

RESEARCH ARTICLE

Evaluation of Radiocapitellar Arthritis in Patients with a Second Radiograph at Least 2 Years after Nonoperative Treatment of an Isolated Radial Head Fracture

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*Research performed at the Massachusetts General Hospital, Harvard Medical School, Boston, USA**Received: 16 April 2017**Accepted: 30 August 2017***Abstract**

Background: To study if patients that have a second radiograph 2 or more years after nonoperative treatment of an isolated radial head fracture have radiocapitellar osteoarthritis (RC OA).

Methods: We used the database of 3 academic hospitals in one health system from 1988 to 2013 to find patients with isolated radial head fractures (no associated ligament injury or fracture) that had a second elbow radiograph after more than 2 years from the initial injury. Of 887 patients with isolated radial head fractures, 54 (6%) had an accessible second radiograph for reasons of a second injury (57%), pain (30%), or follow-up visit (13%). Two orthopedic surgeons independently classified the radial head fractures on the initial radiographs using the Broberg and Morrey modified Mason classification, and assessed the development of RC OA on the final radiograph using a binary system (yes/no).

Results: Four out of 54 (7.5%) patients had RC OA, one with isolated RC arthrosis that seemed related to capitellar cartilage injury, and 3 that presented with pain and had global OA (likely primary osteoarthritis).

Conclusion: With the caveat that some percentage of patients may have left our health system during the study period, about 1 in 887 patients (0.1%) returns with isolated radiocapitellar arthritis after an isolated radial head fracture, and this may relate to capitellar injury rather than attrition. Patients with isolated radial head fractures can consider post-traumatic radiocapitellar arthritis a negligible risk.

Keywords: Arthritis, Nonoperative, Osteoarthritis, Radial head fracture, Radiocapitellar

Introduction

Radial head fractures are common and radiocapitellar osteoarthritis (RC OA) rarely brings patients to the doctor. Broberg and Morrey modified Mason's classification of isolated partial articular fractures by adding thresholds of 30% of the articular surface and 2 mm displacement. While a 2 mm step off was linked to arthrosis in some joints, the same relationship does not appear to hold true in the elbow. In fact, the concern with displacement is that there will be hindrance of forearm rotation, not arthritis of the radiocapitellar or

proximal radioulnar joints (1). A cadaver study testing found that 3 mm of displacement hindered forearm rotation in 7 of 9 cadavers (2). In another study of nonoperatively treated Mason type II fractures, patients with displacement less than 2 mm had no difference in functional outcome measures, range of motion, and subsequent RC OA compared to with patients with more than 2 mm displacement (3).

If slight deformity does not result in RC OA we can downgrade that issue in treatment considerations.

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This study addressed the primary null hypothesis that there are no factors associated with RC OA after non-operative treatment of isolated radial head fractures. Secondly, we aimed to study the time to the diagnosis of RC OA.

Materials and Methods

Patients

In a retrospective study, we used the database of 3 academic medical centers to find patients with the diagnosis of radial head fracture from 1988 to 2013 using International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis code of 813.05. We included patients older than 16 years of age, with an isolated radial head fracture treated nonoperatively, and with an accessible follow-up elbow radiograph of more than 2 years after the initial injury. We excluded patients with concomitant elbow fracture or fracture-dislocation, and patients with prior elbow trauma or osteoarthritis. Of 4306 elbow injuries with radial head fractures, 887 patients had isolated radial head fracture, out of which 54 patients had a follow-up elbow radiograph after more than 2 years from the initial injury. We excluded patients with concomitant injuries and patients treated operatively (radial head prosthesis, open reduction and internal fixation, and head resection) leaving 54 patients with 54 isolated radial head fractures treated nonoperatively.

We reviewed the medical record to gather demographic data and injury characteristics. The reason for the later radiograph was recorded and grouped as subsequent injury, persistent pain, and research visits.

Radiographic assessment

Anteroposterior and lateral radiographic views of the elbow at the time of injury and at the final follow-up visit were captured. Radial head fractures were classified on the initial radiographs using the Broberg and Morrey modified Mason classification: type I (fracture fragment less than 30% of the head and less than 2 mm displacement), type II (fracture fragment more than 30% of the head and more than 2 mm displacement), and type III (comminuted fracture involving the whole head). Further, development of radiocapitellar osteoarthritis (RC OA) was assessed on the final radiograph. Because isolated RC OA is not a common finding on radiographs and it is usually mild, we used a binary rating to group the patients based on whether RC OA was developed (yes/no). Two orthopedic surgeons reviewed the radiographs independently (ARK and DR) to classify the radial head fracture type as well as to rate the RC OA. A consensus was made after discussion if there was any disagreement between raters regarding the type of the fracture or the existence of RC OA. Only 4 (7.5%) developed RC OA all of which were Mason type I radial head fracture.

