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Hand Surgery & Rehabilitation
Hand Surgery and Rehabilitation 35 (2016) 10–15

Original article

The role of extrinsic ligaments in maintaining carpal stability – A prospective statistical analysis of 85 arthroscopic cases

Rôle des ligaments extrinsèques dans la stabilité du carpe. Analyse statistique prospective sur 85 testings arthroscopiques

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Received 24 February 2015; received in revised form 20 September 2015; accepted 29 September 2015

Abstract

Several biomechanical studies have shown that the scapholunate (SL) and lunotriquetral (LT) ligaments are not the only stabilizers of the proximal carpal row. However, no study has yet analyzed the range of ligament lesions leading to instability in vivo. Arthroscopy has been used to assess the condition of the wrist's extrinsic ligaments by palpating and tensioning the various ligament and capsule structures. In this prospective study, this arthroscopic method was used in 85 cases of wrist sprain without static instability to evaluate the correlation between lesions of the intrinsic and extrinsic carpal ligaments and carpal instability. In SL instability, a scapholunate interosseous ligament (SLIL) lesion was statistically correlated with lesions of the long radiolunate ligament ($P < 0.05$). There also was a statistically significant correlation between lesions of the SLIL and the radioscaphocapitate, scaphotrapezial and dorsal intercarpal ligaments. There was a correlation between the stage of SL instability and the number of lax extrinsic ligaments ($P < 0.05$) but not with the severity of the extrinsic ligament lesions. In LT instability, a LT interosseous ligament lesion was statistically correlated with lesions of the dorsal intercarpal ligament ($P < 0.05$). There also was a correlation between the stage of LT instability and the number ($P < 0.005$) and severity ($P < 0.001$) of the extrinsic ligament lesions. Arthroscopy can reveal hidden radiographic instability and can also be used to define the number and severity of injured ligaments. In carpal instability, a lesion of one intrinsic carpal ligament was associated with a lesion of one or more extrinsic ligaments.

Keywords: Extrinsic ligament; Arthroscopy; Testing; Carpal instability; Wrist sprain

Résumé

De nombreuses études biomécaniques ont montré que les ligaments scapho-lunaire (SL) et luno-triquétral (LT) ne sont pas les seuls stabilisateurs de la rangée proximale du carpe. Cependant, aucune étude n'a encore analysé in vivo le spectre des lésions ligamentaires menant à l'instabilité. L'arthroscopie a déjà été proposée pour établir l'état des ligaments extrinsèques du poignet par leur palpation, permettant d'évaluer leur état de tension. Dans cette étude prospective sur 3 ans basée sur 85 cas d'entorses du poignet ne présentant pas d'instabilité statique, les auteurs ont utilisé cette évaluation arthroscopique pour évaluer la corrélation entre les lésions des ligaments intrinsèques et extrinsèques et l'instabilité du carpe. Dans l'instabilité SL, une lésion du ligament scapho-lunaire interosseux (SLIO) était statistiquement associée avec une lésion du seul ligament radio-lunaire long ($p < 0{,}05$). Il y avait aussi une association statistiquement significative entre une lésion du SLIO et une lésion associée des ligaments radio-scapho-capital, scapho-trapézien et intercarpien dorsal. On trouvait une corrélation entre le stade d'instabilité SL et le nombre de ligaments extrinsèques détendus ($p < 0{,}05$), mais pas avec la sévérité de la lésion des ligaments extrinsèques. Dans l'instabilité LT, une lésion du ligament luno-triquetral interosseux était statistiquement associée à une lésion du ligament intercarpien dorsal ($p < 0{,}05$). Il existait aussi une corrélation entre le stade d'instabilité LT et le nombre ($p < 0{,}005$) et la sévérité ($p < 0{,}001$) des lésions des ligaments extrinsèques. L'arthroscopie

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http://dx.doi.org/10.1016/j.hansur.2015.09.004

est utile pour prouver une instabilité radiographiquement occulte, mais peut aussi définir le nombre de ligaments extrinsèques atteints, et la sévérité de leur lésion. Dans l'instabilité du carpe, il existe toujours une association entre une lésion d'un ligament intrinsèque et une lésion d'un ou plusieurs ligaments extrinsèques.

