

CASE REPORT

Not as Simple as It Looks: A Case Report With Multimodality Approach to Bennett's Fracture

Nathania Djaja¹, Rosy Setiawati^{1,2}, Sianny Suryawati^{1,3}

¹ Surabaya Orthopedic and Traumatology Hospital, Emerald Mansion TX-10, Surabaya, East Java, Indonesia, 60213

² Department of Radiology, Faculty of Medicine, Universitas Airlangga, Prof. DR. Moestopo No. 47, Surabaya, East Java, Indonesia, 60132

³ Department of Radiology, Faculty of Medicine, Universitas Wijaya Kusuma, Dukuh Kupang XXV No. 54, Surabaya, East Java, Indonesia, 60225

ABSTRACT

Bennett's fracture, an intra-articular fracture of the first metacarpal base with trapeziometacarpal joint dislocation, requires careful evaluation due to its potential for instability. We present a case of a 17-year-old male with right thumb pain and limited mobility following a motorcycle accident. Imaging revealed a Bennett's fracture with dorsoradial subluxation and multiple torn stabilizing ligaments, including the anterior oblique, intermetacarpal, and dorsal ligament complex. A multimodal radiographic approach using X-ray, CT, and MRI was employed to comprehensively assess the extent of injury. The patient underwent open reduction and internal fixation with Kirschner-wires, followed by immobilization and rehabilitation. This case highlights the importance of accurate imaging to evaluate ligament integrity and fracture stability. Recognizing the biomechanics and severity of such injuries is crucial for effective management and preventing complications such as joint instability or early arthritis. Multimodal imaging aids in tailored treatment, optimizing functional outcomes.

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Corresponding Author:

Rosy Setiawati, PhD, MD, CCD

Email: rosy-s@fk.unair.ac.id

Tel:+62 815-5032-109

INTRODUCTION

Bennett's fracture, a two-fragment intra-articular fracture of the base of the first metacarpal along with dislocation of the trapeziometacarpal joint, occurs in approximately 4% of wrist and hand fractures. It is unique because the small volar ulnar fragment of the first metacarpal is held in place by the anterior oblique ligament (AOL), while the larger fragment is displaced dorsally and radially. This injury typically occurred due to compression along the axis of the partially flexed metacarpal bone. The displacement of the larger fracture fragment is caused by traction of abductor pollicis longus (APL) muscle and adductor pollicis muscle, resulting in an unstable fracture (1). We present a case report in which we conduct a multimodal radiographic approach to give a comprehensive radiographic assessment and therefore

aid the physician to decide the proper treatment.

CASE REPORT

A 17-year old male complained of pain in the right thenar eminence and functional limitation of the right thumb following a motorcycle accident three months prior. Tenderness of the trapeziometacarpal joint and a reduced range of motion were observed.

Diagnostic examinations such as right hand radiograph, computed tomography, and magnetic resonance imaging were performed. Radiographic examinations revealed an avulsion, intra-articular fracture at the base of the first metacarpal with dorsoradial subluxation of the trapeziometacarpal joint and surrounding soft tissue swelling, indicating a Bennett's fracture (Figure 1). Computed tomography of the right hand confirmed this fracture (Figure 2). The right hand MRI revealed further injuries such as total tear of anterior oblique ligament (AOL), intermetatarsal ligament (IML), dorsal radial ligament (DRL) (Figure 3), posterior oblique ligament



Figure 1: Anteroposterior (a) and oblique (b) radiograph of the injured right hand is demonstrating the intra-articular avulsion fracture of the base of the first metacarpal along with dorsal and radial displacement of the remaining fragment (yellow arrow), a characteristic of Bennett's fracture.



Figure 2: Coronal (a) and sagittal (b) computed tomography of the right hand showing the avulsion fragment (yellow arrow) of the base of the first metacarpal bone (blue arrow). An ossicle is also visualized (white arrow).

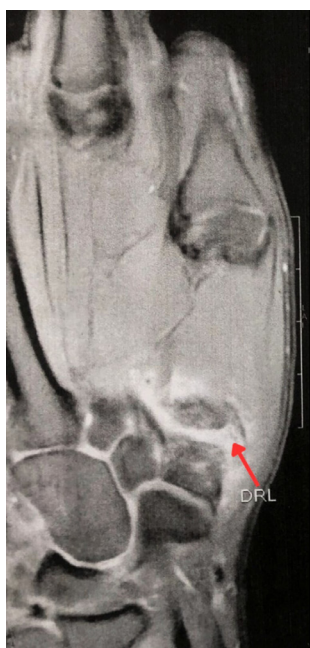


Figure 3: Focused right-hand MRI revealed a total tear of the dorsoradial ligament (DRL) (red arrow). This ligament normally extend from trapezium to the first metacarpal base.

