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Case reports

Acute Traumatic Isolated Subluxation of Trapeziometacarpal Joint: Case Report-Literature Review

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Abstract

Trapeziometacarpal joint (TMCJ) of the thumb is an unstable joint anatomically and depends on the integrity and normal functionality of the ligaments to prevent dislocation. Dislocation or subluxation of trapezio-metacarpal joint generally appears more often as injuries accompanied with intraarticular fracture of base of first metacarpal or trapezium. Isolated dorsolateral subluxation of trapeziometacarpal joint appears more often with osteoarthritis of the joint rather than as traumatic lesion and is an unstable injury because ligaments of the joint present some degree of impairment. Suspicions to diagnose the injury and precocious therapeutic management avoid complications which lead to impairment of hand function quality. Therapeutic procedures for TMCJ dislocation is controversial in literature. The aim of this study is to present a case of a 28 year-old man, who after a direct impact with a heavy object (hummer) over the base of the thumb, presented in the emergency department with an anterolateral subluxation of trapeziometacarpal joint and based on this case, to recall the modalities of the adequate treatment of the respective injury in literature.

Keywords: ***Trapeziometacarpal joint, traumatic subluxation, traumatic dislocation, stability, pinning, ligament reconstruction.***

Introduction

Thumb has a critical role in the hand function due to its localization in relation with the other fingers in the hand. First carpometacarpal joint present a remarkable range of motion since geometry of the joint permit for opposition [1]. Trapeziometacarpal joint (TMCJ) comprises substantial daily activities with a broad range of motion (varied from adduction to opposition) indispensable for pinch and forceps grasp movies and for this reason thumb is addicted to subluxation or dislocation in situations which functionality of trapeziometacarpal ligaments is affected [2]. Trapeziometacarpal joint anatomically is an unstable joint and depends on the integrity and normal functionality of the respective ligaments to avoid joint dislocation. Dislocation of trapezio- metacarpal joint general appears more often as injuries accompanied with Bennett fracture of base of the thumb or trapezium [3,4].

Isolated trapeziometacarpal joint dislocation is uncommon injury accounting to less than 1% of the hand injuries [5]. Respective lesion is a result of transmitted axial loading on thumb which is flexed leading to dorsal dislocation of the joint and tear of dorsal radial ligament and anterior oblique ligament. Paradoxical is the fact that the dislocation is easy to reduce in some cases instability continue after reduction [6,7,8]. Isolated dorsal subluxation of trapeziometacarpal joint appears more frequent in osteoarthritis of the joint and very rare is a result of traumatic cause [2,9].

Internationally, there is no agreement regarding the treatment of these lesions. There are opponents of the conservative treatment (close reduction and immobilization with cast, or closed reduction and Kirshner wire) and supporters of surgical ligament reconstruction with scope to avoid the risk of posttraumatic instability of TCMJ [4,6,10].

The aim of this study is to present a case of a man manual worker of 28 years old, who after a direct impact with a heavy object (hummer) over the base of the thumb, presented in the emergency department with an anterolateral subluxation of trapeziometacarpal joint and based on this case first to create the suspension of such injuries in emergency department and secondly to recall the modalities of the adequate treatment of the respective injury in literature.

Case Report

A 28-year-old manual worker was admitted to the emergency department after a direct impact with a heavy object (hummer) over the base of the left thumb. The affected limb was the dominant hand.

