The Uncommon Trapezium Fracture: A Case Series

S. R. Beekhuizen, MD¹ C. R. Quispel, MD¹ J. Jasper, MD¹ R. L. M. Deijkers, MD¹

¹ Department of Orthopaedic Surgery, HagaZiekenhuis, The Hague, The Netherlands

Address for correspondence S.R. Beekhuizen, MD, Department of Orthopaedic Surgery, HagaZiekenhuis, Sportlaan 600, 2566 MJ The Hague, The Netherlands (e-mail: stefanbeekhuizen@me.com).

J Wrist Surg 2020;9:63–70.

Abstract

Background Isolated trapezium fractures are rare and account for only 1 to 5% of all carpal fractures but are still the third most common carpal fracture. Trapezium fractures are hard to detect and easily missed on standard radiographs. Trapezium fractures can be treated conservatively, as well as operatively, the best treatment is still debatable. Damage of the joint surface between the trapezium and the base of the first metacarpal or scaphoid could cause pain and restriction of movements. Therefore, it is important to diagnose and treat the fracture at early stage, so that articular congruence is guaranteed.

Case description We present four cases of the uncommon trapezium fracture. All four cases are conservatively treated with good results, there was no need for operative treatment in all the cases.

Literature review The literature describes the possibility to use fixation techniques, only when it is not possible to reduce the displaced fracture or the residual articular step-off is too high a fixation technique should be used.

Clinical relevance Primarily, we would recommend navicular cast immobilization for 4 to 6 weeks as initial treatment.

Keywords

- trapezium
- fracture
- uncommon
- conservative treatment
- casting

Isolated trapezium fractures are rare and account for only 1 to 5% of all carpal fractures but is still the third most common carpal fracture.^{1–6} Twenty percent of these fractures are isolated (with a vertical sagittal split).⁷ Often, the fracture also accompanies other injuries such as Rolando's or Bennett's fracture dislocation, scaphoid fracture, and usually a dislocation of the first carpometacarpal (CMC) joint.^{4,8} The fracture of the trapezium can be classified according to the Walker's classification (► **Fig. 1**); type I: horizontal sagittal split, type IIa: medial distal avulsion, type IIb: medial proximal avulsion, type III: lateral distal avulsion, type IV: vertical sagittal split, type V: comminuted.⁹ Only a few cases have been described in which an isolated trapezium fracture has occurred due to a fall on outstretched hand.^{2,10,11} Trapezium fractures are difficult to detect and easily missed on standard radiographs, so you have to be aware.¹² Damage of the joint surface between the trapezium and the base of the first metacarpal or scaphoid could cause pain and in restriction of

movements.¹³ Therefore, it is important to diagnose and treat these fractures at early stage, so that articular congruence is guaranteed. Trapezium fractures can be treated conservatively, as well as operatively, the best treatment is still debatable.^{8,12,14–16} The aim of this report is to increase awareness regarding trapezium fractures, diagnostic tools, and to share our treatment experiences.

Case Series

Case One

A 60-year-old man came to the emergency department after a slow driving car hit him during walking. He fell on his outstretched left hand. He had pain around the first CMC region. Physical examination showed swelling around the thenar and pain during palpation over the anatomical snuff-box. The initial X-ray (► **Fig. 2A and B**) showed no fracture but because of the amount of pain and the suspiciousness of a

received

December 13, 2018

accepted

February 6, 2019

published online

March 27, 2019

Copyright © 2020 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
Tel: +1(212) 760-0888.

DOI <https://doi.org/10.1055/s-0039-1683846>.
ISSN 2163-3916.

Fig. 1 Walker's classification; type I: horizontal sagittal split, type IIa: medial distal avulsion, type IIb: medial proximal avulsion, type III: lateral distal avulsion, type IV: vertical sagittal split, and type V: comminutive.

scaphoid fracture a navicular cast was given. After 1 week, the patient returned to the outpatient clinic with persistent pain over the anatomical snuffbox, therefore a computed tomography (CT) scan was performed. The CT scan (►Fig. 2C–E) showed a fracture of the trapezium (Walker's type IIb). The patient was successfully treated with navicular cast immobilization for 4 weeks. Six weeks after the trauma, clinical examination showed no pain, unlimited function and movement of thumb, and wrist. He could play the accordion just as well before the incident. At the final visit, no X-ray was made because of this complete recovery and also because the limited value of X-ray in this case.

