

1 **DOI: <https://doi.org/10.47391/JPMA.4185>**

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3 **A rare double-delta sign in a bucket handle tear of lateral meniscus: a**
4 **case report**

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10
11 **Abstract**

12 The two most common causes of a meniscus tear are trauma and degenerative
13 processes. Meniscus tears clinically present with pain, swelling and limited mobility of
14 the knee joint. Bucket handle tear (BHT) is a full-thickness tear of the meniscus
15 usually involving the inner portion of the medial meniscus. It is three times more
16 likely to occur in the medial meniscus than in the lateral meniscus. Various signs such
17 as the double anterior cruciate ligament (ACL) sign, double posterior cruciate
18 ligament (PCL) sign, and triple PCL sign have helped radiologists diagnose this tear
19 on magnetic resonance imaging (MRI). This case report is about a BHT of the less
20 commonly involved lateral meniscus identified with a double-delta sign on MRI which
21 has rarely been reported. A comparison of various radiological signs reported in the
22 literature has been made, which will aid radiologists in diagnosis and have importance
23 for the medical literature.

24 **Keywords:** meniscus tear, bucket handle tear, lateral meniscus.

25
26 **Introduction**

27 Injury of the fibrocartilaginous menisci of the knee results in meniscal tears. Meniscus
28 tears overall constitute a common knee pathology resulting in knee pain with a mean

29 annual incidence reported around 66 per 100,00 population (1). Tibiofemoral load
30 transmission, shock absorption, and lubrication of the knee joint are the primary
31 functions of the menisci.(2).

32 Meniscal tears are not only an important cause of disability and time lost from work
33 but are also associated with a four-fold increase in the long-term risk of knee
34 osteoarthritis. Playing soccer and rugby were evidenced as strong risk factors for acute
35 meniscus tears (3). According to Cooper's classification of meniscus tears, Bucket
36 Handle Tears (BHT) are considered a separate type of meniscus tears (4).

37 A BHT of a meniscus is a longitudinal tear with an attached fragment displaced away
38 from the meniscus (5). BHT is considered a sub type of longitudinal meniscus tear in
39 which the inner part is centrally displaced. It often causes intermittent locking of the
40 affected knee as the displaced fragment flips into the intercondylar notch (6). These
41 tears are reported to occur either in young athletes as a consequence of sports injuries
42 or in an older group of patients as a result of degenerative changes in the body(2).The
43 rise in these cases has been attributed to increased undertaking of sports as recreational
44 activities (7). Specifically, medial meniscus BHT has a higher occurrence rate in the
45 younger patient population due to acute trauma(8). Moreover, there is evidence in the
46 literature that BHT occurs at a greater frequency in the medial meniscus than in the
47 lateral meniscus (9). Reportedly, one-third of meniscal tears are also associated with
48 anterior cruciate ligament (ACL) injury (2).

49 Magnetic Resonance Imaging (MRI) is the preferred modality to diagnose meniscus
50 pathologies, especially tears. Its preference is owing to its higher imaging accuracy,
51 structure visibility, and non-invasiveness as stated by De Smet(10). The essential
52 characteristics of meniscal tears, such as location, shape, length, and depth can be
53 revealed by MRI scans. Although MRI is the most important imaging modality for
54 meniscus tears, arthroscopy is the gold-standard for the diagnosis of meniscal
55 tears (2). This unique case of displaced lateral meniscal BHT is a significant
56 contribution to the scientific literature because it presents as an isolated double-delta
57 sign on a sagittal view that to our knowledge has rarely been reported in the scientific

58 literature. Here, we will further review literature for similar cases and discuss various
59 signs and presentations for BHT.

60

61 **Case Report**

62 A 23-year-old male patient presented to Capital Hospital (CDA), Islamabad on 21st
63 March 2021, with a history of pain in his right knee for the past one month. The pain
64 occurred on external rotation of the knee, was sudden in onset, and resulted from a
65 twisting injury incurred while practicing boxing at home. He was not only a
66 professional athlete, neither did he have any previous co-existing medical conditions.
67 Moreover, he had not undergone any surgical procedure in the past. His family history
68 was unremarkable and he was not on any medications. On general physical
69 examination, there were no signs of obvious distress and his vital signs were within
70 normal range. On further examination, his right knee was slightly swollen and there
71 was pain on external rotation of the knee. His movement was restricted which resulted
72 in his knee locking and inability in moving.

73 A plain radiograph of the right knee was unremarkable. However, on MRI of the right
74 knee, a double-delta sign was seen on sagittal images suggesting lateral meniscus
75 BHT. A flipped low-signal fragment was seen on the anterior aspect of the lateral
76 meniscus extending to the anterior intercondylar notch, measuring 19mm transverse
77 (TR) x 12mm antero-posterior (AP), as shown in Figure 1. High signal areas in Hoffa's
78 fat pad indicated co-existing hoffitis and moderate knee joint effusion extending to the
79 supra patellar compartment as shown in Figure2.

