

Isolated Capitate Fracture Associated With a Traumatic Synovial Cyst: A Pediatric Case Report

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ABSTRACT

Introduction: Isolated capitate fractures, caused by high-energy trauma, are rare in children. They can be missed at the initial assessment of the patient and radiographs only allow the identification of lesions in ossified bones, so complementary tests such as magnetic resonance imaging are necessary to rule out possible associated carpal lesions, especially in children under 10 years old. We present the case of an isolated capitate bone fracture with the appearance of a synovial cyst due to trauma in a pediatric patient, treated by immobilization with a short arm cast for four weeks, with good evolution. **Conclusion:** The management of these cases depends on the severity of the injury. In most cases, conservative treatment is enough but early diagnosis allows us to choose the best option and avoid possible complications such as nonunion or avascular necrosis.

Keywords: Capitate bone; fracture; synovial cyst

Level of Evidence: IV

Fractura aislada del hueso grande asociada a quiste traumático sinovial: presentación de un caso en un niño

RESUMEN

Introducción: Las fracturas aisladas del hueso grande son muy infrecuentes en los niños y se producen por traumatismos de alta energía. Pueden pasar desapercibidas en la valoración inicial y las radiografías solo permiten identificar las lesiones en huesos osificados, por lo que son necesarias pruebas complementarias, como la resonancia magnética, para descartar posibles lesiones del carpo asociadas, sobre todo en menores de 10 años. Se presenta el caso de una fractura aislada del hueso grande con aparición de quiste sinovial por causa traumática en un paciente pediátrico, tratado mediante inmovilización con yeso antebraquial durante cuatro semanas, con buena evolución. **Conclusión:** El manejo de estos casos depende de la gravedad de la lesión y, aunque por lo común evolucionan bien con un tratamiento conservador, su diagnóstico precoz nos permite elegir la mejor opción y evitar posibles complicaciones, como la no unión o la necrosis avascular.

Palabras clave: Hueso grande; fractura; quiste sinovial.

Nivel de Evidencia: IV

INTRODUCTION

Scaphoid fracture is the most frequent injury to the carpus both in adults and in pediatric patients. In children, capitate bone fracture, although rare, represents the second most frequent. In the first decade of life, it is usually associated with or involves other carpal bones; on the other hand, an isolated capitate fracture represents a very unusual entity and is even rarer when not associated with a dislocation.¹

In an immature patient under 10 years of age, the carpus does not present a complete ossification of all the bones that compose it; therefore, for the most part, they are still covered by a thick layer of cartilage around the ossification center, which gives them greater elasticity, and requires high-energy trauma to cause damage to them.²

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The capitate bone is the first to ossify in the carpus, after the first year of life, which can lead to greater vulnerability in the event of this type of trauma.³ In isolated injuries, the most frequent scenario involves minimal displacements in the fracture area and treatment by immobilization tends to be satisfactory, but it is important to rule out associated injuries, since there are reports of their relationship with scaphoid fractures, as in the so-called scaphocapitate syndrome.

Regarding the synovial cyst, it is the most common tumor of the wrist and hand in the general population, but the publications referring to this pathology in children are scarce, since its appearance is less frequent than in adults: it comprises only 10% of the cases. It does not usually cause symptoms and, due to its benign nature with high rates of spontaneous remission (79%) and the high rate of recurrence with surgical treatment (43%), conservative treatment tends to be used.⁴ Although not the most common, one of the theories about its origin is based on the fact that injuries to the wrist joint, such as a possible ligament injury around the scaphoid, can cause synovial fluid leaks in the periarticular tissue. In their series of a pediatric population, Bracken and Barlett⁵ showed that the synovial cyst is associated with traumatic injury to the carpus in 20% of cases and that the cyst is predominantly located in the palmar area. In this same age range, Calif et al.⁶ described 0.8% of synovial cysts also due to traumatic causes.