Case Two

A 36-year-old man came to the emergency department after a fall on his outstretched left hand in the bathroom. There was a lot of pain and swelling around the thenar. Physical examination showed pain over the first metacarpal bone and anatomical snuffbox. The initial X-ray (►Fig. 3A and B) showed no fracture. However, because of the pain and the suspiciousness

of a scaphoid fracture navicular, cast immobilization was given. After 10 days the patient returned to the outpatient clinic for re-evaluation. There was persistent pain, mainly during palpation over the distal part of the anatomical snuffbox, the proximal ridge of the trapezium. An additional X-ray, a lateral radioulnar radiograph in 10 to 30 degrees supination, also showed no fracture. Because a scaphoid fracture was clinically highly suspect, an additional CT scan was made. The CT scan (►Fig. 3C–E) showed an isolated fracture of the trapezium (Walker's type IV). The patient was treated with navicular cast immobilization for 12 weeks. Initially 6 weeks of cast immobilization was opted but because of persistent pain and on insistent request of the patient the cast immobilization was extended three times for 2 more weeks. Three months after the trauma, the patient returned to the outpatient clinic with a good function of the wrist and thumb and no pain.

Case Three

A 17-year-old man came to the emergency department after he fell off his bike on his outstretched left hand. Physical

Fig. 2 Case 1; (A) X-ray AP view, (B) X-ray lateral view, (C) CT-scan lateral view, (D): CT scan AP view, (E): CT-scan transversal view. AP, anteroposterior; CT, computed tomography.

examination showed swelling dorsal of the first CMC region and pain during palpation over the anatomical snuffbox. Also, there was a subtle dorsal dislocation in the first CMC joint. The X-ray (►Fig. 4A and B) showed a trapezium fracture and a fracture of the first metacarpal bone with dorsal subluxation of the metacarpal. An additional CT scan (►Fig. 4C–E) was performed showing a volar avulsion of the base of the first metacarpal bone and a radial avulsion of the trapezium, with radiodorsal subluxation of the first CMC joint (Walker's type IIa). A closed reduction was performed without additional pin fixation and was stable afterwards. The patient was successfully treated with 5 weeks of navicular cast immobilization. After 6 weeks an extra radiograph was made (it was thought that it was standard care as in a scaphoid fracture), but both the orthopaedic surgeon and the radiologist were unable to evaluate the consolidation on an X-ray. Clinically, the patient had no pain and almost full

function of wrist and thumb; therefore, in consultation with the patient no additional CT scan was made.

Case Four

A 16-year-old male came to the emergency department after he fell on his outstretched left hand. There was pain around the first CMC joint, mainly at the palmar side. Physical examination showed a laceration, swelling, and a hematoma at the thenar. There was pain during palpation over the trapezium. The X-ray (►Fig. 5A and B) showed an intra-articular comminuted fracture of the trapezium. The additional CT scan (►Fig. 5C–E) confirmed the isolated intra-articular comminuted fracture of the trapezium (Walker's type IV). The patient was successfully treated with 6 weeks of navicular cast immobilization. The patient returned after the cast immobilization and did not have any residual pain and a good function of the wrist and thumb. No X-ray was made.

Fig. 3 Case 2; (A) X-ray AP view, (B) X-ray lateral view, (C) CT-scan AP view, (D) CT-scan lateral view, (E) CT-scan transversal view. AP, anteroposterior; CT, computed tomography.

