medial meniscal repair, the ACL showed complete loss of tension, and was therefore reconstructed simultaneously to enable proper meniscal healing.
DISCUSSION AND CONCLUSION: Chronic ACL insuffiency is a major risk factor for subsequent medial meniscus tear, especially bucket handle tear. The locked knee might unable proper pre-operative clinical examination. The preoperative MRI therefore being the only possibility to diagnose concomitant ligamentous injury. This is the first case reported in literature showing, that a positive PCL angle sign might be falsely negative due to a locked medial meniscus bucket handle tear.

1. Introduction

Injuries to the anterior cruciate ligament (ACL) are the most frequent injuries to the knee [1]. Direct signs on Magnetic Resonance Imaging (MRI) of a torn ACL are its oedematous and swollen appearance, an increased signal on T2 or fat saturated Proton Density (FS PD) sequences, a discontinued course of the fibres or a change in its usual orientation with an tibial-ACL angle less steep than the intercondylar roof (Blumensaat's line) [2]. It may also appear fragmented, abnormally oriented or even absent in chronic tears [3]. Bone contusions on the "sulcus terminalis" of the lateral femoral condyle and the postero-lateral femoral tibial plateau, bone-bruise of the postero-medial tibial plateau combined with a menisco-capsular ramp lesion, or a Segond fracture are highly suspicious or even almost pathognomonic for an underlying acute ACL tear and might be visible in up to 80% of acute ACL ruptures [4].

The angle of the posterior cruciate ligament (PCL) has been shown to be pathologic in ACL acute tears with a lax and more redundant aspect; a buckled aspect of the PCL due to anterior tibial displacement is considered an indirect sign and PCL angle less than 107 degrees has been described with a sensitivity of 52% and a specificity of 94% [2,5]. Moreover, the PCL angle is thought to decrease with time after its injury, and may therefore be more useful as a sign of chronic anterior instability [6–8].

This report highlights the influence of an acute meniscal bucket handle tear on the PCL angle in a chronic ACL insufficient knee.

* Corresponding author at: Division of Orthopedics and Trauma Surgery, Geneva University Hospitals, Rue Gabrielle-Perret-Gentil 4, 1205, Geneva, Switzerland.
E-mail address: Ph.Tscholl@sunrise.ch (P.M. Tscholl).
[1] Co-first author.

https://doi.org/10.1016/j.ijscr.2020.09.007

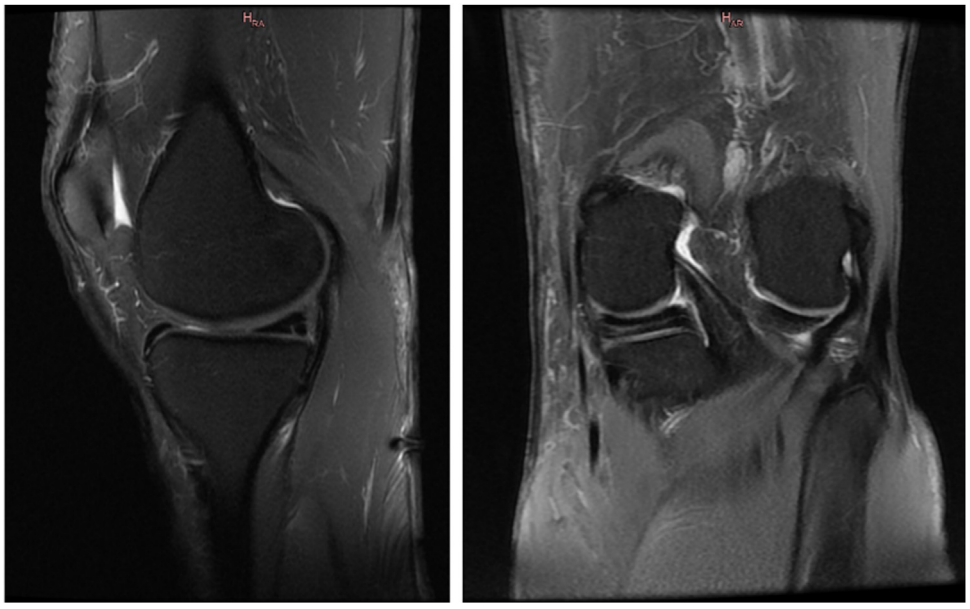

Fig. 1. Stable grade III meniscal undersurface tear with horizontal cleavage of the posterior medial meniscus on **A**) sagittal and **B**) coronal DP FS images, without any signs of meniscal instability or ramp lesion.