Patient reported pain on the base of the TMCJ especially during motions of the thumb and swelling. Clinical examination revealed a painful trapeziometacarpal joint during range of motion and sign of partial instability. Initial radiographic examination (anteroposterior an oblique views) display a normal joint congruity. (**Fig.1(a)-(b)**) Because of the prolonged symptom of the pain, we examined the patient again with new x-Rays with a stress over the MCPJ and we diagnosed the subluxation. (**Fig 2(a)-(b)**) The subluxation was reduced and during control of stability of the joint in motion of opposite was re-subluxated. We decided on an open treatment with scope to examine the capsuloligamentous complex of the trapeziometacarpal joint. Under wide-awake local anesthesia no tourniquet (WALANT) technique, a 6 cm zig-zag incision is placed over the dorsal aspect of TMCJ. First dissected the subcutaneous tissue and we recognized and protected the superficial branches of the radial nerve and dorsal branch of the radial artery. Near to the base of the 1st metacarpal we recognized the insertion of the abductor pollicis longus tendon and ulnar of the tendon we diagnosed the dorsal radial ligament (DRL) which appears a partial rupture (< at 1/3 of diameter of the ligament) near the insertion to metacarpal base. Also, the dorsal capsular was torn, but the articular cartilage of the joint was intact. We performed reduction and we sutured with 3.0 non-absorbable sutures, the partial tear of the DRL and the joint capsule (end to end) with 3.0 absorbable suture. To protect the reduction, we placed two Kirchner wires (one from 1st metacarpal base to trapezium and one from the 1st metacarpal base to 2nd metacarpal base). We checked the reduction with fluoroscopy initially, and immediate post-surgery with radiographic views. (**Fig 3(a)-(b)**) After closure of the wound, we applied a thumb spica cast. Postoperative sutures were removed at two weeks while k-wires and cast at 6 weeks and rehabilitation protocol was started. Passive exercises and manual therapy performed initially to increase soft tissue flexibility and the range of movement. Light to moderate exercises were performed also to increase active range of motion and muscle strength. The mobilization enhance the earlier recovery of mobility and return to previous level of daily activities.

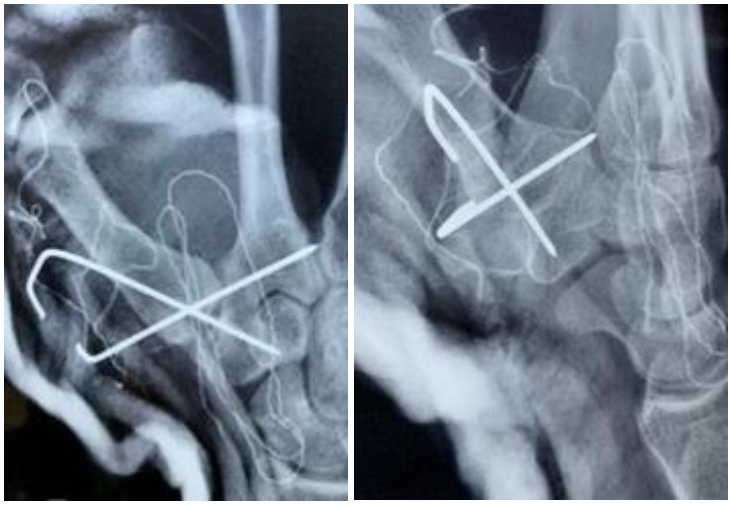
At final follow up, at ten months, the patient had a full range of motion painless and without any restriction or residual instability and he returned to the previous level of daily activity. Radiographic examination revealed normal joint congruity without any sign of osteoarthritis or subluxation. Final Kapandji's score was 10/10 while Quick Dash score was 0.11.

(a) **(b)**

Figure 1: Initial X-Ray views (anteroposterior(a) and oblique(b)) which present a normal congruity of TMCJ.

(a) **(b)**

Figure 2: Radiographical examination (anteroposterior(a) and Robert view(b)) under stress (white arrow) which appear subluxation of TMCJ



(a) **(b)**

Figure 3. Postoperative radiographical examination (anteroposterior(a), profile (b) views) which appear reduced subluxation of TMCJ and stabilized with Kirchner wires.

(a) **(b)**

Figure 4: Dorsal view(a) Palmar view(b). 1. Intermetacarpal ligament, 2. Dorsoradial ligament, 3. Anterior oblique ligament(beak), 4. Ulnar collateral ligament, 5. Posterior oblique ligament. (Artist's rendition of schematic presentation of the ligaments anatomy of trapeziometacarpal join (compliments of Kastani Evangelia).

