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# Is there a need for a clinical decision rule in blunt wrist trauma?

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ABSTRACT

*Background:* Blunt wrist trauma is a very common injury in emergency medicine. However, in contrast to other extremity trauma, there is no clinical decision rule for radiography in patients with blunt wrist trauma.
*Objective:* The purpose of this study is to describe current practice and to assess the need and feasibility for a clinical decision rule for radiography in patients with blunt wrist trauma.
*Methods:* All patients with blunt wrist trauma who presented to our Emergency Department (ED) during a 6-month period were included in this study. Basic demographics were analysed and the radiography ratio was determined. The radiography results were compared for different demographic groups. Current practice and the need and feasibility for a decision rule were evaluated using Stiell's checklist for clinical decision rules.
*Results:* A total of 1019 patients with 1032 blunt wrist injuries presented at our ED in a period of 6 months. In 91.4% of patients, radiographs were taken. In 41.6% of those radiographed, a fracture was visible on plain radiography. Fractures were most common in the paediatric and senior age groups. However, even in the lower-risk groups we observed a fracture incidence of about 20%.
*Conclusion:* There is no need for a clinical decision rule for radiography in patients with blunt wrist trauma because the fracture ratio is high. Neither does it seem feasible to develop a highly sensitive and efficient decision rule. Therefore, the authors recommend radiography in all patients with blunt wrist trauma presenting to the ED.



Blunt wrist trauma is a common injury in the general population; however, little is known about current diagnostic strategies in these patients. Distal forearm fractures comprise about 3% of all trauma visits to the Emergency Department (ED) [1] and are, because of the high incidence, the most expensive injury type in the Netherlands [2]. The incidence of distal forearm fractures in the Netherlands is estimated to be between 21 and 38 per 10,000 person-years, with a peak incidence in both the paediatric and the elderly populations [1,3]. This is comparable to other Western countries [4].

In contrast to ankle, knee or cervical spine injury, there is no clinical decision rule for taking radiographs in blunt wrist injury patients [5–7]. Clinical decision rules could possibly reduce the number of radiographs and lead to a reduction in both time in the ED and costs [8]. Recently, there have been several initiatives to create a clinical decision rule for blunt wrist trauma [9–11], but until now no validated decision rule exists for blunt wrist trauma. None of these studies assessed the amount of radiographs taken in current practice. Our study evaluated the radiography ratio in current practice.

In traumatic neck, ankle and knee injuries, a decision rule has proved to be effective [8]. As the injuries are common and the actual percentage of fractures is low, it would be inefficient to take radiographs in all patients. On the contrary, hip injury in elderly patients for example is not appropriate for a decision rule. The percentage of fractures is high; hence, the current use of the diagnostic test (hip radiograph) is efficient [12]. A good example of an efficient clinical decision rule is the well-known Ottawa Ankle Rules [5]. Before its introduction the majority of ankle trauma patients underwent radiography; yet only a small minority had fractures. In a multicentre implementation trial, the decision rule resulted in an absolute reduction of ankle radiography of 22% (radiography ratio: 83–61%). There was a fracture ratio of approximately 12% for malleolar fractures in refinement,

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validation and implementation studies [13,14]. This implies that in ankle trauma patients with a good decision rule (Ottawa Ankle Rules), in one of five patients the radiograph detects a fracture. We expect a clinical decision rule for the wrist to be more complicated, because of the more complex anatomy of the wrist.

The aim of our study is to determine the need and feasibility for a clinical decision rule for radiography in patients with blunt wrist trauma. Current practice was evaluated using the checklist for clinical decision rules as suggested by Stiell et al. [12]. This checklist covers several domains such as the prevalence of a condition, current use of the diagnostic test, etc.

## Patients and methods

All ED electronic medical records during a 6-month period from 1 January until 30 June 2009 were manually reviewed for blunt wrist trauma; those patients with blunt wrist trauma were selected and included in our study. The source population was all patients presenting to the ED of two hospital locations in the west of The Netherlands. The hospital catchment population is approximately 250,000 [15]. One location is an urban level one trauma centre, with an ED attendance rate of approximately 50,000 patients per year. The other location is a community hospital with an ED attendance rate of approximately 25,000 patients per year.

Inclusion criteria were:

1. Patients with blunt wrist trauma presenting to the ED within 72 h after the trauma and
2. pain in the distal one-third of the forearm and/or the carpal region.

Patients referred to the ED after radiographs were taken (either requested by the general practitioner (GP) or referred from another hospital) were not included.