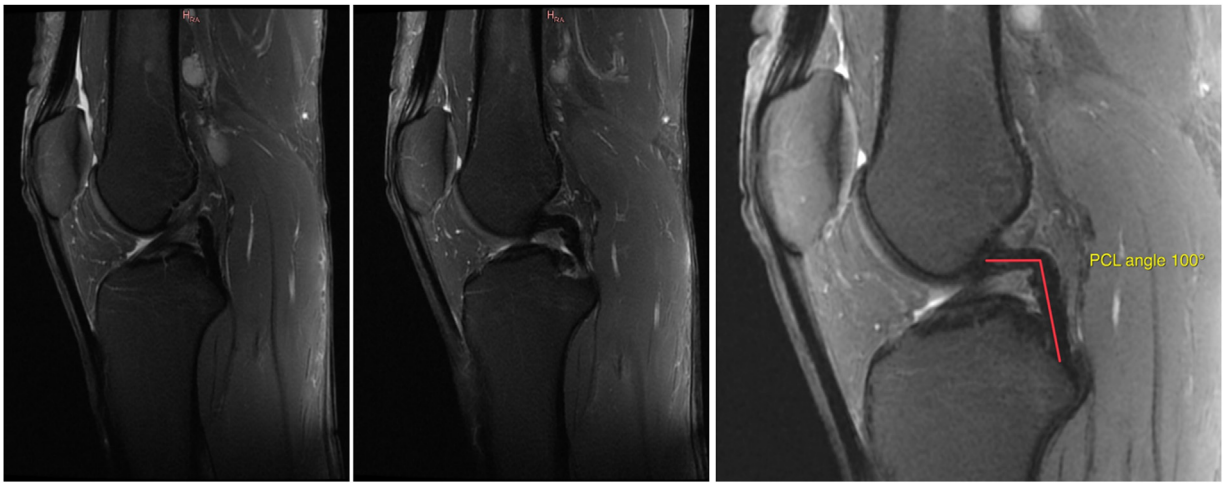

Fig. 2. Visualisation on DP FS images of the **A**) normal signal and morphological appearance of the ACL however with the **B** and **C**) buckling of the PCL (100°) on sagittal DP FS, showing the spontaneous anterior drawer of the tibia in the prone position during MRI acquisition.

2. Case report

A 27-year-old female patient, non-smoker, former professional ballet dancer and at the time of injury performing alpine skiing and jogging, is admitted to the emergency department with a locked left knee. In her medical records, there is nothing in particular except a road accident with major dermal injury to her left lower limb three years previously with multiple skin grafting.

The patient explains having felt the night before a sharp pain to the medial joint-line of her left knee after a minor twisting movement while dancing. She was unable to regain full range of motion and to load. There was no immediate large joint effusion. Prior to this event, her knee was pain free, without sensation of apprehension, giving-way or knee swelling. However, she experienced several catching for one year. At that time, she was evaluated by her sports-physician that diagnosed a partial ACL tear (with a differential of 4 mm on the KT-1000 anterior tibial translation device) on clinical exam, no pivot-shift and a negative McMurray's test on both menisci. An MRI has been performed thereafter and found a grade III meniscal injury of the medial posterior horn (Fig. 1A) with a horizontal cleavage (Fig. 1B), a normal ACL signal (Fig. 2A), no bone marrow oedema and a buckled PCL of 100° (Fig. 2B). Based on the clinical exam, radiological assessment and the absence of any other major knee trauma, it was concluded that her left knee might have undergone a partial ACL tear during the road accident two years previously.

On the day of presentation at the emergency department, the clinical exam showed only moderate knee effusion, a range of motion of F/E 110°/20°/0°, the Lachman test and anterior drawer test was positive, and a side-to-side difference of anterior translation on the KT-1000 measuring device of 2 mm. Neither the pivot-shift nor the meniscal manoeuvres were performed due to the suspected meniscal bucket handle tear.

