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Research Article

Injuries to the Scapholunate Ligament: How Often do we Miss it?

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Abstract

Injuries to the wrist are a common sighting in casualty. The diagnosis is usually based on the patient's history, a physical examination and X-rays. Once a bony injury can be excluded, the patient is discharged. However, a number of patients remain symptomatic thereafter. We reviewed Clients with persisting symptoms after wrist injuries in a medico legal setting. Injuries of the SL ligament were by far the most common finding. Their share was 50% in wrists with persisting symptoms. The relevance for a delayed diagnosis is the risk of premature arthritis and an advanced collapse of the carpus.

Keywords: *Scapholunate Ligament; Wrist Injuries; Missed Injuries of the SL Ligament; SLAC Wrist*

Introduction

Injuries to the scapholunate ligament (SL) usually result from a fall onto the outstretched wrist with an axial overload or hyperextension with supination or ulnar deviation [1,2]. The position of the wrist at the time of impact predisposes to further associated injuries. There is a high coincidence with AO type A2 and A3 fractures in which the trauma force breaks the distal radius and subsequently, due to further carpal supination, disrupts the SL ligament. In type B1 fractures, the SL disruption results from an avulsion fracture of the radial styloid process due to ulnar deviation of the wrist. Pilny [3] found in 56% of their cases SL instability in the radiographs. After 6 weeks, their number increased to 81%. Besides, Schädel-Hopfner [4] described a high co-incidence in fractures extending in a sagittal plane into the distal radius (AO type C1).

Apart from radius fractures, a coincidence of scaphoid and intrinsic ligament injuries was found by Jorgsholm [5]. 29/41 cases revealed an involvement of the scapholunate ligament, with complete rupture in 10 wrists. Strobel [6] also documented a coincidence of SL injuries and scapholunate dissociations.

The classification of SL instability follows the Mayfield and Mayo classification [7].

Clients with a chronic tear usually present symptoms on weight-bearing activities [8]. Tasks that can be affected involve repetitive movements, e.g. using a PC mouse, or symptoms on lifting, holding and turning or tasks that require good grip strength. Sometimes, the patient describes even an audible click on movements with the wrist.

The clinical examination can reveal tenderness at the extreme of dorsi- or palmar flexion, tenderness over the proximal carpal row, the anatomical snuff box or tenderness on passive mobilisation of the lunate against the scaphoid (Ballottement Test). Radial- and ulnarduction in a flexed position of the wrist is described as painful. The Kirk-Watson Test reveals the typical clicking in the wrist joint once complete instability has occurred.

Further investigations after trauma consists of standard X-rays of the wrist in 2 planes. The most noticeable sign is the widening of the scapholunate gap on PA and PA grip radiographs. However, obtaining a PA view that clearly shows the scapholunate gap without some bony overlap can be difficult. Findings should always be compared with the opposite side [9].

Suspicion of a SL ligament involvement should be raised in fractures of the radius in general and in sagittal intraarticular distal radial fractures with a fracture line pointing at the SL interval in particular (AO type C1).

Kindynis [10] suggested to measure the space at the level of the midportion of the flat ulnar facet of the scaphoid. However, it is not entirely clear, which amount of gap is acceptable to define a scapholunate dissociation. Authors' opinions vary from 2 mm to 5 mm on plain radiographs [2,10-14]. Cautilli and Wehbe [15] measured the gap on 100 normal radiographs and found a mean distance of 3.7 mm (range, 2.5 - 5 mm). They suggested that a scapho-lunate distance of up to 5 mm is not necessarily indicative of carpal instability. Tanaka [16] reported a normative value of 1.8 mm measured with MRI.

Given this wide range, comparison of the injured wrist with the contralateral side can help in decision making. Arthro MRI scans, in contrast, can help to identify the lesion but do not necessarily indicate if it is a static or dynamic lesion. Arthroscopy is despite MRI still the gold standard for the diagnosis. It allows for direct visualization and assessment of the ligament fibres and can assist in open and arthroscopic repair methods.

Method

In the surrounding of a medico legal setting, 68 wrist injuries were seen for the purpose of a medico legal report. Among those, 22 patients with persisting symptoms were identified and included in this review. They fulfilled criteria of a previous trauma with ongoing pain symptoms, functional impairments for their activities of daily living and/or a restricted function. The physical examination focused on the range of movement, tenderness over the anatomical snuffbox, signs for a positive ballottement of the carpal bones, the evaluation of the Kirk-Watson Test and the possibility of an involvement of the distal radioulnar joint, the ulnar compartment or pathologies of the 1st carpometaphalangeal joint. Clients with one or more positive criteria on examination were recommended for stress views of the SL ligament (ap "Clenched fist views" in ulnarduction in comparison to the opposite side) and an Arthro-MRI of the injured wrist. For the evaluation of the SL interval, the distance of the midsection of the lunate and scaphoid was measured.

