Observer Variability in Evaluating Pisotriquetral Osteoarthritis using Pisotriquetral View

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Abstract

A pisotriquetral (semilateral) view of the wrist may improve the assessment of pisotriquetral osteoarthritis (OA), but its reliability and reproducibility are unclear. The purpose of this cross-sectional observer study was to investigate (1) the inter- and intraobserver agreement of evaluating pisotriquetral OA using pisotriquetral views with a special focus on sclerosis, joint space width (JSW) narrowing and osteophyte formation, and (2) the incidence of these latter radiographic features in patients suspected for pisotriquetral OA. Five independent observers rated independently at two different occasions 27 pisotriquetral views from patients treated for ulnar-sided wrist pain suspected for pisotriquetral OA requiring a pisiform resection. The agreement was calculated using kappa statistic. Agreement between observers ranged from 0.38 (fair) to 0.56 (moderate). Average intraobserver agreement ranged from 0.43 (moderate) to 0.52 (moderate). In 36% of the ratings, JSW narrowing was observed, followed by osteophyte formation (30%) and sclerosis (28%). Observers found it especially difficult to detect JSW narrowing. Despite the availability of a pisotriquetral view to enhance visualization of the pisotriquetral joint, assessment of the specific features indicating pisotriquetral OA leads to only fair-to-moderate agreement. This limits the applicability of a radiographic assessment. A rationale for a more reliable radiologic approach in assessing the level of pisotriquetral OA is needed, which may require the use of more advanced imaging techniques.

Keywords

- ▶ pisiform
- ▶ triquetral
- ▶ pisotriquetral joint
- ▶ pisotriquetral osteoarthritis
- ▶ observer

Introduction

The pisotriquetral joint is the second most common location of carpal osteoarthritis (OA) after the scaphotrapezotrapezoid joint.¹ Pisotriquetral OA is associated with ulnar-sided wrist pain and is usually a consequence of a traumatic injury or a rheumatic disease, but may also be a normal part of human aging.^{2,3} Standard treatment starts with physiotherapy, non-steroidal anti-inflammatory drugs, and/or local injection of steroids. When nonsurgical methods are insufficient, a pisiform resection is considered as an effective treatment.⁴

To distinguish pisotriquetral OA from other wrist pathologies, a complete physical examination of the wrist usually with the help of confirmatory response injection should be performed. In radiographic imaging, an additional pisotriquetral view—a semilateral view—may enhance visualizing the pisotriquetral joint (▶ Fig. 1). As a specific radiographic classification system is absent, general features including sclerosis, joint space width (JSW) narrowing and osteophyte formation can be used to assess the level of pisotriquetral OA.⁵ Radiographic evaluation of the pisotriquetral joint, however, seems to be prone for misinterpretation.² Despite

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Fig. 1 Example of a pisotriquetral view of a wrist suspected for pisotriquetral osteoarthritis.

the common use of pisotriquetral views in the workup of patients suspected for pisotriquetral OA, there is a lack of investigation into the observer reliability and reproducibility of them amongst hand surgeons.

The purpose of this cross-sectional observer study was to investigate (1) the inter- and intraobserver agreement of evaluating pisotriquetral OA using pisotriquetral views with a special focus on sclerosis, JSW narrowing and osteophyte formation, and (2) the incidence of these latter radiographic features in patients suspected for pisotriquetral OA.

Methods

Data Acquisition

We performed a database search to identify patients treated for ulnar-sided wrist pain suspected for pisotriquetral OA requiring a pisiform resection at our specialized hand surgery unit between 2000 and 2015. Inclusion criteria included (1) adult patients (age > 18 years), (2) history of ulnar-sided wrist pain as documented in the medical record, or ulnar-sided wrist pain as recognized during physical examination, (3) suspicion for pisotriquetral OA as documented in the medical record requiring additional imaging, (4) executed pisiform resection, either unilaterally or bilaterally, (5) availability of a preoperative pisotriquetral view as obtained by standard protocol. Our standard protocol describes a semilateral view in which the pisotriquetral joint is visualized with the forearm approximately 30 degrees supinated off the neutral position. Exclusion criteria included (1) patients with ulnar-sided wrist pain explained by other wrist pathologies than pisotriquetral OA, (2) nonadult patients (age ≤ 18 years), (3) endocrine/hormonal disorders which may affect bone health including diabetes mellitus (type 1 or 2) and hyperparathyroidism, (4) corticosteroid medication which may affect bone health including long term use of prednisone and cortisone. Our human research committee approved this study.

Survey

Using an online survey, five independent observers rated pisotriquetral views in the same order without clinical and demographic information. The observers were all staff plastic surgeons, with a special interest in wrist surgery. For each image, observers were required to answer the following questions with either yes, no, or inability to evaluate with respect to the pisotriquetral joint: do you observe (1) sclerosis, (2) JSW narrowing, (3) osteophytes, and, in conclusion, (4) OA in general? All observers repeated the survey after 2 to 7 weeks.