The primary outcome was any radiographically visible carpal, distal radial or distal ulnar fracture on initial ED visit. In case of discrepancy in interpretation of the radiograph between the clinician (resident surgery, resident emergency medicine, surgeon and emergency physician) and the radiologist, the radiograph was interpreted by a second radiologist whose interpretation prevailed. Fractures not visualised on initial radiography and detected with further examination (e.g., computed tomography (CT) scan, bone scintigraphy or magnetic resonance imaging (MRI)) are beyond the scope of this study. The secondary outcome was the percentage of radiographs taken, type of fracture and missed fractures in the non-radiography group. Furthermore, basic demographics were analysed.

Radiography outcome was grouped into six categories. Each case was grouped into one of the six fracture categories. If multiple fracture groups were applicable, the most specific fracture group was chosen (e.g., an epiphyseal plate fracture of the distal radius was only categorised as an epiphyseal plate fracture and not as a distal radius fracture).

The fracture categories were:

1. No fracture on ED radiography,
2. isolated distal radius and/or distal ulna fracture,
3. isolated carpal fracture,
4. combined carpal and radial fractures,
5. greenstick and/or torus fractures of distal radius and/or ulna
6. epiphyseal plate fractures (Salter–Harris fractures).

For all patients without radiographs taken in the ED on the initial visit, we assessed the radiology reports during a 6-month period after the ED visit to check for missed fractures.

Age was grouped into 10-year age groups. A total group analysis was made as well as a separate analysis for patients younger than 18 years of age, those between 18 and 50 years of age and those of 50 years of age or older. These age groups were based on past epidemiological studies [1,2].

Data entry and analysis were performed with the Statistical Package for Social Sciences (SPSS) version 17.0 for Windows, which was licensed to the Landsteiner Institute, The Hague, The Netherlands. Mean, median, mode and standard deviation were obtained for age. Descriptive statistics (frequencies) were obtained for fracture (type), hospital location, mechanism of injury and sex. For differences in baseline characteristics, chi-squared tests were used for categorical variables and *t*-tests were used for continuous variables. A $p$ value $<0.05$ was considered to be significant. For evaluation of different fracture risks, between-group odds ratios (ORs) were calculated for the 0–17-year- and the 50–95-year age groups in comparison to the 18–49-year age group. The OR for fracture risk was also calculated comparing men with women in each of these age groups.

## Results

In the 6-month study period, there were 36,312 ED visits and 1014 of these visits involved blunt wrist trauma (2.8%). In 18 of the 1014 patients, both wrists were injured, resulting in a total of 1032 blunt wrist traumas that were included in our study.

The mean age of all patients was 30.6 years (mode, 11 years) and 54.9% of the patients were female. The characteristics of the study patients are summarised in Table 1. The mean age in the community hospital was higher than in the trauma centre; this is similar to the different demographics of the catchment population [14]. This was reflected in the percentage referred for radiography and the radiographs positive for fracture. Fall on outstretched hand was the most common mechanism of injury (76.3%), followed by direct trauma (14.9%) and motor vehicle accidents (3.9%).

In 91.4% (943/1032) of the cases, radiographs were taken. These illustrated one or more fractures in 41.6% (392/943) of those radiographed. The radiography findings are summarised in Table 2.

Of the 1032 blunt wrist trauma cases, 466 (45%) involved children (younger than 18 years of age). There was no difference in radiography ratio in the overall paediatric or adult population (91.2% vs. 91.5%). The risk for a fracture on radiography was slightly higher in the overall adult population compared to the paediatric population (OR 1.37, 95% confidence interval (CI) 1.05–1.78).

**Table 1**
Characteristics of all the blunt wrist trauma patients seen at the two study locations.

| | Trauma Centre ($n=554$) | Community Hospital ($n=478$) | Total ($n=1032$) |
|---|---|---|---|
| Age-mean (SD) | 27.8 (21.2) yr | 33.9 (26.4) yr* ($p<0.001$) | 30.6 (23.9) yr |
| Age-range | 1–92 yr | 1–95 yr | 1–95 yr |
| Gender-female | 286 (51.6%) | 281 (58.8%)* ($p=0.02$) | 567 (54.9%) |
| Referred for radiography | 490 (88.4%) | 453 (94.8%)* ($p<0.001$) | 943 (91.4%) |
| Radiography positive for fracture | 181 (32.7%) | 211 (44.1%)* ($p=0.003$) | 392 (38.0%) |

* Statistically significant