80 There were no associated injuries to the ACL and the PCL. The medial meniscus also
81 remained intact. Based on history, examination, and radiological findings, a diagnosis
82 of bucket handle tear (BHT) of the lateral meniscus of the right knee joint was made
83 and the patient was scheduled to undergo therapeutic arthroscopy on the next day. On
84 arthroscopy, his BHT of lateral meniscus was confirmed and a meniscectomy was
85 done via trimming the patient's BHT. The patient experienced postoperative
86 bradycardia for which he was reviewed by a cardiologist. He was stable thereafter and

87 was discharged a day later with oral cefixime 400 mg once daily for three days and
88 diclofenac sodium 50 mg twice daily for three days. He was followed up seven days
89 following discharge in the outpatient department. No personal patient information has
90 been disclosed and a written informed consent was obtained before reporting this case.

91

92 **Discussion**

93 In this case, a unilateral BHT of the lateral meniscus of the right knee with no
94 associated injury to the ACL and the PCL, or the medial meniscus is presented. This
95 specific case had an MRI finding of double-delta sign (intercondylar notch), along
96 with evidence of inflammation of Hoffa's fat pad indicating possible hoffitis.

97 In literature, MRI signs are described such as a double ACL sign occurring
98 secondarily to BHT of the lateral meniscus with the torn fragment trapped behind the
99 ACL giving the appearance of the double ACL sign (11). This sign otherwise typically
100 occurs due to BHT of the medial meniscus. In our case, this was not noted.

101 Double PCL sign has also been seen due to posteriorly displaced BHT of medial
102 meniscus but that can also be mimicked by a discoid meniscus(5). Triple PCL sign has
103 been reported due to BHT of both the menisci of the knee and ruptured ACL causing
104 the displaced meniscus fragments to be seen in the same plane as the PCL giving a
105 triple PCL sign (12).

106 In a study on 25 patients with arthroscopically proven BHT, V sign (as seen in axial
107 plane) occurred in 66.7% of patients with double-delta sign whereas, in our patient, no
108 V sign was noted (13). In another study of 215 patients with torn ACL, 37 (17%) had
109 an associated major lateral meniscal tear with only 7 (3%) having a BHT.(14)

110 Independent risk factors for major tears were male gender, age less than 30 years, and
111 a contact mechanism. In our patient risk factor of male gender and age less than 30
112 was present but a contact mechanism was not there since there was a twisting of the
113 leg leading to the BHT. There has been a report of injury to both menisci of the knee
114 with intact ACL and PCL in a dancer while in our case medial meniscus along with
115 ACL and PCL were intact with a BHT of the lateral meniscus (15). According to the

116 authors' knowledge, in the literature, no case of isolated lateral meniscus BHT has
117 been reported showing a double-delta sign on MRI without accompanying ACL and/or
118 PCL injury.

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120 **Conclusion**

121 In this case, a rare and isolated BHT was picked in the less common lateral meniscus.
122 This was done by recognizing the double-delta sign which as of now, is not given
123 much significance while reporting meniscal injuries. The double-delta sign has rarely
124 been reported in the past medical literature. Radiologists must recognize this important
125 and subtle sign on MRI which is suggestive of a BHT of the meniscus for early
126 diagnosis and management of the patient. It is also important to be familiar with
127 various other signs to aid the diagnosis of meniscal tears. A precise, early, and correct
128 diagnosis of the meniscal tear, especially a repairable one like BHT can be helpful for
129 the surgeon to plan the meniscal repair procedure and save the meniscus with early
130 intervention.

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132 **Informed consent:** Written informed consent was taken from the patient for
133 publication of this care report.

134 **Disclaimer:** None to declare.

135 **Conflict of interest:** None to declare.

136 **Funding disclosure:** None to declare.

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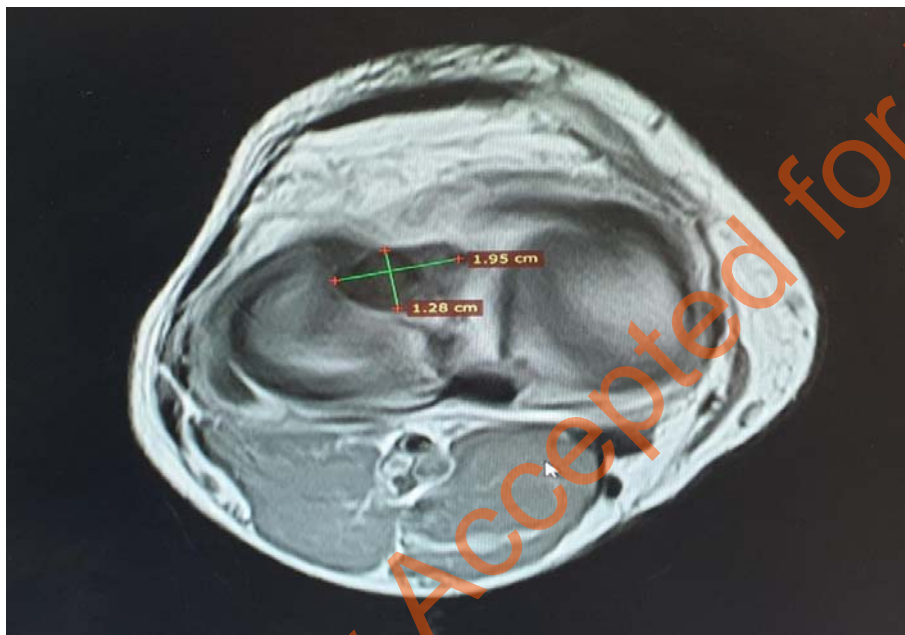
138 **References**

