Available online at www.sciencedirect.com

ScienceDirect

The Surgeon, Journal of the Royal Colleges of Surgeons of Edinburgh and Ireland

www.thesurgeon.net

Safety of dorsal wrist arthroscopy portals: A magnetic resonance study

Umile Giuseppe Longo [a], *Mattia Loppini* [a], *Riccardo Del Vescovo* [b], *Luigi Cazzato* [b], *Bruno Beomonte Zobel* [b], *Nicola Maffulli* [c,d,*], *Vincenzo Denaro* [a]

[a] *Department of Orthopaedic and Trauma Surgery, Campus Bio-Medico University, Via Alvaro del Portillo, 200, 00128 Rome, Italy*

[b] *Department of Radiology, Campus Bio-Medico University, Via Alvaro del Portillo, 200, 00128 Rome, Italy*

[c] *Department of Musculoskeletal Disorders, Faculty of Medicine and Surgery, University of Salerno, 84081 Baronissi, Salerno, Italy*

[d] *Centre for Sport and Exercise Medicine, Queen Mary University of London, London, England, United Kingdom*

ARTICLE INFO

Article history:
Received 5 August 2016
Received in revised form
2 September 2016
Accepted 10 September 2016
Available online xxx

Keywords:
Wrist arthroscopy
Dorsal portals
Radial vascular bundle
Superficial radial nerve
Ulnar vascular bundle
Dorsal ulnar nerve

ABSTRACT

In wrist arthroscopy, the standard dorsal portals are the most commonly used. However, their placement can be associated with injuries to the neurovascular structures of the radiocarpal joint. The present study assessed and compared the distance of commonly used dorsal portals to radial and ulnar neurovascular structures.

Forty patients (20 males, 20 females) were evaluated with T1-weighted spin-echo (SE) magnetic resonance (MR) sequences. We measured the distance between 1–2 and 3–4 portals and radial vascular bundle and the nearest branch of the superficial branch of radial nerve (SBRN). We also measured the distance between 4 and 5, 6/U and 6/R and ulnar vascular bundle and the nearest branch of the dorsal ulnar nerve (DUN).

The median age of patients was 39 years (95% IC 36.97–43.32 years). The 3–4 portal was farther away from the vascular structure than the 1–2 portal ($P < 0.0001$), 4–5 portal ($P = 0.008$), 6/R ($P < 0.0001$), and 6/U portals ($P < 0.0001$). Moreover, the 3–4 portal was farther away from the nerve branch than the 1–2 portal ($P < 0.0001$), 4–5 portal ($P < 0.0001$), 6/R ($P < 0.0001$), and 6/U portals ($P < 0.0001$). No statistical significant differences were found between the two genders.

The 3–4 and 4–5 portals are the farthest away from the neurovascular structures, and likely reduce the risk to damage these structures. On the other hand, the 1–2 and 6/U portals likely increase the risk of neurovascular damage, because of their proximity to neurovascular structures.

Level of evidence: Diagnostic study; Level III.

* *Corresponding author*. Centre for Sports and Exercise Medicine, Barts and The London School of Medicine and Dentistry, Mile End Hospital, 275 Bancroft Road, London E1 4DG, England, United Kingdom. Fax: +44 20 8223 8930.

E-mail address: n.maffulli@qmul.ac.uk (N. Maffulli).

http://dx.doi.org/10.1016/j.surge.2016.09.008

Please cite this article in press as: Longo UG, et al., Safety of dorsal wrist arthroscopy portals: A magnetic resonance study, The Surgeon (2016), http://dx.doi.org/10.1016/j.surge.2016.09.008

Introduction

Wrist arthroscopy has advanced greatly in the last decades. Although it is technically challenging, its applications continue to expand allowing diagnosis and management of several intra-articular disorders.[1–4] The most common indications include tears of the triangular fibrocartilage complex (TFCC), dorsal ganglion cysts, articular fractures of the distal radius carpal fractures and carpal instability, and inflammatory arthritis of the radiocarpal joint.[5]

Both dorsal and volar wrist portals allow complete examination of the joint.[2] In surgical practice, the standard dorsal portals are usually preferred because they are safer than the volar portals. Traditionally, the 3–4, 4–5 and 6/R portals are the diagnostic and main working portals. The 1–2 portal allows to access to the radial styloid and the distal radius and carpal bones, such as the scaphoid and the lunate. The ulnar portals, including 6U and 6R portals, give access to the ulna-sided structures.[2]

Despite the relative lack of neurovascular structures on the dorsum of the wrist, the placement of dorsal portals can be associated with injuries to the vascular or nervous structures, both on the radial and ulnar side of the radiocarpal joint.[6,7] Vascular injuries include lesions of radial and ulnar vascular bundles.[8] Nerve injuries include the lesions of the superficial sensory nerves, such as branches of the superficial branch of the radial nerve (SBRN) on the radial side and branches of the dorsal ulnar nerve (DUN) on the ulnar side.[9,10]

The present study assessed and compared the distance of commonly used dorsal wrist arthroscopy portals to radial and ulnar neurovascular structures. The null hypothesis was that the distance between the portal and the nearest nerve branch and vascular bundle is the same for each standard dorsal portal.