Discussion

Stability and mobility of the thumb carpometacarpal joint is based on osseous morphology of the metacarpal and trapezium, capsuloligamentous complex and muscles. The last two factors especially, play diverse roles in stability, laxity, and proprioception of this intricate joint [12]. Trapeziometacarpal joint present a concave - convex saddle shape which permits a grade spectrum of motion of the thumb. Metacarpal base is concave dorsal volar and convex radioulnar, while trapezial base is concave radioulnar and convex dorsal volar. Articular surface of the 1st metacarpal and trapezium had dissimilar rays of convexity that are congruous in terminal range of motion [13]. Cavity of both articular surfaces is of little depth, so stability of the joint is enhanced with the static stabilizers of the joint (ligaments) and dynamic elements (muscles and tendons) [12,14]. This characteristic shape of the TMCJ with offset mechanical axes permits a range of motion in three planes with only two axes of control [14].

Bettinger *et al* (1999) in a anatomic study recognize a thickening joint capsule constituted of sixteen ligaments around the trapeziometacarpal joint, with fourteen inserting upon the trapezium and two inserting independently to the first metacarpal (proper intermetacarpal and the dorsal intermetacarpal) [15]. Recently, researchers suggest that only four ligaments (the anterior oblique, the intermetacarpal, the dorsoradial, and the posterior oblique ligament) and joint capsule too, are essential stabilizers of TMCJ [2.6,8,12,13,16]. (**Fig 4(a)-(b)**) Controversy exists regarding the importance of every ligament on stability of the TMCJ. Eaton *et al* (1973) initially supported that the anterior oblique ligament (AOL) is the main stabilizer of the joint. Other researchers suggest that dorsolateral ligament (DRL) is also a critical stabilizer in clinical studies, while others report that intermetacarpal ligament has an essential role of the TMCJ [15,17,18,19]. Anterior oblique ligament (beak ligament) split into a narrow deep (dAOL) and a wide superficial layer (sAOL). Beak ligament is a thickening of the articular capsule situated at the volar surface of the TMCJ and in past was consider as the most important stabilizer of the respective joint because avoid the dorsoradial subluxation [2,20]. Pellegrini (2001) in an anatomic study execute sectioned the dAOL and histologic and biomechanics research concluded that insufficiency or degeneration of the respective ligament increased shear forces via the joint and produce dorsal translation of TMCJ and joint contact archetype which is most ordinary appear in osteoarthritis [21]. Edmunds (2006) and Colman (2007) in their own research, support

that dAOL and DRL act together functionally to maintain joint stability [19,22].

Dorsal radial ligament is short, dense, and broad ligament. Their fibers originate from the dorsolateral tubercle of trapezium span the TMC joint and inserted broadly on the base of the dorsal edge of the first metacarpal [19]. Strauch *et al* (1994) in an anatomic study discover the fact that when the DRL is sectioned, produces greater incidence of subluxation of the TMCJ when the other ligaments were intact, while Bettinger and Imaeda support that the DRL impedes supination and pronation when the TMCJ is flexed [8,15,25]. Colman *et al* support that for lateral pinch the DRL is more critical for stability of TMCJ than dAOL [19]. In majority isolated traumatic dislocation of TMCJ is a result of transmitted axial loading on thumb which is flexed. Volar capsule of the joint enhanced by multiple ligament which anatomically are stronger and thicker than dorsal capsule leading to dorsal dislocation of the joint when the respective mechanism is applied [7]. The main value of the DRL in stability of the joint was proven and surgically by many authors, but also proven as anatomical thick, mechanical strong, highly cellular, and well innervated ligament [4,9,8,12,15,19,23,24]. In our case we found the dorsal radial ligament with partial rupture and after suture, the joint was stable and we agreed that DRL is the main critical stabilizer of the TMCJ. (**Fig 5(a)-(b)**).

Regarding the optimal treatment of dislocation or subluxation of trapeziometacarpal joint, there is no agreement in bibliography. There are opponents that believe close reduction following immobilization with a thumb spica cast or orthosis is sufficient, while others believe that closed reduction and Kirchner-wire pinning or primary ligament repair with or without pinning and finally primary ligament reconstruction with or without pinning [26]. Owings *et al* (2016) postulate that the most important factor after reduction, is stability of the TMCJ, independently the treatment [10]. Castellanos *et al* (2008) in 7 cases with traumatic dislocation perform conservative treatment (closed reduction and forearm cast) in 5 and in other two cases use Kirchner wire with a mean of follow-up of 36 and 79 months suggesting that closed reduction followed by immobilization (combined with K-wires in cases of residual instability further to reduction) offers satisfactory results [4]. Watt *et al* (1987) compared two procedures (closed reduction and spica versus percutaneous pinning) and recommended that ligament reconstruction would be a second choice of treatment if subluxation persists after initial treatment [29].

