The double ACL sign: An aberrant bucket-handle tear of lateral meniscus

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ABSTRACT
Introduction: Meniscal injuries are one of the most common musculoskeletal injuries around the knee affecting patients of different genders, ages and activity levels. These injuries could be acute or chronic tears that cause pain and mechanical symptoms based on the injury severity and whether it is displaced and entrapped in an abnormal location within the knee or not. Advances in magnetic resonance imaging (MRI) allowed us to have a better understanding of multiple bucket handle meniscal tear patterns with its specific MRI signs which have been reported in the literature.

Case presentation: This report presents a rare case of a 16-year-old boy with atypical bucket-handle tear of lateral meniscus and MRI showed a bucket-handle tear of lateral meniscus with a fragment entrapped behind and parallel to the anterior cruciate ligament (ACL) appearing as another ACL in sagittal views. Meniscus was repaired arthroscopically.

Conclusion: In our case, the unique and infrequent mechanism led to a bucket-handle tear involving lateral meniscus with a meniscal fragment entrapped in an unusual place intra-articularly behind ACL giving the appearance of a rare MRI sign “double ACL sign”. However, double ACL sign secondary to lateral meniscal tear has been reported only once previously up to the authors’ knowledge.

1. Introduction

Meniscal injuries are one of the most common musculoskeletal injuries around the knee affecting patients of different genders, ages and activity levels [1,2]. These injuries could be acute or chronic tears that cause pain and mechanical symptoms based on the injury severity and whether it is displaced and entrapped in an abnormal location within the knee or not [3]. Advances in MRI allowed us to have a better understanding of multiple bucket handle meniscal tear patterns with its specific MRI signs which have been reported in the literature [4–10]. We aim in this case report to present a characteristic MRI sign of bucket handle tear of lateral meniscus with a meniscal fragment being sequestered behind the ACL resulting in the double ACL sign. Double ACL sign secondary to lateral meniscal tear has been reported only once by Bui-Mansfield and DeWitt [11]. This case has been reported in line with the Surgical Case Report Guidelines (SCARE) 2018 criteria [12].

The patient’s parents were informed that the clinical data concerning the case would be submitted for publication and they provided informed consent.

2. Case report

A 16 year old boy who twisted his left knee while trying to stand up at a brisk pace from a sitting position on floor. Instantaneously, he heard a popping sound associated with pain and swelling. At emergency department in our institute, initial examination was limited because of knee swelling and guarding due pain.

X-ray (AP and lateral) views as shown in “Fig. 1” were completely normal. Analgesia, instruction of ice padding, and orthopedic follow-up were the initial management. In clinic, detailed history was taking in which he reported improvement of his left knee pain and swelling. Unremarkable past medical and surgical history with no known allergies. Physical examination of his left knee showed tenderness at the lateral joint line, limited knee extension (from 15° to 130°) compared to the right knee (from 0 to 130°). Thessaly [12] and McMurray tests were positive. Collateral and cruciate ligaments demonstrated no laxity with valgus stress, varus stress, anterior drawer, posterior drawer, Lachman and pivot-shift tests [13–15]. Plain radiographic images of his left knee were normal. MRI of left knee showed a long longitudinal tear of lateral meniscus extending from posterior horn to...
anterior horn. The medial meniscus, ligaments, and articular cartilage were normal. Coronal view of left knee showed entrapment of meniscal fragment within the intercondylar notch represents “the fragment within the intercondylar notch sign” [7,16] and absence of lateral meniscal body in its anatomical position (Fig. 2A). On sagittal view, vertical tear in the peripheral zone of lateral meniscus (Fig. 2B). At the level of ACL on sagittal view, a meniscal fragment was seen posterior to ACL (Fig. 2C). These findings indicate displacement of lateral meniscal fragment toward intercondylar notch and entrapment behind and parallel to the ACL fibers which led to the appearance of double ACL. The patient consented for diagnostic arthroscopy of left knee which showed a bucket handle tear of lateral meniscus. The tear starts from the posterior horn of lateral meniscus extending to the beginning of anterior horn at the level of red-white zone (Fig. 3). The fragment was reduced to its anatomic position and repaired. The procedure was done by the senior author with 15 years of arthroscopy experience. The patient was followed for two years. In last visit at our clinic, the patient was asymptomatic and able to achieve full range of motion with complete participation in sports activities.