The MRI performed a few days later found a medial meniscal bucket handle tear (Fig. 3A, B and C). There was no bone contusion, neither on the lateral nor the medial femoro-tibial compartment, or signs of antero-lateral avulsion of the joint capsule. The PCL angle was 130° (Fig. 4A), and the ACL showed a slightly inhomoge-

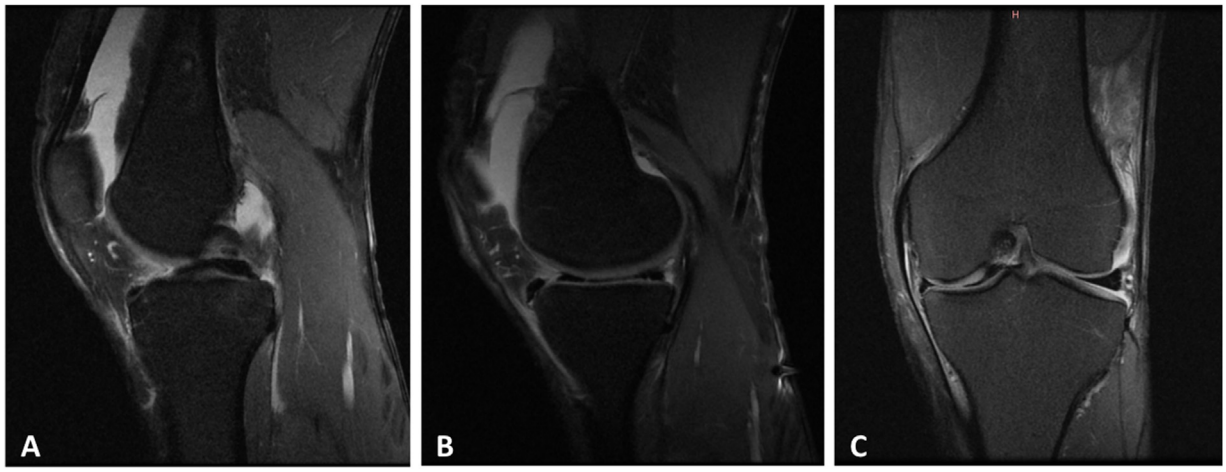

Fig. 3. A–C – Locked bucket handle tear of the medial meniscus in the intercondylar notch (DP FS forte); note the double PCL sign (A) and absent bow-tie (B) signs on the sagittal plane, and the fragment in notch sign (C: abnormal presence of three elements in the intercondylar notch) on the coronal plane.

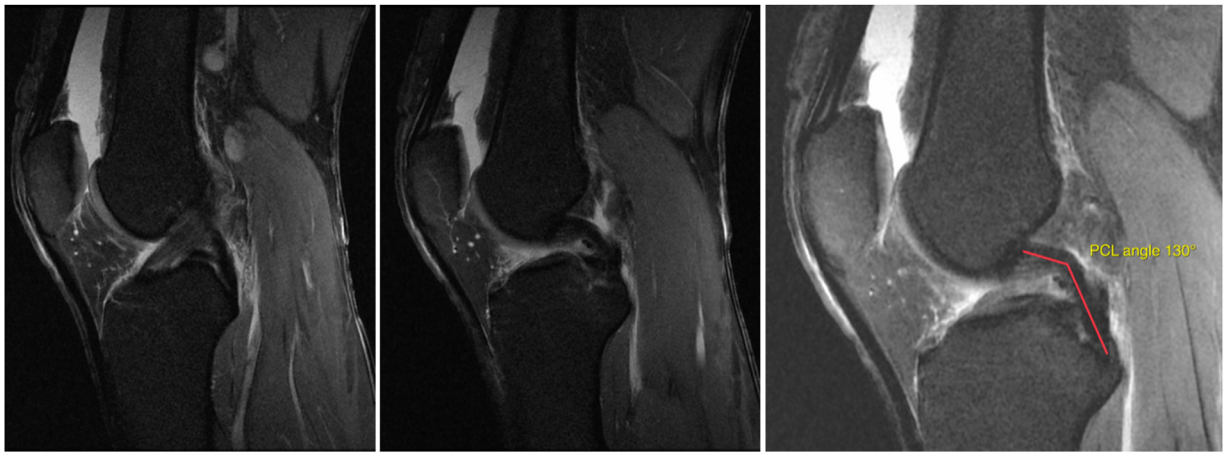

Fig. 4. Not the slight hyperintense ligament signal of the ACL (A), with normalization of the PCL angle (B and C, DP FS forte) compared to Fig. 2B and C.

neous hyperintense signal without clear signs of disrupted fibres or fragmentation (Fig. 4B).

