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The yield of subsequent radiographs during nonoperative treatment of radial head and neck fractures

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Objectives: After diagnosis of an isolated radial head or neck fracture and selection of nonoperative treatment, the value of subsequent radiographs is uncertain. This study tested the null hypothesis that there are no patient, surgeon, or injury factors associated with alteration in patient management based on subsequent radiographs. Secondarily, we tested the null hypothesis that the use of subsequent radiographs is not associated with patient, surgeon, and fracture characteristics.
Methods: We identified 415 adult patients with nonoperative treatment for isolated Broberg and Morrey modified Mason type 1 or 2 fractures at a large urban hospital system during years 2013 and 2014. Patient demographics, fracture characteristics, provider characteristics, and treatment details were obtained from a hospital database. Bivariate analysis and multivariable logistic regression modeling were performed.
Results: One of 255 patients with 262 fractures that had subsequent radiographs (0.4%) was offered surgery but declined. In multivariable analysis, displaced fractures were more likely to have subsequent radiographs, but surgeon-to-surgeon variation was a far more influential factor.
Conclusions: Radiographs subsequent to diagnosis do not alter treatment of radial head fractures with no associated ligament injuries or fractures. The substantial surgeon-to-surgeon variation in the use of subsequent radiographs suggests that this may be a good focus for quality improvement initiatives.
Level of evidence: Level II; Retrospective Design; Prognosis Study

Keywords: Radiographs; radial head; fractures; nonoperative treatment; quality improvement; orthopedic trauma

If a fracture is unlikely to change over time, serial radiographs have a limited utility and increase costs.[7,16] Isolated fractures of the radial head are usually treated nonoperatively.[5,6] Even partial articular fractures with more than 2 mm displacement might not benefit from open reduction and internal fixation.[5,6]

The Massachusetts General Hospital, Harvard Medical School Institutional Review Board approved this study under protocol #2009P001019/MGH.

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To our knowledge, the only study that identified a notable rate of displacement of isolated radial head fractures (33%) was by Radin and Risborough[15] in the 1960s. In addition, variation in radiographic technique can be misinterpreted as displacement. Examination findings, such as restriction of forearm rotation or crepitation with forearm rotation, are generally used to decide when to offer open reduction and internal fixation.[5] Current thinking suggests that serial radiographs may not be necessary after the initial radiographs for diagnosis.

Shulman et al[16] studied various nonoperative treatment strategies of 56 nondisplaced or minimally displaced radial head or neck fractures (Mason type 1) without additional injury to the affected limb. They documented an average of more than 4 additional radiographs after the initial outpatient presentation, none of which altered treatment or informed prognosis. Jayaram et al,[13] in Glasgow, UK, described their results with Emergency Department evaluation alone for stable Mason type 1 and 2 fractures of the radial head and neck with well-understood histories. Among 202 patients treated, only 20 (10%) requested a second in-person evaluation, and 2 (1%) had subsequent surgery. More than 90% were satisfied with their care.

This study investigated whether subsequent radiographs are useful after the initial nonoperative treatment of isolated radial head and neck fractures. We tested the null hypothesis that subsequent radiographs that change management of nonoperatively treated isolated radial head and radial neck fractures are not associated with patient (eg, age, sex), surgeon (eg, specialty, specific surgeon), or fracture (eg, classification) characteristics. In addition, we examined the null hypothesis that the use of subsequent radiographs during nonoperative treatment of these fractures is not associated with patient, surgeon, and fracture characteristics.

Materials and methods

Patients

An institutional database with medical record and billing information was searched using International Classification of Diseases, Ninth Revision codes (813.5) and Current Procedural Terminology (American Medical Association, Chicago, IL, USA) codes (24650, -55, -65, -66) to retrospectively select patients from a large urban hospital system during a 2-year period between January 1, 2013, and December 31, 2014. The data collection started after July 1, 2015, to ensure at least 6 months between the initial diagnosis and the last inspection of the database. The database includes records from 5 hospitals and 1 outpatient center in the system.

We identified 415 patients, 243 (59%) women and 172 (41%) men aged 18 years or older, with an isolated (no other fractures, ligament injuries, or wounds), actual or suspected, Broberg and Morrey modified Mason types 1 and 2 fractures seen in the office of 1 of 86 orthopedic surgeons and treated nonoperatively. Injuries not evaluated by clinicians or with incomplete records were excluded. Bilateral injuries occurred in 10 patients (2.4%). The mean age was 47 (standard deviation, 19) years. Most patients were Caucasian (84%), English-speaking (93%), single (49%) or married (37%), and with private insurance (64%; Table I).

Table I Characteristics of patient sample

Characteristics	All patients (n = 415)
Age, mean (SD), y	47 (19)
Sex, No. (%)	
Men	172 (41)
Women	243 (59)
Marital status, No. (%)	
Single	205 (49)
Married	155 (37)
Divorced/separated	27 (7)
Widowed	10 (2)
Other	18 (4)
Race, No. (%)	
Caucasian	348 (84)
Black	9 (2)
Hispanic	17 (4)
Asian	16 (4)
Not specified	25 (6)
Spoken language, No. (%)	
English	385 (93)
Non-English	30 (7)
Insurance status, No. (%)	
Private	266 (64)
Medicare	68 (16)
Medicaid	53 (13)
Self-pay	15 (4)
Other	13 (3)

SD, standard deviation.

Outcome measures

The primary outcome measure was a recommendation for surgery or altered weight-bearing/work status based on the interpretation of subsequent radiographs. The use of subsequent radiographs was our secondary outcome variable.

Explanatory variables

Demographic explanatory variables obtained from the hospital database included patient age, sex, marital status, race, spoken language, and insurance status. Medical records and radiographs were reviewed to determine the type of fracture and characteristics of the treating surgeon (ie, surgeon volume, years in practice, and specialization).

The radial head fractures were characterized as suspected or definite fractures. Suspected fractures were divided into fractures with an anterior fat pad sign present or absent on a lateral radiograph. We used the Broberg and Morrey modification of the Mason classification.[1] Definite fractures were categorized as radial neck, Broberg and Morrey modified Mason type 1 partial articular fractures (≤2 mm displacement), and Broberg and Morrey modified Mason type 2 fractures (≥2 mm displacement, involving only a part of radial head).[1,13]