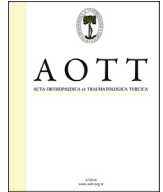




Contents lists available at ScienceDirect

## Acta Orthopaedica et Traumatologica Turcica

journal homepage: <https://www.elsevier.com/locate/aott>

## Lack of experience is a significant factor in the missed diagnosis of perilunate fracture dislocation or isolated dislocation

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## ARTICLE INFO

## Article history:

Received 29 July 2016

Received in revised form

6 March 2017

Accepted 7 April 2017

Available online xxx

## Keywords:

Dislocation

Lunate

Perilunate

Wrist injury

Scaphoid fracture

Trans-scaphoid

## ABSTRACT

**Objective:** The aim of this study was to analyze the risk factors contributing to the misdiagnosis of perilunate injuries.**Methods:** The study included patients who had perilunate dislocation or fracture dislocation correctly or incorrectly diagnosed on initial examination between 2008 and 2014. Data related to the length of time until correct diagnosis of the perilunate injury; cause of injury; presence of associated fractures, poly-trauma or concomitant trauma in the ipsilateral upper extremity; time between injury and first presentation; first treatment applied; presence of ligamentous perilunate injuries only or fracture and dislocation; inadequate radiographic assessment; and experience of the physicians were recorded and analyzed.**Results:** A total of 44 wrists were included in the study. Of those, 10 (22.7%) wrists (mean patient age: 44.4 years [28 ± 58 years]) with perilunate injuries were misdiagnosed in the initial evaluation. All of the risk factors were found to be similar between the group of patients with correct initial diagnosis and missed diagnosis group, except for the experience of the orthopedic surgeon assessing the injury ( $p = 0.0001$ ). Of the surgeons who missed the diagnosis, 70% reported that it was their first encounter with a perilunate injury.**Conclusion:** The results of this study indicated that lack of experience was the most important factor in the misdiagnosis of perilunate fracture dislocation or isolated dislocation.© 2017 Turkish Association of Orthopaedics and Traumatology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Perilunate dislocation is an uncommon injury of the carpus most commonly seen in young males. This injury usually results from high-energy trauma, such as a motor vehicle accident, a fall from a height, or a sports-related injury that causes forceful wrist hyperextension, ulnar deviation, and intercarpal supination.<sup>1–4</sup> In addition, a less known and probably less common reverse perilunate instability resulting from hyperextension, ulnar deviation, and midcarpal pronation mechanism has also been described in the literature.<sup>5,6</sup>

A patient with perilunate dislocation may be misdiagnosed by a medical professional, which will lead to delay in treatment. Early diagnosis is important due to the progression of carpal instability,

and traumatic arthritis may result from delayed treatment. Recognition of perilunate injury patterns may be difficult for the untrained eye.<sup>1,3</sup> In the literature, it has been reported that the diagnosis was missed at the time of initial evaluation in 14.8%–25% of patients.<sup>2,7</sup> Variations in the pattern of perilunate injuries can occur with associated fractures of carpal bones, resulting in perilunate fracture dislocations. Areas of potential fracture include the distal radius, scaphoid, trapezium, capitate, hamate and triquetrum, all aligned along a larger arc encircling the lunate.<sup>8</sup> Despite the usual involvement of high-energy trauma and the severity of the carpal injury, initial diagnosis of perilunate injuries may be delayed.<sup>2,9</sup> Inadequate radiographs or improper radiographic technique can also lead to misdiagnosis.<sup>10</sup>

Studies analyzing misdiagnosed perilunate dislocations are somewhat limited. The main reason for investigating medical errors is to try to prevent them. Therefore, this study was conducted to investigate characteristics of cases with misdiagnosed perilunate injuries and the risk factors for misdiagnosis.

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Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

<http://dx.doi.org/10.1016/j.aott.2017.04.002>1017-995X/© 2017 Turkish Association of Orthopaedics and Traumatology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Patients and methods

The current study consisted of a retrospective analysis of wrists with diagnosed and misdiagnosed perilunate dislocation or fracture dislocation (Mayfield stage 3/4) on initial examination at the clinic between 2008 and 2014. Approval for the study was granted by the Local ethics committee.

The study comprised 44 wrists (42 patients) with perilunate dislocation or fracture dislocation. A total of 10 (22.7%) wrists were misdiagnosed on initial examination by an orthopedic surgeon.

All patients who were misdiagnosed were treated with cast or splint immobilization in the orthopedic emergency department before obtaining correct diagnosis. After initial medical assessment and treatment, the patients presented to outpatient clinics for follow-up evaluation, where they were examined either by the same or another physician (Figs. 1 and 2.). All of the patients with misdiagnosis received the correct diagnosis in follow-up clinic examination with new radiographs reviewed by another orthopedic surgeon in the department (Table 2). These patients were correctly diagnosed at mean of  $31.7 \pm 32.2$  days after injury.