Due to the known history of her knee exam one year earlier and the past MRI showing a buckled PCL, a chronic ACL tear was highly suspected as underlying cause of the medial meniscal bucket handle tear. It was discussed with the patient, that if the ACL was not tight or even avulsed, an ACL reconstruction would be performed at the same time as the medial meniscus repair. Due to the extensive skin grafting on her left lower limb, an Achilles tendon allograft was planned to be used for this intervention.

The patient was taken to the operating room for medial meniscal repair a few days later, which was performed by the first author. After reduction and the sutures to the medial meniscus, the ACL showed complete loss of tension (Fig. 5), and therefore simultaneous ACL reconstruction was performed by the first author.

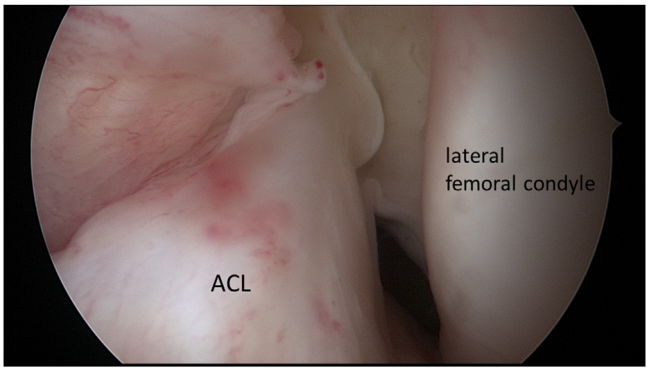

Fig. 5. Intra-operative arthroscopic picture of partially detached ACL, with loss of tension. Slight intratendinous hematoma visible, however with no obvious fresh ACL rupture.

3. Discussion

Indirect signs of ACL rupture on MRI are important to recognize, since bone oedema, effusion or signal alteration of the ligament may be absent especially in chronic ACL deficient knees [9]. The present case report shows that an acute locked bucket handle tear of the medial meniscus may reduce the anterior tibial subluxation in chronic ACL (partial) tear and therefore falsely normalize the PCL angle (see Figs. 2A and 4A). Thus, the PCL angle that is positive especially in chronic ACL deficient knees [2,6–8,10–12] may not be an adequate sign in such cases.

An acute locked meniscal bucket handle tear as a consequence of chronic ACL deficiency might already occur after a minor trauma, since it is a fatigue induced meniscal injury [9,13], clinical examination and MRI interpretation are a challenge in this setting [14,15]. The clinical presentation might show joint-line tenderness only, with a loss of range of motion and small joint effusion. The Lach-

man test and the anterior drawer test are difficult to interpret due to pain and the mechanical obstacle of the meniscal interposition in the intercondylar notch. In our experience, the "stable Lachman" test [16] with the examiner's knee under the patient's injured knee is more reliable, since the anterior translation can be monitored by the palpating fingers on either side of the joint-line and compared to the healthy side. Whereas MRI is a very reliable tool in the acute and chronic setting for complete ACL tear and concomitant injuries [17,18], partial ACL tears are less obviously recognized on conventional morphologic sequences, especially in a chronic setting [19,20]. Whereas functional sequences as diffusion weighted imaging MRI may not improve diagnosis [21,22], stress MRI are a valuable tool to visualise translatory and rotatory instability [23,24].

Missing to diagnose a deficient ACL and thereafter to perform an isolate meniscal repair without an ACL reconstruction will lead to increased failure rate of the meniscal suture.

Therefore, in low energy trauma with a locked bucket handle tear, a chronic ACL deficiency needs to be ruled out even with minor joint effusion, no bone contusion or abnormal signal of the ACL and a normal PCL angle.

4. Conclusion

The locked meniscus of a bucket handle tear in the intercondylar notch might reduce the anterior tibial translation and therefore falsely normalize the PCL angle. Therefore, the PCL angle might not be an adequate sign for ACL insufficiency with concomitant secondary meniscal bucket handle tear.

Declaration of Competing Interest

The authors report no declarations of interest.

Funding

There was no funding for this study.

Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Philippe M. Tscholl: Conceptualization, Investigation, Writing - Original Draft and Review and Editing.
Sana Boudabbous: Writing - Review & Editing.
Julien Billières: Review & Editing.
Amine Korchi: Writing - Review & Editing.

Registration of research studies

Since it is a case report, no registration was performed.

Guarantor

Philippe Tscholl.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Acknowledgement

The manuscript has been edited in accordance with the SCARE criteria [25].

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