Results

68 patients were involved in falls onto the outstretched wrist. 22 Clients complained of ongoing symptoms. The time of their presentation was 13 (3 to 36 months) months after their initial trauma. The precise position of the wrist at the time of impact was generally not reproducible. 6/22 occurred as a fall off a bicycle, 8/22 as a fall of a motorcycle, 2/22 as a result of a trip and fall, and 6/22 as occupant in a car. All Clients described a hyperextension type of injury as a result of their fall. Occupants of cars hyperextended their wrists on the steering wheel or when they reached out their hands and impacted their wrists on either the dashboard or the passenger's seat in the front.

All patients complained of immediate pain in their wrists and localized swelling. 20/22 patients had X- rays. 5 scaphoid fractures, 3 fractures to the radial styloid, 2 radius fractures, 1 perilunate dislocation, and 1 ulna fracture could be identified. 7 images were normal and without bony injuries. In no patient, further stress views or MRI investigations were conducted before their examination through the medical expert.

Figure 1: *44-year-old female Client fell onto the wrist. Initial X-rays queried a scaphoid fracture. The XR shows an intraarticular fracture to the distal radius with extension of the fracture line into the SL interval, which is 2,4 mm wide. Standard MRI confirmed the fracture but did not refer to an SL involvement. Later stress views showed widening of the SL interval to 4,3 mm, the Arthro MRI a complete tear of the SL ligament.*

The treatment options in one scaphoid fracture consisted of screw fixation and cast immobilization over a period of 8 weeks. Cast immobilization alone (15/22) took place over a period of 10 weeks (4 to 108 weeks). 16 Clients had physiotherapy that was regarded as helpful in 5/16 patients.

At the time of the medico legal examination, the Clients complained of a painful wrist (22/69) with limitations for weight-bearing tasks or movements (22/22). The physical examination revealed tenderness over the anatomical snuff box (17/22), a positive ballottement of the scaphoid and lunate (11/22), a positive Kirk-Watson Test (15/22), a restricted range of movement (11/22) and findings over the 1st MCP joint or the ulnar compartment.

In 13 Clients, further stress views were requested, 11/13 Clients revealed a widening of the SL interval with an average of 2,7 mm (1,8 to 3,8 mm). In the 2 Clients with an SL gap of less than 1,8 mm, a previous scaphoid fracture and degenerative changes of the CMC joint were found. The Kirk Watson Test and tenderness over the anatomical snuffbox correlated with a gap formation (p = 0,9829).

In 14 Clients, an Arthro MRT became available. In 12 cases, tears of the SL ligament could be confirmed. 1 Client had a non-union of a scaphoid fracture, 1 degeneration to the CMC joint, 2 a TFC tear. All 12 cases with evidence of an SL ligament involvement correlated with widening of the SL interval of more than 1,8 mm. 3 of them occurred with a scaphoid fracture.

In Clients without MRI, a widening of the SL interval coincided with an ulna styloid fracture, a perilunate dislocation and one unknown cause.

Discussion

The anatomy of the wrist with the distal forearm and the articulation of the carpal bones is complex and follows a highly differentiated course of single movements of multiple joints. Their mobility is possible through various ligament structures that span over the palmar

and dorsal aspect of the wrist and palm as well as connections that extend between the carpal bones. The carpus consists of two rows of bones. The proximal row with the scaphoid, lunate, triquetrum and pisiforme connects the hand with the distal forearm. It is particularly vulnerable for instability. The distal row with the hamate, capitates, trapezium and trapezoid contributes to stabilization and load sharing.

The SL ligament acts as a central stabiliser like a keystone in a roman arch. It can be divided into a dorsal, intermediary and volar section. The volar section is highly innervated and has a tensile strength of 150N and is responsible for controlling rotational motion. It is believed to have a major proprioceptive role. The intermediate section is the weakest segment. It has a tensile strength of only 25 - 50N, is free neurovascular bundles and prone to degenerative tears as well as avulsion off the scaphoid. The strongest component is the dorsal part of the ligament with a tensile strength of 300 N. It extends into the dorsal radiocarpal articular capsule, the scaphotriquetral and dorsal intercarpal ligaments posteriorly and the intermediate portion of the ligament proximally.