3. Discussion

The advances in MRI granted us a sound knowledge about meniscal anatomy and pathology and facilitated correlation with arthroscopic findings [6,17]. Based on this, Multiple MRI signs of meniscal bucket-handle tears have been reported in the literature [5,18,19]. The double ACL sign can be caused by a bucket-handle tear of either medial meniscus with a meniscal fragment displaced and entrapped anterior to the ACL as reported by K. Takayama et al. [20] or by lateral meniscus [11]. In our case report, we present a bucket-handle tear of lateral meniscus with a displaced meniscal fragment entrapped posterior to the ACL.

Double posterior cruciate ligament sign “double PCL” was described by Singson et al. [21] and Weiss et al. [22] where the meniscal fragment is entrapped in front of PCL in the intercondylar notch and mainly involves medial meniscus. In our case, no meniscal fragment from lateral bucket-handle meniscal tear was displaced and entrapped in front of PCL as proven by MRI sagittal views and arthroscopic examination.

D.J. Dandy [23] examined arthroscopically 1000 symptomatic meniscal tears in his article and described that half width and half-length vertical tears of lateral menisci are the commonest types. Terzidis et al. [24] evaluated 378 meniscal tears in stable knees and found 69.3% were located in the medial meniscus and 30.7% in the lateral meniscus. As well, he found the most frequent tear patterns of lateral meniscus were radial (32.7%) and horizontal (25.8%).

Most reports describe a bucket-handle tear in medial meniscus with a displaced meniscal fragment entrapped in intercondylar notch in front...
of PCL [25–28]. In our case, the unique and infrequent mechanism led to a bucket-handle tear involving lateral meniscus with a meniscal fragment entrapped in an unusual place intra-articularly behind ACL giving the appearance of a rare MRI sign “double ACL sign”.

In conclusion, detached ends of meniscal tears can assume various positions relative to cruciate ligaments. Double ACL sign on MRI images can be indicative of meniscal tear with marked displacement within the intercondylar notch.

Ethical approval

We have reported a single case with no requirement for ethical approval. This manuscript does not describe a clinical study.

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Author contribution

Adel Alahaidib-literature review and writing introduction.
Yasser alshehab – writing the case details.
Ahmed alajlan – following the patient.
Abdulaziz alahaideb-surgeon in charge.
Hamza Alrabia-editing and article reviewing.

All authors approved the final manuscript.

Registration of research studies

We have reported a single case with no requirement for registry. This manuscript does not describe a clinical study.

Guarantor

Adel Alahaidib (Sports Medicine fellow).

Consent

Informed parental consent for the publication of this work was Given on behalf of the patient.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

None.
Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2020.04.006.