Patient data were collected retrospectively from the electronic medical record system at Kartal Dr. Lütfi Kırdar Research and Education Hospital. Specific International Classification of Diseases 10th Revision codes were used for data collection: S63.03, subluxation and dislocation of midcarpal joint; S63.09, other subluxation and dislocation of the wrist and hand; S62.001A, unspecified fracture of navicular (scaphoid) bone of the right wrist, initial encounter for closed fracture; and S62.002A, unspecified fracture of navicular (scaphoid) bone of the left wrist, initial encounter for closed fracture.

An assessment form was prepared by the authors. The items documented were the length of time until diagnosis of the perilunate dislocation, cause of injury, associated fracture(s), presence of polytrauma or concomitant trauma in the ipsilateral upper extremity, time of first presentation, first treatment applied, presence of ligamentous perilunar injuries only or fracture dislocation, inadequate radiographic assessment, the experience of the physicians, and time between injury and hospital presentation.

The initial radiographs were reviewed by the authors for the purpose of this study. Associated fractures and injuries were noted. In cases where radiographs were inadequate or missing, the case was classified by the researchers as inadequate radiographic evaluation.

If the orthopedic surgeons had no previous encounter with a lunate injury in clinical practice, they were classified as inexperienced, whereas previous observation and diagnosis was classified as experienced.

The injuries were classified as stage I (the relationship of the lunate to the radius is normal), stage IIa (lunate is displaced to the palmar side with rotation of lunate of less than  $90^\circ$ ) and stage IIb (rotation of the lunate of more than  $90^\circ$ ) according to the Herzberg radiological classification.<sup>2</sup>

As a result of other medical conditions or contraindication for early surgical treatment, closed reduction and cast immobilization were applied to 4 wrists as definitive treatment. A total of 40 wrists (38 patients) were operated on under general or regional anesthesia with a tourniquet. Fractures and dislocations were reduced using open reduction. Volar or dorsal or combined volar and dorsal approaches were used as required. The dorsal approach was performed routinely unless there was an irreducible volar lunate dislocation. The treatment costs of the patients were covered by their health insurance.

Statistical analysis was performed using SPSS for Windows, Version 16.0 (SPSS Inc., Chicago, IL, USA) statistical software. The data obtained were analyzed using descriptive statistical methods at a 95% confidence interval and at 0.05 significance level to determine mean, percentage distribution, and standard deviation. The Fisher's exact test, Chi-square test, and Mann–Whitney *U* test were used to compare groups.

## Results

Among the evaluations of 27 orthopedic surgeons, 10 wrists were initially misdiagnosed. The mean age of the patients was  $35.5 \pm 11.3$  years (range: 20–60 years) in the correctly diagnosed group and  $44.4 \pm 10.4$  years (range: 28–58 years) in the undiagnosed group. No statistically significant difference was determined with respect to age ( $p = 0.056$ ). With the exception of patients with polytrauma, all other patients were treated immediately following the correct diagnosis. The time from trauma to surgery was  $9.07 \pm 9.4$  days (range: 0–47 days) in the diagnosed group and  $34.2 \pm 36.2$  days (range: 3–120 days) in the initially misdiagnosed group. The difference between the 2 groups was statistically significant ( $p = 0.023$ ). The mean length of hospital stay was  $14.9 \pm 22.9$  days (range: 2–86 days) in the diagnosed group and  $5.9 \pm 5.1$  days (range: 3–20 days) in the undiagnosed group. Among the patients with correct immediate diagnosis, 18 right wrists and 16 left wrists were injured, and in the group correctly diagnosed with perilunate injury later, 1 right wrist and 9 left wrists were injured. None of the patients in the late diagnosis group had bilateral injury or concomitant trauma in the ipsilateral extremity. Two patients with bilateral injury were correctly diagnosed on admission by an experienced surgeon.

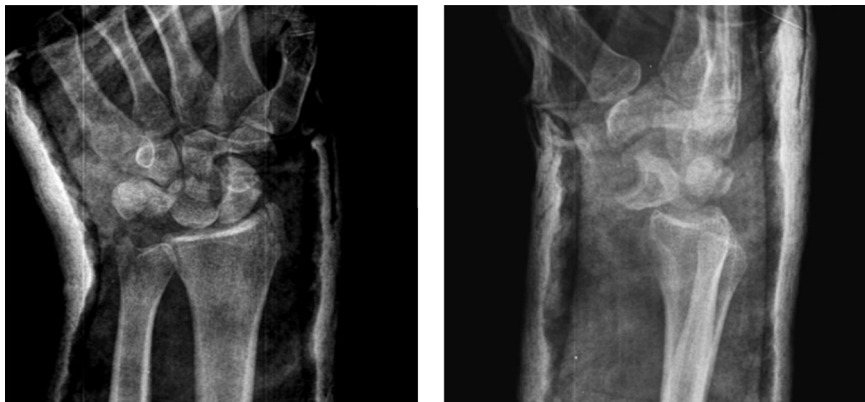


Fig. 1. A 28-year-old male with left transradial volar lunate fracture dislocation. Initial diagnosis was radius styloid fracture and treatment was short arm cast immobilization.

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