SCIENTIFIC ARTICLE

Carpal Coalitions on Radiographs: Prevalence and Association With Ordering Indication

Bastiaan T. van Hoorn, BS,* Taylor Pong, BS,*
Wouter F. van Leeuwen, MD,* David Ring, MD, PhD†

Purpose Carpal coalitions are common and usually incidental to the indication for wrist radiographs. It is not clear if, or when, carpal coalitions cause pain. The aim of this study was to assess the prevalence of incidental carpal coalitions by evaluating radiographs taken for various indications and to test the association of demographic variables and ordering indications with the finding of a carpal coalition.

Methods We reviewed 1,119 posteroanterior wrist radiographs for the presence of carpal coalition. We used bivariate and multivariate analyses to assess demographic factors for their independent associations with the presence of carpal coalitions and to compare the difference in the prevalence of carpal coalitions between radiographs obtained to evaluate traumatic wrist pain (623 wrists), nontraumatic wrist pain (175 wrists), and other reasons (321 wrists).

Results Radiographs of 98 out of 1,119 patients (8.8%) showed a carpal coalition. Carpal coalitions were equally likely on radiographs obtained for traumatic wrist pain and nontraumatic wrist pain. Patients with no wrist trauma or wrist pain were less likely to have a carpal coalition on their radiograph.

Conclusions We consider carpal coalitions an unlikely cause of wrist pain. The lower prevalence in radiographs obtained for causes other than wrist trauma or wrist pain remains unexplained, although it may be spurious. In the evaluation of a patient with nonspecific wrist pain, clinicians should be careful ascribing symptoms to anatomical variations on radiographs. These incidental findings should not usually affect management. *(J Hand Surg Am. 2017;■(■):■−■. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Diagnostic III.

Key words Carpal coalitions, prevalence, pain, radiograph indication, wrist.

A CARPAL COALITION IS A DEVELOPMENTAL synostosis or synchondrosis of 2 or more carpal bones. They are distinguished from carpal fusion, which is mostly caused by inflammatory arthritis.[1] The reported prevalence of carpal coalitions varies widely, from 0.1% to 9.5%.[1−3] Coalitions may exist between any of 2 adjacent carpal bones in the proximal or distal carpal row. Prior studies suggest that complete coalitions are most common between the lunate and the triquetrum,[1,4,5] but incomplete coalitions are more

*From the *Department of Orthopaedic Surgery, Hand and Upper Extremity Service, Massachusetts General Hospital, Harvard Medical School, Boston, MA; and the †Department of Surgery and Perioperative Care, Dell Medical School at the University of Texas at Austin, Austin, TX.*

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Corresponding author: David Ring, MD, PhD, Dell Medical School, The University of Texas at Austin, 1400 Barbara Jordan Blvd., Suite 2.834; MC: R1800, Austin, TX 78723; e-mail: david.ring@austin.utexas.edu.

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common and the definition, classification, and diagnosis of coalitions varies. A carpal coalition is the result of incomplete segmentation of the carpal cartilaginous layer and, depending on the degree of ossification, they are often classified as bony (synostosis) or fibrocartilaginous (synchondrosis).[6,7]

Most carpal coalitions are incidental findings.[1,7] It is not clear if, or when, carpal coalitions cause symptoms of wrist pain. A rationale for carpal coalitions causing pain is that deficient articular cartilage may lead to degenerative arthritis and corresponding symptoms under conditions of increased physical stress or that they may cause compensatory alterations in kinematics between the remaining carpal bones.[1]

The purpose of this study was to assess the prevalence of carpal coalitions on wrist radiographs and their association with wrist pain. We tested the primary null hypothesis that there are no differences in the prevalence of carpal coalition between radiographs obtained to evaluate (1) wrist pain associated with a traumatic event, (2) wrist pain that is not associated with a traumatic event, and (3) anything other than wrist trauma or wrist pain (eg, ganglion cysts, superficial skin infections). In addition, we tested the secondary null hypothesis that there are no demographic factors independently associated with the presence of carpal coalition in patients who underwent radiographic imaging of the wrist.

MATERIALS AND METHODS

Study design

The institutional review board approved this retrospective study and granted a waiver of informed consent. We reviewed radiology reports of all radiographic imaging studies performed at our institution between January 2015 and March 2015 that included the wrist (Current Procedural Terminology codes 73100 and 73110). This included posteroanterior radiographs of the wrist of 1,237 patients.

We excluded patients who had evidence of prior surgery (n = 64; 5.2%), rheumatoid arthritis affecting the hand (n = 43; 3.5%), severe arthrosis that distorted the radiographic alignment of the carpal bones (n = 6; 0.49%) or an unclear or poor-quality radiograph (n = 5; 0.40%). The final cohort for this study included 1,119 patients with 1,207 posteroanterior images of the wrist. For the 88 patients with a posteroanterior radiograph of both wrists, we randomly included the left limb of 44 patients and the right limb of the other 44 patients. Radiographs were obtained to evaluate wrist pain associated with a traumatic event for 623 wrists, wrist pain that was not associated with a traumatic event for 175 wrists, and other reasons than wrist trauma or pain for 321 wrists. One trained investigator (B.T.v.H.) reviewed all radiographs for the presence of carpal coalitions and reviewed borderline coalitions with an experienced orthopedic hand surgeon (D.R.), both blinded to the indication for the radiograph. We determined the type of coalition (lunate-triquetrum, capitate-hamate, capitate-trapezoid) and degree of fusion (complete/incomplete) for all coalitions according to the classification of Singh et al (2003).[8]

Outcome measures and study variables

Our primary outcome measure was the prevalence of carpal coalitions on wrist radiographs as a proportion of the total number of patients. We extracted demographic data (age, sex, and race) and radiographic indication from the medical record and the radiology report. Indications were categorized as wrist pain associated with a traumatic event, wrist pain that was not associated with a traumatic event, and other reasons than wrist trauma or wrist pain (eg, ganglion cysts, superficial skin infections). Among patients with several sets of radiographs over time, we used only the first posteroanterior radiograph made between January 2015 and March 2015.

Statistical analysis

We calculated the prevalence of carpal coalition as a percentage of the total number of patients included in this study who underwent radiographic imaging of the wrist. In addition, we determined the type of coalition and the proportions of fusions at each level (using the classification of Singh et al[8]) as a percentage of the total number of coalitions. Categorical variables are presented as frequencies with percentages and continuous variables as means with SD.

In bivariate analysis, we compared differences in proportions among patients with and without a carpal coalition using a Fisher exact test for sex, race, and categorized indication for the radiograph, and a Student *t* test for the mean age.

In multivariable logistic regression analysis, we looked at the association of explanatory variables—age, sex, race, and categorized indication for the radiograph—with the presence of carpal coalition, accounting for potential confounding by any of the included variables in the multivariable model. We calculated odds ratios with 95% confidence intervals (95% CI), and provided *P* values. A 2-tailed *P* value less than .05 was considered statistically significant.