Statistical Analysis

Interobserver agreement was calculated using the Fleiss' kappa for multiraters and intraobserver agreement using the Cohen's kappa for the ratings at two occasions per observer, in R statistics version 3.0.2 (The R Foundation for Statistical Computing, Vienna, Austria). Kappa values were interpreted according to Landis and Koch criteria in which values between 0.01 and 0.20 represent slight agreement, between 0.21 and 0.40 fair agreement, between 0.41 and 0.60 moderate agreement, between 0.61 and 0.80 substantial agreement, and between 0.81 and 1.00 almost perfect agreement.⁶

Sample Size

We considered around 30 subjects, a reasonable sample size, as this sample size has previously been proposed as a general rule of thumb for a reliability study as long as the goal is to prove that kappa is different from zero (i.e., better than chance) and a moderate level or better kappa value (> 0.40) is expected.⁷

Results

We retrieved 27 pisotriquetral views of 26 consecutive patients (11 men; 15 women; average age: 48 years [range: 28–77 years]) with unilateral ($N = 25$) or bilateral ($N = 1$) pisiform resection. Agreement between observers ranged from 0.38 (fair) to 0.56 (moderate) (►Table 1). Average intraobserver agreement ranged from 0.43 (moderate) to 0.52 (moderate) (►Table 2). In 36% of the ratings, JSW narrowing was observed, followed by osteophyte formation (30%), and sclerosis (28%). Also, in 22% of the ratings observers felt unable to evaluate JSW narrowing properly, followed by sclerosis (12%) and osteophyte formation (11%). In 35% of the ratings of images in which OA was considered present one specific feature was noted, in 34% two features, and in 31% three features.

Discussion

Pisotriquetral joint disorders are often underrecognized in clinical practice.¹ Additional specific radiographic views may improve detecting pathology of the pisotriquetral joint, including OA. This observer study showed that there was only fair-to-moderate agreement among observers in rating pisotriquetral OA using pisotriquetral views. Observers found it especially difficult to detect JSW narrowing. In the

Table 1 Interobserver agreement based on evaluation of pisotriquetral joint in semisupinated oblique radiological views

Reading	General OA	Sclerosis	JSW narrowing	Osteophyte
1st	0.39 (0.26–0.56)	0.49 (0.34–0.66)	0.47 (0.32–0.63)	0.56 (0.41–0.69)
2nd	0.40 (0.21–0.58)	0.41 (0.22–0.62)	0.38 (0.21–0.56)	0.45 (0.32–0.59)
Overall	0.41 (0.28–0.54)	0.47 (0.32–0.62)	0.42 (0.28–0.58)	0.51 (0.38–0.64)

Abbreviations: JSW, joint space width; OA, osteoarthritis.

Note: Values are presented as modified Fleiss' kappa values (95% confidence interval).

Table 2 Intraobserver agreement based on evaluation of pisotriquetral joint in semisupinated oblique radiological views at two time increments

Observer	General OA	Sclerosis	JSW narrowing	Osteophyte
1	0.55 (0.29–0.81)	0.59 (0.35–0.83)	0.49 (0.25–0.72)	0.63 (0.37–0.89)
2	0.37 (0.11–0.63)	0.22 (–0.07 to 0.51)	0.37 (0.09–0.65)	0.69 (0.47–0.92)
3	0.37 (0.13–0.62)	0.42 (0.09–0.75)	0.24 (–0.02 to 0.50)	0.39 (0.14–0.64)
4	0.51 (0.26–0.76)	0.84 (0.54–1.0)	0.56 (0.30–0.82)	0.40 (0.14–0.66)
5	0.65 (0.41–0.89)	0.50 (0.21–0.79)	0.47 (0.18–0.76)	0.51 (0.22–0.81)
Average	0.49	0.51	0.43	0.52

Abbreviations: JSW, joint space width; OA, osteoarthritis.

Note: Values are presented as Cohen's kappa values (95% confidence interval).

current series, sclerosis, JSW narrowing, and osteophyte formation were almost equally often observed.

At our hospital, usually, a pisotriquetral view is acquired in addition to the standard wrist view when pisotriquetral OA is suspected. In this semilateral view, the pisotriquetral joint is visualized with the forearm approximately 30 degrees supinated off the neutral position. In a previous technical note, this view was considered consistently useful in patients presenting with the pisotriquetral disease.⁸ To the best of our knowledge, this is the first study reporting on both intra- and interobserver agreement with special attention to assessing pisotriquetral OA using specific views.

Despite having a standard protocol, variations in imaging quality may occur, influencing observer agreement. This can be caused by logistic or technical factors such as the layout of the X-ray room, or the way technicians are instructed. Improper wrist positioning and poor technical detail often result in poor diagnostics.⁹ Therefore, special care should be taken for a proper adherence to the imaging protocol. Besides imaging quality, also the level of observer experience influences agreement.¹⁰ In the current study, the observers were all staff plastic surgeons with at least 4 years of experience in wrist surgery. They all completed a 6-year plastic surgery residency program including dedicated radiology courses in interpreting wrist images. We, therefore, consider this observer group a representative sample of experienced observers. Still, we recommend caution when extrapolating the reported results to other specialists such as radiologists who are trained differently. Moreover, some observer studies

demonstrated that specific training programs might improve the reliability of characterizing fracture patterns, such as the classification of proximal humerus fractures or diagnosis of scaphoid displacement.^{11,12}

A limitation of this study is the fact that we were unable to objectify the exact wrist position at imaging among the patients, due to the retrospective setting. Despite this limitation, we deem our results clinically useful as it reflects common practice. This study was not intended as an experimental study to find the exact optimal view for assessing the pisotriquetral joint. Also, due to the absence of a golden standard for pisotriquetral OA, we could not investigate the sensitivity and specificity of the investigated imaging method. The true incidence of the pisotriquetral OA in the current series is, therefore, unknown.

Despite the availability of a specific pisotriquetral view to improve visualization of the pisotriquetral joint, assessment of radiographic features indicating OA leads to only fair-to-moderate agreement. This limits the applicability of radiographic assessment in both research and clinical practice. It remains, therefore, unclear to what extent radiographic evidence guides treatment. A rationale for a more reliable radiologic approach in assessing the level of pisotriquetral OA is needed, which may require the use of more advanced imaging techniques such as computed tomography scanning. Due to the absence of an established gold standard for diagnosing pisotriquetral OA, we recommend future studies to compare the diagnostic value of radiologic observations with clinical parameters such as confirmatory response injection and intraoperative findings.

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Conflict of Interest

None.

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