Toupin *et al* (1995) in eight cases with TMC dislocation performance closed reduction and percutaneous pinning with a mean follow-up 27,5 months and report 62,5% satisfactory results concluded that only in cases which appear degenerative changes of TMCJ on initial radiographs ligamentous reconstruction or arthroplasty might be treatment of choise [27]. Obert *et al* (1997) with the same procedure in 7 with a mean follow-up eight year postinjury cases reported satisfactory outcomes without instability or degenerative change of the joint [28]. Trapeziometacarpal joint dislocation affected the capsuloligamentous complex of the thumb and must be treated as ligamentous injury, so percutaneous pinning must be accompanied by reconstruction of ligaments [16]. Shah *et al* (1983) suggest that closed reduction of TMCJ dislocation has unstable results and open reduction and ligament reconstruction with tendon graft is efficacy treatment [23]. Simonian *et al* (1996) support the same point of view, compared primary ligament reconstruction with closed reduction and percutaneous pinning reported better outcomes in group with reconstruction while in second group 50% present recurrent instability [30]. Edmunds (2006) postulate that acute isolated dislocations of TMCJ requires open ligamentous reconstruction either by direct suturing or by tenodesis of the TMCJ using graft as flexor carpi radialis tendon [22].

Published treatment modalities, regarding tendon graft for reconstruction of TMCJ dislocation, included flexor carpi radialis tendon (FCR), Abductor pollicis longus (APL), Palmaris longus (PL) and most recently Extensor carpi radialis longus (ECRL) [6,17,31,32]. Eaton *et al* first introduced FCR tendon graft as an advantage of near location of the tendon to dislocated site and the ability to correct the hypermobility of the TMCJ (reconstruct the palmar ligament and reinforced dorsal capsule). Other study which follow the Eaton and Littler surgical technique, report satisfactory outcomes regarding full range of motion without pain or instability [33,34,35]. Ozer (2006) reconstructed all four ligaments of the TMCJ using a half strip of ECRB in 4 cases and report full range of motion without instability or post injury arthritis of TMCJ [6]. Baker *et al* (2014) first implement CMC joint suspension arthroplasty and report improved pinch and grip strength and painless function of the thump [32]. Stauffer *et al* (2020) used as tendon graft APL and reported in 15 operated thumbs that postoperative grip, pinch strength, and passive stability were not significantly different between operated and non-operated sides while Mean DASH score was 13.3 and VAS 1,1 [31]. Kim *et al* (2021) in a systematic review 85% report that most common tendon graft which utilize was FCR (57%) following by APL (29%) and all studies with this two methods prove normal range of motion without posttraumatic instability sustainment the effectiveness of the two methods [16].

McCarthy *et al* (2014) suggest an algorithm to treat the acute TMCJ dislocation or subluxation started with closed reduction and radiographic control of instability. If subluxation persisted, repair of dorsolateral ligament was performed by using suture anchors with pinning the joint and cast immobilization for 6 weeks [16]. The advantage of repair of DRL is the most important stabilizer of trapeziometacarpal joint [16]. In our case we follow this algorithm and we repair the DRL with end-to-end suture.

Conclusion

Isolated traumatic trapeziometacarpal dislocation or subluxation is a very uncommon lesion which can be missed in the emergency department, so the physician must be suspicious of such a species of injury. Undiagnosed injury led to significant alteration of hand function. Acute restoration of joints is the goal of treatment to avoid subluxation or arthritis so in a situation of postreduction instability primary repair of dorsal radial ligament is essential. Ligamentous reconstruction by tendon graft is the method which must be performed in subacute or chronic cases.

Competing interests

Authors have declared that no competing interests exist.

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