Discussion

An isolated trapezium fracture is a rare injury, with an incidence of 1 to 5%.¹ In our department, we diagnosed four (2.5%) trapezium fractures out of a total of 158 carpal fractures in 6 years. In most cases, a trapezium fracture also accompanies other injuries such as Rolando's fracture, Bennett's fracture dislocation, scaphoid fracture, and usually dislocation of the first CMC joint.^{4,8}

The trapezium articulates with four bones: the first metacarpal distally, the scaphoid proximally, and with the trapezoid and second metacarpal medially (→ Fig. 6). Biomechanical studies showed highly increased forces at the CMC joint with grasp and forceful pinch (the joint reactive force at the base of the thumb is 12 times greater than that generated at the tip of the thumb with lateral pinch), and on the scapho-trapezium joint during gripping.¹⁷ At the palmar surface, there is at its upper part a deep groove that is running from

above obliquely downward and medial ward. Within the groove, bordered laterally by an oblique ridge, runs the flexor carpi radialis (FCR) before it inserts as the base of the 2nd and 3rd metacarpal bone (→ Fig. 6).¹⁸ The first CMC joint is saddle shaped and stabilized by 16 surrounding ligaments, while the scapho-trapezium-trapezoid (STT) joint is stabilized by the STT ligamentous complex that consists of four components: the scapho-trapezial ligament (main stabilizer), scapho-capitate ligament, palmar capsule, and dorsal capsule.¹⁹ The blood supply to the trapezium is guaranteed by two separate extraosseous systems. The branches from the radial artery directly supply the palmar, posterior and lateral surfaces, and branches of the recurrent radial artery supply the palmar surface. Between these two vessels are intraosseous anastomoses. Due to the good vascularization the trapezium is considered as a very rare site of nonunion, in contrast to scaphoid fractures proximal of the perforating vessels (single osseous vessel).²⁰

Fig. 4 Case 3; (A) X-ray AP view, (B) X-ray lateral view, (C) CT-scan AP view, (D) CT-scan lateral view, (E) CT-scan: 3D reconstruction. 3D, three-dimensional; AP, anteroposterior; CT, computed tomography.

There are two main injury mechanisms for thumb CMC dislocations and trapezium fractures.^{4,5} The mechanism of injury usually involves either indirect axial overload or direct dorsoradial impaction.³ An indirect axial overload caused by a fall on the out-stretched hand, resulting in hyperextension and radial deviation of the hand, where the trapezium gets compressed between the base of the first metacarpal and the radial styloid, resulting in a shear fracture through the radial side of the body of the trapezium.¹⁰ This produces an injury to the CMC ligaments and could give CMC instability.^{2,10,11} Trapezial ridge fractures may be a result of a direct trauma to the base of the ridge (type 1) or avulsion of the transverse carpal ligament from the tip of the ridge.^{6,21}

Fractures of the trapezium are rare and often unrecognized and lately diagnosed. To diagnose the fracture radiographs with specific projections are necessary that clearly separate the outline of the trapezium from the radial side of the carpal bony complex.²² A lateral radioulnar radiograph in

10 to 30 degrees supination is needed to visualize the trapezium.²³ If these radiographs are not conclusive an additional CT scan should be performed. A recent study shows that neither magnetic resonance imaging (MRI), nor CT and bone scintigraphy are 100% accurate in diagnosing occult scaphoid fractures.²⁴ It is likely that those results also apply to diagnosing trapezium fractures.

Since diagnosing trapezium fractures with conventional or additional oblique X-rays is often not possible, these X-rays have no or limited value as a radiographic follow-up at the final visit. Therefore, it can be discussed if a CT scan should be made as a follow-up examination. However, if clinical examination shows no pain and an unlimited or good function of the wrist and thumb, we see no need for a CT scan. The fact that trapezium fractures heals well, because of the good vascularization, support this thought. In making this discussion, one must also consider the high radiation exposure of a CT scan.

Fig. 5 Case 4; (A) X-ray AP view, (B) X-ray lateral view, (C) CT-scan AP view, (D): CT-scan lateral view, (E): CT-scan transversal view. AP, anteroposterior; CT, computed tomography.

When a trapezium fracture is diagnosed, the fractures could be divided in multiple groups. Walker et al divided these fractures into five main patterns: vertical intra-articular, horizontal, dorsal radial tuberosity, anterior medial ridge, and comminuted⁹ (►Fig. 1). Type 1 fractures are located at the base of the ridge and could be treated with thumb spica cast immobilization for 4 to 6 weeks. Type 2 fractures do have a smaller avulsion fragment, with a rupture of the anterior oblique ligament (AOL), with a higher incidence of symptomatic nonunion. Consideration for early operative excision of symptomatic type 2 lesions should be discussed with the patient.²⁵