References

[1] T.H. Magee, G.W. Hinson, MRI of meniscal bucket-handle tears, Skeletal Radiol. 27 (1998) 495–499.
[2] D.T. Shakespeare, H.S. Rigby, The bucket-handle tear of the meniscus. A clinical and arthrographic study, J Bone Joint Surg Br 65 (1983) 385–387.
[3] D.H. Wright, A.A. De Smet, M. Norris, Bucket-handle tears of the medial and lateral menisci of the knee: value of MR imaging in detecting displaced fragments, AJR Am. J. Roentgenol. 165 (1995) 621–625.
[4] S.P. Fischer, J.M. Fox, W. Del Pizzo, M.J. Friedman, S.J. Snyder, Ferkel RD Accuracy of diagnoses from magnetic resonance imaging of the knee. A multi-center analysis of one thousand and fourteen patients, J Bone Joint Surg Am 73 (1991) 2–10.
[5] C.A. Helms, A. Laorr, W.D. Cannon Jr., The absent bow tie sign in bucket-handle tears of the menisci in the knee, AJR Am. J. Roentgenol. 170 (1998) 57–61.
[6] D.W. Jackson, L.D. Jennings, R.M. Maywood, P.E. Berger, Magnetic resonance imaging of the knee, Am. J. Sports Med. 16 (1988) 29–38.
[7] G.G. Poehling, D.S. Ruch, S.J. Chabon, The landscape of meniscal injuries, Clin. Sports Med. 9 (1990) 539–549.
[8] M.A. Reicher, S. Hartzman, G.R. Duckwiler, L.W. Bassett, L.J. Anderson, R.H. Gold, Meniscal injuries: detection using MR imaging, Radiology 159 (1986) 753–757.
[9] C. Ruff, J.P. Weingardt, P.D. Ruff, R.F. Kilcoyne, MR imaging patterns of displaced meniscus injuries of the knee, AJR Am. J. Roentgenol. 170 (1998) 63–67.
[10] R.D. Singson, F. Feldman, R. Staron, H. Kiernan, MR imaging of displaced bucket-handle tear of the medial meniscus, AJR Am. J. Roentgenol. 156 (1991) 121–124.
[11] L.T. Bui-Mansfield, R.M. DeWitt, Magnetic resonance imaging appearance of a double anterior cruciate ligament associated with a displaced tear of the lateral meniscus, J. Comput. Assist. Tomogr. 30 (2) (2006) 327–332.
[12] R.A. Agha, M.R. Borrelli, R. Farwana, K. Koshy, A. Fowler, D.P. Orgill For the SCARE Group, The SCARE 2018 statement: updating consensus surgical CAse REport (SCARE) Guidelines, Int. J. Surg. 60 (2018) 132–136.
[13] Theofilos Karachalios, Michael Hantes, Aristides H. Zibis, Vasilios Zachos, Apostolos H. Karantanas, Konstantinos N. Malizos, Diagnostic accuracy of a new clinical test (the thessaly test) for early detection of (1) meniscal tears. The Journal of Bone and Joint Surgery, American 87 (5) (2005) 955–962.
[14] J.S. Torg, W. Conrad, V. Kalen, Clinical diagnosis of anterior cruciate ligament instability in the athlete, Am. J. Sports Med. 4 (2) (1976) 84–93.
[15] J.F. Feito, J.L. Marshall, Injury to the anterior cruciate ligament producing the pivot-shift sign, J Bone Joint Surg Am 61 (5) (1979) 716–714.
[16] R.D. Bronstein, J.C. Schaffer, Physical examination of knee ligament injuries, J. Am. Acad. Orthop. Surg. 25 (4) (2017) 280–287.
[17] J.H. Yoo, S.H. Hahn, S.R. Yi, S.W. Kim, Posterior double PCL sign: a case report of unusual MRI finding of bucket-handle tear of medial meniscus, Knee Surg. Sports Traumatol. Arthrosoc. 15 (2007) 1343–1345.
[18] U. Aydingoz, A.K. First, O.A. Atay, M.N. Doral, MR imaging of meniscal bucket-handle tears: a review of signs and their relation to arthroscopic classification, Eur. Radiol. 13 (2003) 618–625.
[19] N. Haramati, R.B. Staron, S. Rubin, E.H. Shreck, F. Feldman, H. Kiernan, The flipped meniscus sign, Skeletal Radiol. 22 (1993) 273–277.
[20] I.P. Terzidis, A. Christodoulou, A. Ploamis, P. Givissis, K. Natsis, M. Koimtzis, Meniscal tear characteristics in young athletes with a stable knee: arthroscopic evaluation, Am. J. Sports Med. 34 (2006) 1170–1175.
[21] Koji Takayama, Takehiko Matushita, Tomoyuki Matsumoto, Seiji Kubo, Masahiro Kurosaka, Ryosuke Kuroda, The double ACL sign: an unusual bucket-handle tear of medial meniscus, Knee Surg. Sports Traumatol. Arthrosoc.: Official Journal of the ESSKA 19 (8) (2011) 1343–1346.
[22] R.D. Singson, F. Feldman, R. Staron, H. Kiernan, MR imaging of displaced bucket-handle tear of the medial meniscus, AJR Am. J. Roentgenol. 156 (1991) 121–124.
[23] K.L. Weiss, H.T. Morehouse, I.M. Levy, Sagittal MR images of the knee: a low-signal band parallel to the posterior cruciate ligament caused by a displaced bucket-handle tear, AJR Am. J. Roentgenol. 156 (1991) 117–119.
[24] D.J. Dandy, The arthroscopic anatomy of symptomatic meniscal lesions, J Bone Joint Surg Br 72 (1990) 626–633.
[25] I.P. Terzidis, A. Christodoulou, A. Ploamis, P. Givissis, K. Natsis, M. Koimtzis, Meniscal tear characteristics in young athletes with a stable knee: arthroscopic evaluation, Am. J. Sports Med. 34 (2006) 1170–1175.
[26] R. Kakel, R. Russell, P. Vanlfeerden, The triple PCL sign: bucket-handle tears: a review of signs and their relation to arthroscopic classification, Eur. Radiol. 13 (2003) 618–625.
[27] A.J. Watt, T. Halliday, N. Ruby, The value of the absent bow tie sign in MRI of bucket-handle tears, Clin. Radiol. 55 (2000) 622–626.
[28] A.N. Ververidis, D.A. Verettas, K.J. Kazakos, C.E. Tilkeridis, C.N. Chatzipapas, Meniscal bucket handle tears: a retrospective study of arthroscopy and the relation to MBI, Knee Surg. Sports Traumatol. Arthrosoc. 14 (2006) 343–349.