Mots clés : Ligaments extrinsèques ; Arthroscopie ; Testing ; Instabilité du carpe ; Entorse du poignet

1. Introduction

Our understanding of carpal biomechanics is evolving [1–4]. Stability of the proximal carpal row depends on the integrity of the interosseous ligaments, which act as primary stabilizers [5–10]. Several recent cadaver studies have shown that certain extrinsic ligaments also contribute to carpal stability [8–19]. A wide spectrum of wrist instability can occur based upon the associated extrinsic ligament lesions. Management of these complex injuries depends on a thorough understanding of the anatomy and the underlying pathomechanics of ligament injuries.

Arthroscopy provides a different view of these extrinsic ligaments relative to conventional imaging modalities [20,21]. Although arthroscopy only reveals the intraarticular appearance of the ligaments, specific mechanical testing of each ligament provides further information about their morphology.

We have previously described an arthroscopic testing method [22] that can be used to assess all extrinsic ligaments and to establish the hierarchy as secondary stabilizers. Here, we report a prospective statistical analysis of 85 complete testing procedures performed over a 3-year period.

2. Patients and methods

2.1. Patients

Between 2009 and 2011, 85 complete arthroscopic assessments of carpal extrinsic ligaments were performed by two surgeons. The study included 32 women and 53 men with an average age of 39.5 years (range 18–69 years). Because the diagnosis of static instabilities does not require arthroscopy, we focused our study on pre-dynamic or dynamic instabilities. Thus, inclusion criteria were CT arthrogram evidence of scapholunate interosseous ligament (SLIL) lesion, potentially associated with lunotriquetral interosseous ligament (LTIL) lesion, without static instability.

All patients presented with a lesion of the dorsal part of the SLIL diagnosed with CT arthrogram, making the series homogenous in this respect. The interval between the injury event and arthroscopy was less than 3 months in 29 cases (34.1%). To grade the intrinsic ligament lesions, we used the five-stage EWAS classification [23] (Table 1), which was adapted from Geissler [24]. This classification describes a partial laxity in stage 3 with two subdivisions: volar (3A) or dorsal (3B). Stage 3C corresponds to complete (volar and dorsal) laxity. The same classification has been used to grade the lunotriquetral joint space. We considered stages 1 and 2 to be stable intervals, stages 3 and 4 to be unstable intervals. In EWAS stage 5, the instability is static; the ligament lesions are widespread, including extrinsic and intrinsic ligaments. Those cases were excluded. Moreover, since the CT scan performed before each arthroscopy provided data about the cartilage condition, arthroscopy did not seem necessary to determine which surgical procedure should be used [23].

2.2. Technique

A 2.7-mm scope and a 1-mm hook probe were used in all procedures with the standard wrist arthroscopy set-up. A vertical traction of 6 kg was applied with a calibrated device. The stability of the scapholunate and lunotriquetral intervals was assessed. Arthroscopic extrinsic ligament testing used a four-stage classification [22] (Table 2). The testing of extrinsic ligaments was performed on all the palmar and dorsal ligaments accessible via the standard radiocarpal or midcarpal dorsal portals (Figs. 1 and 2).

With the scope in the 3/4 radiocarpal (RC) portal and the probe in the 4/5 RC portal, the following ligaments were tested: radiocarpal part of the radioscaphocapitate (rcRSC), long radiolunate ligament (LRL), short radiolunate ligament (SRL), ulnolunate ligament (UL), ulnotriquetral ligament (UT) and dorsal radiocarpal ligament (DRC).

With the scope in the MCR portal and the probe in the MCU portal, the following ligaments were tested: scaphotrapezial ligament (ST), midcarpal portion of the radioscaphocapitate ligament (mcRSC), triquetrocapitate ligament (TC), and dorsal intercarpal ligament (DIC).

In the radiocarpal (RC) joint, the rcRSC and LRL ligaments are easily palpated through the interligament sulcus. The SRL

Table 1
EWAS stages of scapholunate interosseous instability [23].

Stages	Arthroscopic testing of SLIL from MC joint Scope through MCR and probe through MCU
Stage I	No passage of the probe
Stage II	Passage of the probe tip in the SL space without widening (stable)
Stage IIIA	Volar widening on dynamic testing from MC joint (anterior laxity)
Stage IIIB	Dorsal SL widening on dynamic testing (posterior laxity)
Stage IIIC	Complete widening of SL space on dynamic testing, reducible with removal of probe
Stage IV	SL gap with passage of scope from RC to MC joint No radiographic abnormalities
Stage V	Wide SL gap with passage of scope through SL joint Frequent X-ray abnormalities such as an increased SL gap, DISI pattern