Tears of the scapholunate ligament are the most common wrist ligament injuries among the intrinsic ligament [17,18]. They show two characteristics. Firstly, the ligament has no blood supply, tears usually show a poor healing potential. Secondly, tears fail to stabilise the proximal carpal row in flexion and extension and allow the proximal carpal bones to shift apart and let the distal carpals penetrate into the gap. This scapholunate advanced collapse is known as “SLAC” and results in poor wrist function and disability.

In the overwhelming number of cases, the only information that the patient is able to provide is that the accident caused a hyperflexion of the wrist. The treating physician will see the patient with a swollen and painful wrist that does not allow a specific examination. X-rays can exclude a bony injury but will leave soft tissue injuries unnoticed. It requires a high degree of suspicion in reading the X-rays and to make the proper diagnosis. A hyperflexion trauma is likely to predispose to various injury patterns, and the coincidence with ligament injuries needs to be considered.

One aspect in commenting on X-rays, is the criteria of the distance of the SL interval. It has been debate in many articles. This study shows that tears of the SL ligament can already be found in wrists with an SL interval of 1,8 mm. In the majority of cases, the volar part of the ligament was involved, which suggests that failure of the ligament may start with the volar section. The mid-section was involved in only one young Client, possibly as an avulsion injury. With the given range of up to 5 mm diastasis in the SL interval, criteria for a complex instability may not be given, but it is significant enough to cause persisting symptoms suggesting some degree of instability.

Our Clients were treated for the obvious bony lesion. However, in Clients with ongoing symptoms, no further treatment took place. It appears that the likelihood of associated injuries has not been taken into account. Reviewing our findings, all our Clients with an SL involvement showed some characteristics.

Firstly, all Clients with an evidence of SL involvement sustained a hyperflexion injury. It is of note that the force of impact did not require a fall but could also occur in the process of bracing in a car shunt.

Secondly, the onset of symptoms was insidious with pain and swelling. The typical clinical symptoms that persist consisted of restrictions for everyday tasks, e.g. opening jars, using door knobs, pushing themselves up from a seated position, bearing weight on a hyperextended wrist, using a PC mouse, gripping or holding items of any weight.

Thirdly, on examination, the wrist could reveal a normal range of movement but showed at least one criterion of tenderness over the anatomical snuffbox, a positive Kirk Watson Test or a positive ballottement.

Given these aspects, considerations were given regarding a soft tissue injury to the wrist. Differentials included the SL ligament injury, instability to the distal radioulnar joint, a tear of the TFC but also missed bony injuries.

Our findings suggest that the likelihood of SL injuries is underestimated. Apart from the obvious fractures to the scaphoid, radius or ulna, Clients with ongoing symptoms after a "wrist sprain" revealed a high likelihood of associated SL injuries. We identified SL injuries in 50% (11/22) of symptomatic wrists when the primary diagnosis was a scaphoid injury, a radius fracture or queried fractures for which the Clients were treated in a cast. But despite cast immobilisation, Clients complained of ongoing symptoms. After an average of 13 months and until the time of the medico legal examination, no further investigations or treatment had taken place, which left the SL injury unnoticed.

In a medico legal setting, the need for further evaluation is imperative for the Client's claim. A precise diagnosis must be made for which the reluctance of further investigations is low. In this process, relevant pathologies can be narrowed or excluded. In our medico legal praxis, we follow the protocol of ap stress views of both wrists followed by an Arthro MRI of the injured wrist. This involves Clients with a history of a hyperextension injury, an impaired weight-bearing tolerance and at least one positive clinical criterion on examination.

However, in the medico legal setting, it took an average of 23 months after the Client's accident until a final diagnosis could be provided. The delay in the diagnosis is of significance for the Claimant and patient. It rises the risk of premature arthritis or progression into an advanced collapse of the carpus ("SLAC Wrist"). To admit, the diagnosis or treatment of SL injuries is rarely made during the acute phase, when it would still be possible to do a direct repair on the ligament [19]. A delay in diagnosis often requires surgical intervention to treat the condition adequately. Focus can be on reconstructive techniques in order to maintain normal carpal kinematics, optimal grip strength and ROM. Scapholunate advanced collapse is a pattern of degenerative wrist arthritis, in contrast, leaves only limited options and may result in total wrist arthrodesis, PRC, denervation, and radial styloidectomy [20,21]. Among the motion-preserving procedures, 2 of the most commonly performed are PRC and capitate-lunate-hamate-triquetrum arthrodesis (4-corner arthrodesis) [22].

Conclusion

Wrist injuries are common but may produce persisting symptoms. In almost 50%, injuries to the SL ligament can be the cause. The significance lies in the late diagnosis and the possible impact on the development of wrist OA or even a SLAC wrist. Clinically, suspicion should be raised in patients with ongoing symptoms with their manual tasks and at least one positive criterion during their physical examination.

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