Patients and methods

Subject selection

We evaluated 40 subjects who underwent magnetic resonance imaging (MRI) assessment of the radiocarpal joint. We enrolled only volunteers who reported to have never suffered from for radiocarpal joint diseases or radiocarpal pain, and who, at clinical examination and imaging, showed no pathological findings in that region. Exclusion criteria included: distal radius and/or ulna fractures; radiocarpal joint dislocations; distal radius and/or ulna osteomyelitis; radiocarpal joint infection; primary bone tumours or osteoblastic metastases of radiocarpal structures; inflammatory arthritis; growth disorders; contraindications to MRI.

All the procedures described in the present study were performed between May 2011 and September 2011, and recorded in a computer database. Patients included in the study provided their demographic data, history, physical examination findings and imaging results.

The study was approved by the local institutional review board.

Magnetic resonance assessment

All subjects were placed in the MR scanner prone with the elbow extended overhead and the pronated hand in the centre of a surface coil, which was placed in the isocentre of the imager. The same rectangular surface coil (loop size, 10 × 20 cm) was used in all scans. Special care was taken to ensure that positioning of the wrist was the same in all subjects, with the third metacarpal aligned with the longitudinal axis of the forearm.

The imaging protocol included T1-weighted spin-echo (SE) sequences in the coronal and trans-verse planes and two coronal intermediate-weighted turbo SE sequences with different repetition and echo times (first sequence: repetition time ms/echo time ms, 4000/45; second sequence: 1800/17). The second intermediate-weighted turbo SE sequence (1800/17) was performed with and without fat saturation. Finally, a coronal three-dimensional gradient-echo (GE) sequence was performed. For fat saturation of the second intermediate-weighted sequence, spectral presaturation inversion recovery was used. The rationale for choosing an echo time of 45 ms for the first inter-mediate-weighted turbo SE sequence was the fact that many anatomic structures of the wrist have short T2 relaxation times.

The standard dorsal portals were identified in the axial sequences according to the wrist extensor compartments and the description of the portal landmarks:

- *Portal* 1–2 is established in the dorso-proximal aspect of the snuffbox (to avoid the dorsal branch of the radial nerve) and just radial to the extensor pollicis longus (EPL) tendon (to avoid the radial artery).[11]
- *Portal* 3–4 is located 1 cm distal to Lister's tubercle, and is bordered on the radial side by the EPL and extensor carpi radialis brevis (ECRB) tendons, on the ulnar side by the extensor digitorum (ED) tendons and distally by the scapholunate ligament[2]; the needle is angled 10° volar to be parallel to the joint surface, thereby decreasing the risk of articular damage.[12]
- *Portal* 4–5 is established 1 cm ulnar to the 3–4 portal and is bordered on the radial side by the ED, on the ulnar side by the extensor digiti minimi (EDM), proximally by the attachment of the radius and triangular fibrocartilage and distally by the lunate.[12]
- there are two *Portals* 6, namely *6/Radial* (6/R) and *6/Ulnar* (6/U). The first is located distal to the ulna head and is bordered radially by the EDM, ulnarly by the extensor carpi ulnaris (ECU), proximally by the triangular fibrocartilage, and distally by the luno-triquetral joint; the second, which may damage the dorsal branches of the ulnar nerve, is located on the ulnar side of the ECU and on the dorsal ulnar side by the ulnar collateral ligament.[12]

For each portal, a line representing the arthroscopic trocar was drawn from the cutaneous plane to the radio-carpal joint space. A line at a 90° angle was drawn between the line representing the portal and the nearest vascular or nervous structure. Two fully trained musculoskeletal radiologists marked out the portals, identified the neurovascular structures and performed the measurements in blind fashion. Finally, the average value for each measurement was calculated for further

Please cite this article in press as: Longo UG, et al., Safety of dorsal wrist arthroscopy portals: A magnetic resonance study, The Surgeon (2016), http://dx.doi.org/10.1016/j.surge.2016.09.008