Data analysis

Categorical and continuous data were presented as absolute numbers with percentages and mean with standard deviation, respectively. Considering RC OA as an

Table 1. Demographic and fracture characteristics of the patients with radial head fracture alone after nonoperative treatment

	RC OA after nonoperative treatment	
	No (N=50)	Yes (N=4)
Age, mean (SD)	52 (13) ^a	50 (16) ^b
Follow up, mean (SD)	6.2 (3.6) ^c	9.6 (4.7) ^d
Sex, no. (%)		
Male	17 (85)	3 (15)
Female	33 (97)	1 (3)
Race, no. (%)		
White	43 (91)	4 (9)
Non-white	7 (100)	0
Side, no. (%)		
Right	25 (93)	2 (7)
Left	25 (93)	2 (7)
Dislocation, no. (%)		
Yes	3 (100)	0
No	47 (92)	4 (8)
Follow up, no. (%)		
Recent trauma	31 (97)	1 (3)
Pain	16 (84)	3 (16)
Follow up	3 (100)	0
Mason type, no. (%)		
I	43 (91)	4 (9)
II	6 (100)	0
III	1 (100)	0

RC OA Radiocapitellar osteoarthritis; SD Standard deviation;

^a Age Min-Max=21-81 years;

^b Age Min-Max=36-73 years

^c Follow up Min-Max=2.1-18 years;

^d Follow up Min-Max=3.4-15 years

outcome variable, we used Chi Square or Fisher's exact test for categorical data and independent student's t-test for continuous data to assess the related factors in the development of RC OA [Table 1].

Results

The only factor related to the development of RC OA was the time elapsed since injury with 3 of 4 presented after 10 years [Tables 2; 3]. Three of 4 patients-all evaluated for pain many years after fracture-had also developed some degrees of ulnohumeral osteoarthritis [Table 3; Figures 1-4].

Table 2. Assessment of the related factors in the development of RC OA

	<i>P value</i>
Mason type (I, II, III)	<i>0.73</i>
Time to follow-up (<5 y, 5-10 y, >10 y)	<i>0.036</i>
Dislocation	<i>0.61</i>
Race	<i>0.42</i>
Age	<i>0.56</i>
Side	<i>0.95</i>
Sex	<i>0.10</i>

RC OA radiocapitellar osteoarthritis

Discussion

Our objective was to assess the relation between the radial head fracture type and the incidence of RC OA after nonoperative treatment of an isolated radial head fracture. Isolated arthrosis of the RC joint is uncommon after isolated radial head fractures.

There are some limitations with retrospective studies including loss of follow up, and inaccurate medical records. Our sample was too small to be representative of the whole isolated radial head fractures and the number of RC OA was too small to let us make a strong inferences; however, our results are internally acceptable for the same population. The subset of patients we studied was not representative of the average patient with radial head fracture. We studied patients that returned, most of whom had recent trauma and less than 1/3 had symptoms,

Table 3. Patients with the finding of radiocapitellar osteoarthritis in the follow-up radiographs

Patient	Sex	Race	Age	Side	Reason of follow-up	Treatment	Dislocation	Mason type	Time to follow-up (year)	Other findings
1	Male	White	42	Left	Pain	Nonoperative	No	1	3	UH OA
2	Female	White	48	Right	Pain	Nonoperative	No	1	10	UH OA
3	Male	White	73	Right	Pain	Nonoperative	No	1	10	UH OA
4	Male	White	36	Left	Trauma	Nonoperative	No	1	15	

UH OA: ulnohumeral osteoarthritis



Figure 1. Anteroposterior elbow view of a 45-year-old male 3 years after the initial injury shows slight deformed head with radiocapitellar and ulnohumeral arthrosis.



Figure 2. Anteroposterior elbow view of a 58-year-old male 10 years after the initial injury shows slight deformed head with radiocapitellar and ulnohumeral arthrosis.



Figure 3. Anteroposterior elbow view of a 83-year-old male 10 years after the initial injury shows slight deformed head with radiocapitellar and ulnohumeral arthrosis.



Figure 4. Anteroposterior elbow view of a 51-year-old male 15 years after the initial injury shows radiocapitellar arthrosis.

likely for reasons unrelated to the original fracture.

There was only one patient with isolated RC arthrosis, which looked like a capitellar cartilage injury. Three other patients had RC OA as part of a global OA (ulnohumeral, PRUS, and RC). All four patients had type I radial head fractures. The patients with global arthrosis might have primary osteoarthritis incidentally or perhaps there was more of an elbow injury than apparent on the radiographs and this is post-traumatic OA, although that seems less likely. The prevalence of OA (7.5%) in our population is likely related to the fact that most patients had a second radiograph of their elbow mostly due to pain.

In the process of aging, degenerative changes start from the radiocapitellar articulation (4, 5). Primary osteoarthritis, fractures involving the lateral elbow compartment, and persistent elbow instabilities might also result in RC OA (6, 9). RC OA is uncommon after radial head fractures even if it heals with deformity. It seems that the radial head fracture type and the degree of deformity after healing was unrelated to the development of RC OA (10).

In conclusion, 6% of patients with isolated radial head fractures returned for a second radiograph more than 2 years after injury. Only 7.5% had radiocapitellar arthrosis

and 3 of the 4 patients had ulnohumeral arthrosis, likely primary. With the caveat that some percentage of patients may have left our health system during the study period, about 1 in 887 patients (0.1%) returns with isolated radiocapitellar arthritis after an isolated radial head fracture, and this may relate to capitellar injury rather than attrition. Patients with isolated radial head fractures can consider post-traumatic radiocapitellar arthritis a negligible risk, but additional study is warranted.

The authors declare that they have no conflict of interest.

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