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Review article

Post-traumatic carpal instability

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ABSTRACT

The complexity of the carpus explains the difficulty treating carpal injuries. Lesions are dominated by perilunate dislocation, scapholunate dislocation, and scaphoid fractures. The other injuries are trivial. Symptoms include pain and loss of wrist strength, reversible for an acute and well-treated lesion. Too often, these ligament injuries are diagnosed late. For delays longer than 6 weeks, ligament repair is ineffective. These old, complex lesions are potentially highly arthritic in the radiocarpal and mediocarpal joints. Improvements in wrist surgery have mitigated these chronic lesions. Various surgical techniques can preserve a functional wrist; wrist arthrodesis is no longer the only solution for these arthritic wrists. Over the past decade, arthroscopy has contributed to better understanding the injuries of the carpus as well as to better healing them. For acute or chronic ligament injuries without degenerative osteoarthritis, arthroscopy is the treatment of the future. This technique involves a long learning curve and the various arthroscopic techniques must be validated.

1. Introduction

Carpal joint and ligament complexity explains the delicate balance of this joint. Many anatomic studies have described the different joints in detail as well as all the intrinsic and extrinsic ligaments of the wrist (Tables 1 and 2). The intrinsic ligaments connect the different bones, whereas the extrinsic ligaments connect the distal extremity of the two bones of the forearm to the carpus or the carpus to the metacarpals. Among the intrinsic ligaments, the scapholunate ligaments (notably its dorsal segment) and ulnotriquetrum (notably its palmar segment) are functionally the most important of the extrinsic ligaments, joining the palmar side of the radius to the carpal side [1,2]. It is difficult to understand the biomechanics of the carpus. A number of publications on the biomechanics of the wrist are available, but they are at times contradictory [3–6].

The main problem of carpal ligament lesions is their high potential for arthritis over the more or less long-term. This arthritis can be first radiocarpal and later intracarpal [7]. Carpal ligament lesions result from high-energy injuries in, for the most part, a young population. Degenerative lesions are related to pathologies such as chondrocalcinosis, rheumatoid polyarthritis, and other rheumatisms. Their management is totally different because treatment must take into account the underlying chronic pathology [8].

Ligament lesions essentially include scapholunate dissociation and perilunate dislocation from the carpus; other lesions are rarer. Fracture of the proximal pole of the scaphoid or associated with a ligament lesion has the same potential for arthritis as a ligament lesion.

2. Generalities and classifications of carpal instability [9–11]

Carpal instability signifies the disappearance of the balance between the extrinsic and intrinsic forces that maintains joint cohesion. It results from bone or ligament lesions and its severity is directly correlated with the severity of these lesions.

2.1. Static and dynamic instability

There is instability at rest, called static instability, and instability occurring during movement called dynamic instability.

2.2. Objective and subjective instability

Static or dynamic instability manifests in modifications of the radiographic ratios of the carpal bones themselves and between the carpals and the radius, whether or not there is also subjective instability (as experienced by the patient) or objective instability (anomaly on the clinical exam such as popping or a drawer phenomenon, etc.).

2.3. Dissociative and nondissociative instability

Dissociative instability can also be raised, which manifests as instability of the proximal row of the carpal bones in which the

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Table 1
Intrinsic carpal ligaments.

Dorsal side
Scapholunate ligament (dorsal segment)
Lunotriquetral ligament (dorsal segment)
Dorsal scaphotriquetral ligament
Dorsal scaphotrapeziotrapezoid ligament
Palmar side
Scapholunate ligament (palmar segment)
Lunotriquetral ligament (palmar segment)
Palmar scaphotriquetral ligament
Radial bundle of the collateral ligament
Ulnar bundle of the collateral ligament
Palmar scaphotrapeziotrapezoid ligament
Interosseous ligament joining trapezium, trapezoid, capitate, and hamate

lunate is considered the intercalated segment. It can be seated between the scaphoid and the lunate or between the lunate and the triquetrum. Scapholunate instability is responsible for dorsal instability of the intercalated segment, or dorsal intercalated segment instability (DISI), whereas lunotriquetral instability is responsible for volar instability of the intercalated segment, or volar intercalated segment instability (VISI).