CLINICAL CASE

A 5-year-old patient was treated in the emergency department after high-energy polytrauma due to a fall on a bicycle, after not being able to stop it on a slope and colliding with a wall. The patient suffered mainly head trauma—as he was not wearing a helmet—thoracic and abdominal trauma, the latter due to direct impact with the handlebars. The constants were correct, maintaining a Glasgow score of 15 at all times and preserving strength and sensitivity. Upon examination, he presented bruising and swelling in the left frontal area and erosion and pain in the lateral area of the thorax and the center of the abdomen, which on palpation was soft, depressible and without signs of peritoneal irritation, with discomfort in the pubic area. Regarding the extremities, the child reported pain in both knees, with preserved joint range of motion.

A cranial computed tomography (CT) scan was performed, which revealed a small acute subdural hematoma and a left frontal fracture that affected the superomedial wall of the orbit and ethmoidal air cells. In the body CT, no noteworthy incidents were found, nor in the simple knee radiographs.

The child was admitted for control of the cranial injuries and, on his second day of hospital stay, the parents commented that he had a lump at the palmar level of the right hand, which did not exist previously. This tumor, soft on palpation, was not painful and was located in the radial region of the carpus, over the area of the scaphoid; its size was 9 x 5 mm. The transillumination test was positive.

In the central area of the carpus there was a slight hematoma, with slight pain on palpation. Additional tests were requested. Plain radiology allowed visualization of a transverse large bone fracture, with minimal displacement ([Figure 1](#)).

Subsequently, an ultrasound was carried out in the area of the tumor, which was described as an ovoid echogenic lesion with possible blood content secondary to trauma, without vascularization in the Doppler study, adjacent to the medial part of the scaphoid and the tendon of the flexor carpi radialis, but without being able to rule out possible injuries to the underlying cartilaginous bone. Since most of the cases in the literature of capitate bone fractures in the pediatric age are associated with other injuries of the carpus, such as scaphoid fracture, and taking into account that there were symptoms and an ultrasound suggestive of a synovial cyst of traumatic cause, a magnetic resonance imaging (MRI) was performed ([Figure 2](#)) in order to rule out other associated injuries. In this case, no alteration was observed in the rest of the carpus or associated ligaments, and the presence of a hyperintense image in the T2 sequence, corresponding to a synovial cyst, was confirmed as the most probable lesion.



Figure 1. Anteroposterior and lateral radiographs of the right hand. Bone age: 5 years. Ossification of the capitate bone can be seen, with a transverse fracture line, as well as ossification of the hamate bone and early stages of ossification of the lunate and triquetral bones.