Treatment in type III to V depends the displacement of the fracture. Displaced fractures should be treated operatively in young active individuals because residual step-off may give a higher risk trapezio-metacarpal or scapho-trapezium-trapezoid osteoarthritis.²⁵ Percutaneous Kirschner's wire fixation, oblique external traction, and open reduction and internal

fixation have all been reported in the literature as successful options.^{3,8,10,13–16,25,26} The nonunion rate after operative treatment of trapezium fractures is unknown because a trapezium fracture is a rare injury, so only a single case is described in literature. Because of the good vascularization, by multiple intraosseous anastomoses, the nonunion rate will be very small. McGuigan et al showed excellent results with open reduction and screw fixation. There was no statistical difference found in thumb or wrist motion and grip or pinch strength between the injured and uninjured hand postsurgery.²⁷

Complications after trapezium fractures include CMC joint stiffness and is associated with contracture of the first web space, posttraumatic osteoarthritis, nonunion, carpal tunnel syndrome, flexor carpi radialis tendinopathy with late rupture, and painful loss of pinch strength and function.²⁵ The step-off in intra-articular fractures can be important for the development of posttraumatic osteoarthritis at the CMC as well as the scapho-trapezium joint. The articular cartilage

Fig. 6 Anatomy of the Trapezium. C, capitulum; FCR, flexor carpi radialis groove; L, lunatum; MC1, first metacarpal; MC2, second metacarpal; MC3, third metacarpal; R, radius; S, scaphoid; Td, trapezoid; Tm, trapezium.

injury may lead to osteoarthritis of the joint during long-term follow-up, and this must be thoroughly explained to patients with trapezium fracture and thumb CMC joint dislocation as well as with other joint intra-articular fractures. Even after early diagnosis and treatment, up to 45% of the patients have osteoarthritis.¹⁹

Our case series shows different types of trapezium fractures according to the Walker's classification. Trapezium fractures can be treated conservatively as well as operatively, depending on the kind of fracture. The duration of cast immobilization differs in our series, partly because of shared-decision making with the patient. One of the possible reasons for differences in duration of treatment could be that the best treatment is still unknown, not only for fractures but also for ligamentous lesions. Trapezium fractures are rare, this means there is lack of experience in treating those fractures. Another possible reason could be the absence of

standardized treatment in the local trauma protocol. We would primarily recommend according to our results, a conservative treatment for 4 to 6 weeks, with navicular cast or thumbspica immobilization depending on the fracture. Nowadays, the treatment of trapezium fractures is based on experience but a standardized treatment protocol has to be developed for future treatment.

Conclusion

Fractures of the trapezium are rare and often unrecognized lesions and therefore the surgeon will have to pay extra attention to recognize these types of injuries at the emergency department. Initially an X-ray should be made. If the X-ray shows no fracture but there is still high suspicion for a carpal fracture, an additional CT scan should be performed.

All four cases are treated conservative with good results, there was no need for operative treatment in all cases. The literature describes the possibility to use fixation techniques, only when it is not possible to reduce the displaced fracture or the residual articular step-off is too high, a fixation technique should be used. Primarily we would recommend navicular cast immobilization for 4 to 6 weeks as initial treatment. Navicular cast or thumbspica immobilization could be given if there is only an avulsion at the CMC-1 joint.

Conflict of Interest

None declared.