- 139 1. Hede A, Jensen DB, Blyme P, Sonne-Holm S. Epidemiology of meniscal lesions in
140 the knee. 1,215 open operations in Copenhagen 1982-84. Acta Orthop Scand. 1990
141 Oct;61(5):435-7.
- 142 2. Maffulli N, Longo UG, Campi S, Denaro V. Meniscal tears. Open access J Sports
143 Med. 2010 Apr;1:45-54.
- 144 3. Snoeker BAM, Bakker EWP, Kegel CAT, Lucas C. Risk factors for meniscal tears:

- 145 A systematic review including meta-analysis. *J Orthop Sports Phys Ther.*
146 2013;43(6):352–67.
- 147 4. Rao AJ, Erickson BJ, Cvetanovich GL, Yanke AB, Bach BR, Cole BJ. The
148 Meniscus-Deficient Knee: Biomechanics, Evaluation, and Treatment Options.
149 *Orthop J Sports Med.* 2015;3(10):1–14.
- 150 5. Wright DH, De Smet AA, Norris M. Bucket-handle tears of the medial and lateral
151 menisci of the knee: Value of MR imaging in detecting displaced fragments. *AJR*
152 *Am J Roentgenol.* 1995;165(3):621–5.
- 153 6. Urzen JM, Fullerton BD. Nonsurgical Resolution of a Bucket Handle Meniscal
154 Tear: A Case Report. *PM R.* 2016;8(11):1115–8.
- 155 7. Nooh A, Waly F, Abduljabbar FH, Janelle C. Bucket-handle meniscal tear in a 9-
156 year-old girl: a case report and review of the literature. *J Pediatr Orthop B.*
157 2016;25(6):570–2.
- 158 8. Greis PE, Bardana DD, Holmstrom MC, Burks RT. Meniscal injury: I. Basic
159 science and evaluation. *J Am Acad Orthop Surg.* 2002;10(3):168–76.
- 160 9. Cerabona F, Sherman MF, Bonamo JR, Sklar J. Patterns of meniscal injury with
161 acute anterior cruciate ligament tears. *Am J Sports Med.* 1988 Nov 1;16(6):603–9.
- 162 10. De Smet AA. How I diagnose meniscal tears on knee MRI. *AJR Am J*
163 *Roentgenol.* 2012;199(3):181–499.
- 164 11. Al-Ahaidib AA, Alrabai HM, Alajlan A, Al-shehab Y, Al-Ahaideb AS. The
165 double ACL sign: An aberrant bucket-handle tear of lateral meniscus. *Ann Med*
166 *Surg (Lond).* 2020;54:93–6.
- 167 12. Kakel R, Russell R, VanHeerden P. The triple PCL sign: bucket handle tears of
168 both medial and lateral menisci in a chronically ACL-deficient knee. *Orthopedics.*
169 2010 Oct;33(10):772.
- 170 13. Nisha R, Patel Y, Opsha O, Chen Q, Owen J, Eisemon E, et al. Use of the V-
171 sign in the diagnosis of bucket-handle meniscal tear of the knee. *Skeletal Radiol.*
172 41(3):293–7.
- 173 14. Feucht MJ, Bigdon S, Bode G, Salzmann GM, Dovi-Akue D, Südkamp NP, et

174 al. Associated tears of the lateral meniscus in anterior cruciate ligament injuries:
175 Risk factors for different tear patterns. J Orthop Surg Res. 2015;10(1):1–8.
176 15. Lykissas MG, Mataliotakis GI, Paschos N, Panovrakos C, Beris AE,
177 Papageorgiou CD. Simultaneous bicompartmental bucket-handle meniscal tears
178 with intact anterior cruciate ligament: a case report. J Med Case Rep. 2010;4(1):34.

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183 **Figure 1: Displaced fragment of the bucket handle meniscal tear lying anteriorly.**

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194 **Figure 2: High signal areas in indicating hoffitis and moderate knee joint**
195 **effusion.**

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Provisionally Accepted for Publication