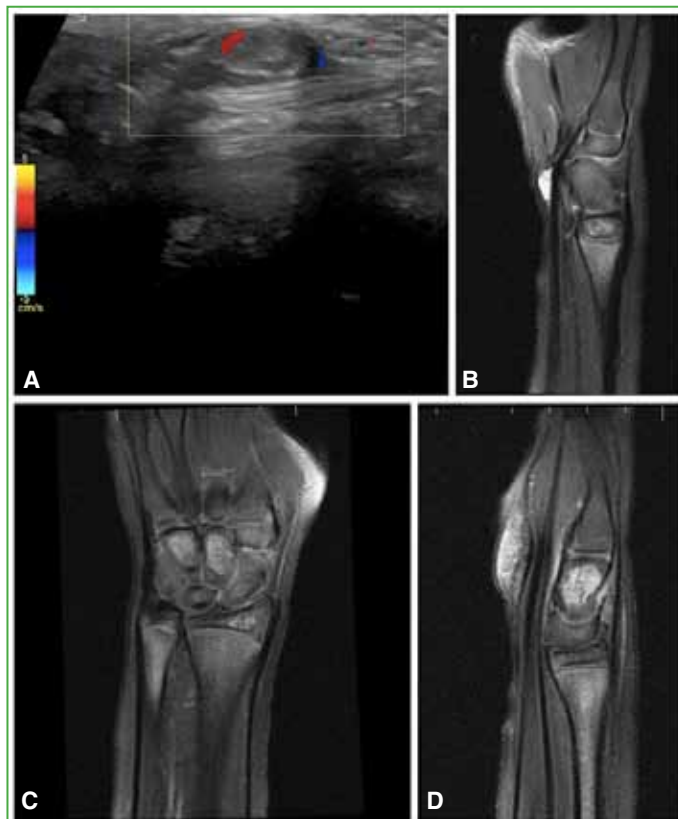


Figure 2. **A.** Anechoic ultrasound image of the tendon structure. **B.** Sagittal MRI PD FSE FS showing a hyperintense synovial cyst. **C and D.** Coronal and sagittal MRI PD FSE FS with bone lesion in the capitate bone, without associated bone lesions.

The patient continued treatment by immobilization with a short arm cast for 4 weeks, with subsequent progressive mobilization exercises at home, without incidents. Radiographic controls were carried out at 1 week, 1 month and 3 months, and the child achieved complete union of the capitate bone without complications. Due to the good evolution and the lack of other associated lesions, follow-up with other complementary tests was not proposed. The synovial cyst decreased in size until its complete disappearance at 6 months.

DISCUSSION

There is little literature related to isolated capitate fractures in children. We found a total of 38 cases described to date,^{3,7,8} the most frequent being those associated with scaphoid fractures⁹ or multiple carpal fractures.¹⁰

The main mechanism of injury occurs by direct trauma and, although the location may be variable, in general, these fractures can be classified into three groups as graphically described by Kadar et al.³ One of the groups is fractures of the body, which includes comminuted, oblique and transverse fractures; this last location is the most frequent.² On the other hand, there are avulsion fractures, both dorsal and volar, and, finally, depression fractures. On many occasions, these fractures are not detected on a simple radiograph; in addition, they may not be clinically evident. Also, in children who still have bone immaturity, ruling out other carpal injuries becomes difficult. For this reason, it is advisable to perform an MRI,^{7,8} taking into account that, in young children, sedation or anesthesia is required to keep the limb immobilized. MRI should include coronal T1-weighted images to assess the anatomic relationships and fracture location, and coronal STIR images to assess bone marrow edema. In non-ossified bones, T1 and T2-weighted images should be assessed. There, the fracture line appears as a discrete linear lesion with low signal intensity or a solution of continuity, which can also be seen on STIR, T2 fat saturated, and T2 with magnetization transfer sequences; however, visualization of edema in the surrounding bone marrow can also hide subtle fractures.^{11,12}

Regarding the possibly associated ligament lesions, they are identified as a discontinuity and signal alteration of both the ligament and the adjacent soft tissues in most cases. 3D gradient echo, STIR, or fat-suppressed T2 sequences with thin sections are the best options for its visualization, although the alternative of magnetic resonance imaging with intra-articular gadolinium injection could also be considered.¹³ When surgery is necessary, this test also helps us to know what injuries we are facing in order to minimize exposure and damage to the intercarpal ligaments.

The complications described in large bone fractures are non-union, which usually occurs in cases of late diagnosis and surgical management in displaced fractures, and avascular necrosis of the proximal pole in relation to its retrograde blood supply, which enters through the palmar middle and the distal third and is directed retrogradely to the proximal pole, which means that this area is the one that, due to a fracture, may be left without vascularization.^{3,7,8}

Capitate bone injury usually involves minimal displacement and resolves uneventfully with conservative treatment. However, in cases of greater displacement or severity, closed or open reduction with percutaneous Kirschner wires, resorbable pins, or screws are the described options.² In cases of non-union, good results are achieved with treatment by bone graft and internal fixation.^{2,8}

The clinical case presented is the first known to date of the association of an isolated capitate bone fracture with the appearance of a synovial cyst due to trauma in a pediatric patient. Thanks to this finding, it was possible to diagnose the bone lesion and rule out possible lesions associated with non-ossified bones at an early age, such as that of this patient. Being aware of this type of presentation and maintaining suspicion when faced with minor patients with high-energy trauma and signs of injury to the carpus can prevent late diagnosis and complications in more serious cases.

The authors declare no conflicts of interest.

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