References

- Borgeskov S, Christiansen B, Kjaer A, Balslev I. Fractures of the carpal bones. *Acta Orthop Scand* 1966;37(03):276–287
- Panigrahi R, Biswal MR, Palo N, Panigrahi N. Isolated coronal fracture of trapezium- a case report with review of literature. *J Orthop Case Rep* 2015;5(03):29–31
- Ramoutar DN, Katevu C, Titchener AG, Patel A. Trapezium fracture - a common technique to fix a rare injury: a case report. *Cases J* 2009;2:8304
- Kose O, Keskinbora M, Guler F. Carpometacarpal dislocation of the thumb associated with fracture of the trapezium. *J Orthop Traumatol* 2015;16(02):161–165
- Tolat AR, Jones MW. Carpometacarpal dislocation of the thumb associated with fracture of the trapezium. *Injury* 1990;21(06):411–412
- Alonso L, Couceiro J. Comminuted Fracture of the Body of the Trapezium and Thumb Carpometacarpal Dislocation: A Particular Pattern. *Surg J (N Y)* 2018;4(01):e34–e36
- Canale ST, Beaty JH, Campbell WC. Campbell's operative orthopaedics. Philadelphia, PA: Elsevier/Mosby; 2013:3383–3476
- Garneti N, Tuson CE. Sagittally split fracture of trapezium associated with subluxated carpo-metacarpal joint of thumb. *Injury* 2004;35(11):1172–1175
- Walker JL, Greene TL, Lunseth PA. Fractures of the body of the trapezium. *J Orthop Trauma* 1988;2(01):22–28
- Suresh S. Isolated coronal split fracture of the trapezium. *Indian J Orthop* 2012;46(01):99–101
- Strobl FF, Notohamiprodjo M, Schmidt GP. [Isolated fracture of the trapezium, a rare wrist fracture after a fall on the hand]. *RoFo Fortschr Geb Rontgenstr Nuklearmed* 2012;184(07):655–657
- Inston N, Pimpalnerkar AL, Arafa MA. Isolated fracture of the trapezium: an easily missed injury. *Injury* 1997;28(07):485–488
- Cordrey LJ, Ferrer-Torells M. Management of fractures of the greater multangular. Report of five cases. *J Bone Joint Surg Am* 1960;42-A:1111–1118
- Horch R. A new method for treating isolated fractures of the os trapezium. *Arch Orthop Trauma Surg* 1998;117(03):180–182
- Pai V, Warbrick-Smith J, Pai V. Extensor pollicis longus dysfunction associated with non-united fracture of the trapezium. *J Hand Microsurg* 2010;2(01):42–44
- Giannikas D, Karabasi A, Fotinopoulos E, Tyllianakis M. Open transtrapezial injuries of the thumb: operative treatment. *J Trauma* 2008;65(06):1468–1470
- Ladd AL, Weiss AP, Crisco JJ, et al. The thumb carpometacarpal joint: anatomy, hormones, and biomechanics. *Instr Course Lect* 2013;62:165–179
- Bishop AT, Gabel G, Carmichael SW. Flexor carpi radialis tendinitis. Part I: Operative anatomy. *J Bone Joint Surg Am* 1994;76(07):1009–1014
- Kohyama S, Tanaka T, Ikumi A, Totoki Y, Okuno K, Ochiai N. Trapezium fracture associated with thumb carpometacarpal joint dislocation: a report of three cases and literature review. *Case Rep Orthop* 2018;2018:2408708
- Gelberman RH, Gross MS. The vascularity of the wrist. Identification of arterial patterns at risk. *Clin Orthop Relat Res* 1986;(202):40–49
- Nixon M, Trail IA. Fractures of carpal bones other than the scaphoid. In: Trail IA, Fleming ANM, eds. *Disorders of the hand: Volume One: Hand Injuries*. London: Springer-Verlag; 2015:237–248
- Pointu J, Schwenck JP, Destree G, Sejourne P. [Fractures of the trapezium. Mechanisms. Anatomic-pathology and therapeutic indications]. *Rev Chir Orthop Reparat Mot* 1988;74(05):454–465
- Kob A, Lang A, Thelen R, Schild H. [Radiologic diagnosis of injuries of the wrist]. *Rontgenblätter* 1988;41(05):215–220
- de Zwart AD, Beeres FJ, Rhemrev SJ, Bartlema K, Schipper IB. Comparison of MRI, CT and bone scintigraphy for suspected scaphoid fractures. *Eur J Trauma Emerg Surg* 2016;42(06):725–731
- Suh N, Ek ET, Wolfe SW. Carpal fractures. *J Hand Surg Am* 2014;39(04):785–791, quiz 791
- Singh HP, Hoare C, Beresford-Cleary N, Anakwe R, Hayton M. Nonunion after trapeziometacarpal arthrodesis: comparison between K-wire and internal fixation. *J Hand Surg Eur Vol* 2015;40(04):351–355
- McGuigan FX, Culp RW. Surgical treatment of intra-articular fractures of the trapezium. *J Hand Surg Am* 2002;27(04):697–703