(POL) with high grade tear of dorsal central ligament (DCL) (Figure 4). The patient underwent open reduction and internal fixation with two Kirschner-wires for 12 weeks.

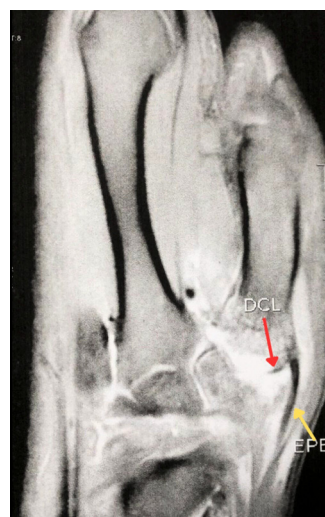


Figure 4: Focused right-hand MR revealed a high-grade tear of the dorsal central ligament (DCL) (red arrow). The DCL lies directly beneath the extensor pollicis brevis tendon (EPB) (yellow arrow).

DISCUSSION

The trapeziometacarpal joint has a wide range of motion so that activities such as grasping and pinching, which flexion-extension, abduction-adduction, and pronation-supination movements, are enabled. Besides its astonishing ability, it is inherently unstable. To stabilize, this joint relies on several ligaments. The volar aspects include both superficial and deep anterior oblique ligament (AOL), and ulnar collateral ligament (UCL). The dorsal aspects include dorsoradial ligament (DRL), posterior oblique ligament (POL), and intermetacarpal ligament (IML). Because of the complexity of this region, the non-invasive MRI evaluation is crucial (2).

The AOL was believed to be the center of trapeziometacarpal joint stability, however, recent studies revealed that the dorsal ligament complex is just as important as the former. The AOL prevents volar metacarpal subluxation and the dorsal ligament complex prevents dorsal metacarpal subluxation. The DRL extends from trapezium to the first metacarpal base, adjacent to the abductor pollicis longus (APL) tendon. The DCL lies beneath the extensor pollicis brevis (EPB) tendon. The POL extends from the dorsal trapezium to dorsal ulnar aspect of the first metacarpal base. The IML extends from the dorsoradial aspect of the second metacarpal base to the ulnar aspect of the first metacarpal base (2).

The patient's right hand MRI revealed multiple torn ligaments (Figure 3-4) which help stabilize the trapeziometacarpal joint, indicating a more unstable injury. The extent of this injury could be easily missed and therefore underestimated. In the case of Bennett's fracture, radiographic evaluations to detect bone fractures, joint space narrowing or enlargement, subluxations, and MR evaluations to assess the integrity of the ligamentous structure are crucial to treatment

choice (2). Although there is still no consensus on its management, the surgical approach has been proven to be more effective in treating this condition (1). Depending on the extent of the injury, the surgical treatment may differ. Sufficient period of immobilization of the trapeziometacarpal joint is needed to stabilize the ligaments (3). Follow-up clinical examination includes visual analogue scale (VAS) for pain and the disabilities of arm, shoulder, and hand (DASH) for physical function status, the ROM of the trapeziometacarpal joint, with grip and pinch strength to be compared to the contralateral side, and a radiographic assessment at the final follow-up. The last follow-up radiograph should be cautious of the intra-articular gap between fracture fragments and if there are arthritic changes. After achieving adequate stabilization of the fracture, early active rehabilitation is recommended to have a satisfactory functional result (4). Since thumb flexibility can be significantly impacted by this injury, improper treatment can further lead to joint instability, which will increase the possibility of developing early arthritic changes (1,3,5).

CONCLUSION

Bennett's fracture is a complex injury involving bone, soft tissue, and joint structures. As seen in this case, recognizing the fracture along with the integrity of the ligamentous complex is needed. This type of injury should not be underestimated or managed as trivial. Knowledge of the biomechanics of the injury is fundamental to explore the extent of injury and possible trapeziometacarpal joint instability, which can affect treatment. The multimodal imaging approach helps in making a comprehensive radiologic assessment which will further aid the physician in deciding whether surgery is indicated and avoiding unnecessary immobilization if ligaments are identified as intact. Despite not being therapeutic modalities, both CT and MRI improve the overall prognosis, as it reduces the likelihood of long-term complications such as chronic instability and post-traumatic arthritis.

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