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Drijkoningen, Tessa; G Guitton, Thierry; Ring, David

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## Plain radiographs are reliable in distinction of nonunions from acute fractures of the scaphoid waist without computed tomography

Dear Sir,

After a fall, a patient with an established scaphoid nonunion may relate the problem to the recent event. Clinicians may misinterpret nonunions as acute fractures, with the potential for undertreatment (e.g. percutaneous screw fixation when debridement and bone grafting of the nonunion is needed). Computed tomography (CT) might help distinguish acute fractures from nonunions. Buijze et al. (2012) studied CT scans of 20 healing scaphoid fractures and 10 confirmed nonunions, and they found the interobserver reliability of diagnosing scaphoid union was good ( $\kappa=0.66$ ), but the negative predictive value was only 0.41. Their findings suggest that CT is better for ruling in than ruling out union. The hypothesis of this study is that there is no agreement between observers on whether a scaphoid waist fracture is a nonunion or an acute fracture viewing radiographs alone compared with radiographs and CT scans.

After approval of our institutional review board, members of the Science of Variation Group with an interest in hand or fracture surgery, were invited to participate in this study. Among the 161 surgeons that felt the study was appropriate for their expertise and interests, 157 completed the questionnaire. Radiographs and CT scans of patients with scaphoid waist fractures made within 30 days (acute fractures) or after 6 months (nonunions) of trauma were obtained from using billing codes via a research database. Inclusion criteria were: patients aged 18 years or older with a fracture of the scaphoid waist who had a plain radiograph and CT scan within 2 weeks of each other. Radiographs included a posteroanterior (PA) view, PA view with ulnar deviation of the wrist, and a lateral view. All scaphoid CT scans had a slice thickness of 1.25 mm or less. Separate movies showed a full series of CT scan images in the coronal plane and sagittal plane. Images were 0.625 mm thickness, shown in bone windows. Radiographs were presented as static images on a web page: posteroanterior, lateral, and scaphoid views. Oblique views were not used because they were not always available. Participants were randomized 1:1 to view either radiographs alone or radiographs and videos of CT scans of 20 patients; 10 patients with acute scaphoid fractures and 10 patients having a nonunion. CT scans were obtained in the routine management of fractures and

**Table 1.** Characteristics of observers.

Characteristics	Number (%)
Gender	
Male	147 (93.6)
Female	10 (6.4)
Location of practice	
US/Canada	81 (51.6)
Europe	55 (35)
Asia	5 (3.2)
Australia	3 (2)
Other	13 (8.2)
Years in practice	
0 to 5	49 (31.2)
6 to 10	39 (24.8)
11 to 20	46 (29.3)
21 to 30	23 (14.7)
Supervising trainees	
Yes	135 (86)
No	22 (14)
Specialization	
Hand-wrist	63 (40.1)
Traumatology	53 (33.7)
Shoulder/elbow	26 (16.5)
General orthopaedics	7 (4.5)
Other	8 (5.1)

nonunions based on surgeon practice style. Observers were asked to diagnose if the fracture was acute or nonunited and to indicate the confidence in their answer.

The vast majority (147) of the 157 participants were men. Sixty-three (40%) of 157 participants specialized in hand and wrist surgery and 53 (34 %) in traumatology (Table 1). Our findings are as follows. (1) There was substantial agreement on the age of the scaphoid fracture among observers that viewed radiographs alone ( $\kappa=0.73$ ) and observers that viewed radiographs and CT scans ( $\kappa=0.80$ ). (2) Raters in the United States and Europe (compared with other parts of the world) had substantial agreement with radiographs alone and nearly perfect agreement when they also had a CT scan. (3) Raters with 0–5 years in practice had substantial agreement. Raters who were more than 5 years in practice had an almost perfect agreement (Table 2). The mean confidence of the observers viewing radiograph alone was 7.2 compared with 7.6 among observers that viewed radiographs and CT scans.

The limitations of our study include: data of tertiary hospitals, spectrum bias (more nonunions than

**Table 2.** Kappa values of inter-observer agreement in Radiographic and CT evaluation.\*

Assessments	Radiograph	Radiograph and CT
Overall	0.73	0.8
Area		
United States	0.77	0.82
Europe	0.7	0.82
Other	0.72	0.7
Years in independent practice		
0–5	0.75	0.73
More than 5 years	0.74	0.83

CT: computed tomography.

\*The agreement is considered substantial when kappa from 0.70 to 0.80, and almost perfect when above 0.80.

would be likely in a typical clinical scenario), and the very small possibility it had some of the fractures treated as acute were actually nonunions.

We conclude from this study that distinction of nonunions from acute fractures of the scaphoid is reliable with plain radiographs without CT scans. Since in practice we have seen misdiagnosis of nonunions as acute fractures, the issue might be anchoring bias or other heuristics that can affect interpretation of diagnostic tests. We advise surgeons to be mindful of a small possibility that a seemingly new fracture is not acute.

**Supplementary material** Supplementary material is available at [journals.sagepub.com/doi/suppl/10.1177/1753193418794862](http://journals.sagepub.com/doi/suppl/10.1177/1753193418794862).

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**Ethical committee** Partners Health Care, Boston.

## Reference

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**Tessa Drijkonigen<sup>1</sup>, Thierry G Guitton<sup>2</sup> and David Ring<sup>3,\*</sup>**

<sup>1</sup>Hand and Upper Extremity Service, Massachusetts General Hospital, Boston, MA, USA

<sup>2</sup>Plastic Surgery, University Medical Center Groningen, Groningen, The Netherlands

<sup>3</sup>Dell Medical School, The University of Texas at Austin, Austin, TX, USA

\*Corresponding author: [david.ring@austin.utexas.edu](mailto:david.ring@austin.utexas.edu)

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## Bipolar osteoarticular reconstruction of the radioscaphoid joint

Dear Sir,

Osteochondral autograft transplantation (OAT) for articular defects in the wrist has been shown to be effective in restoring joint congruity, relieving pain and also potentially delaying the rapid progression of degenerative arthritis (Mall et al., 2013; Tang and Imbriglia, 2013). The medial femoral trochlea (MFT) has been established as a reliable free vascularised osteochondral flap in reconstruction of difficult proximal pole non-unions with minimal donor site morbidity (Burger et al., 2013; Windhofer et al., 2016).

Here we present a unique case of a young male who presented after failed internal fixation for a proximal pole scaphoid non-union with a resultant defect in the distal radius articular surface due to marked screw prominence. He was treated with a MFT osteochondral free flap and a concomitant OAT to resurface the distal radius articular defect.

A 28-year-old, right-hand dominant concreter presented to our institution with a right proximal pole scaphoid non-union following a fall, which he sustained 9 months prior. He initially underwent open reduction and fixation using a single antegrade 3.0 mm headless compression screw with cancellous distal radial bone graft via a dorsal approach.

At the 6-month review the patient had ongoing pain and stiffness and radiographs revealed a persistent non-union with collapse of the proximal pole. As a result of the proximal pole collapse, the screw head had migrated proximally causing an osteochondral defect measuring 6 mm × 6 mm