Non-dissociative instability is characterized by the absence of instability within the proximal row of the carpal bones. It indicates instability between the distal extremity of the radius and the proximal row of the carpus (radiocarpal instability), or between the first and second row (mediocarpal instability).

There are also other complex types of instability that associate dissociative and non-dissociative instability.

2.4. Radial, ulnar, and mixed instability

This axial instability (i.e., in the axis of the wrist) includes radial instability (radial side of the wrist), ulnar instability (ulnar side of the wrist), and mixed instability.

2.5. Adaptive instability

Adaptive instability is characterized by normal intrinsic and extrinsic ligaments. Misalignment of the carpal bones in this case originates in the bones.

2.6. Acute, subacute, and chronic instability

Acute and chronic instability were mentioned above. This difference conditions the potential for healing ligament lesions. When the injury dates from less than 1 week, it is considered acute instability. A lesion between 1 and 6 weeks is considered a chronic lesion; its treatment is often difficult and remains poorly codified.

Table 2
Extrinsic carpal ligaments.

Radial side
Radial collateral ligament
Ulnar side
Ulnar collateral ligament
Dorsal side
Dorsal radiotriquetral ligament
Dorsal ulnotriquetral ligament
Palmar side
Radioscaphocapitate ligament
Radiolunotriquetral ligament
Radioscapholunate ligament
Short radiolunate ligament
Ulnolunate ligament
Palmar ulnotriquetral ligament

Fig. 1. Mayfield stage 1: scapholunate dissociation caused by intracarpal supination.

3. Perilunate dislocation of the carpus

Usually posterior, this dislocation associates complex ligament lesions and can compromise vascularization of the lunate. It can be purely ligamental or associated with a fracture of a carpal bone; 30% of these lesions are not diagnosed early.

3.1. Pure ligament lesions

Mayfield describes four stages [12,13]:

- stage 1: scapholunate dissociation caused by intracarpal supination (Fig. 1);
- stage 2: capitolunate dislocation caused by lateral disruption (Fig. 2);
- stage 3: triquetrolunate and radiolunate dislocation resulting in retrolunate dislocation (Fig. 3);
- stage 4: radiolunate lesion as severe as enucleation of the lunate caused by rupture of its two constraints with risk of lunate necrosis (Fig. 4).

This perilunate lesion can be associated with a transcaphoid fracture, or a transtriquetral or transcapitate fracture. The associated fracture generally ensures preservation of the neighboring scapholunate or lunotriquetral ligament (Herzberg classification [14]).

Frequently, the diagnosis is radiographic with particular importance awarded to the strict lateral view because the AP x-ray is

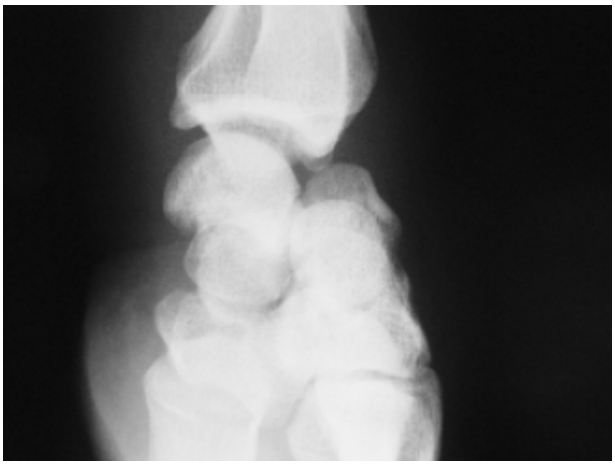

Fig. 2. Mayfield stage 2: capitolunate dislocation caused by lateral disruption.