Outcomes of Concomitant Fractures of the Radial Head and Capitellum: The "Kissing Lesion"

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Abstract

Background Radial head compression against the capitellum may cause concomitant fracture of the capitellum. The purpose of this study was to investigate if radial head fracture type is associated with a concomitant fracture of the capitellum.

Patients and Methods Data were identified from five area hospitals. We retrieved records of patients older than 18 years of age who underwent treatment for concomitant capitellum fracture and radial head fracture between January 2002 and January 2013. Patients with olecranon fractures or trochlea fractures were excluded.

Results A total of 10 patients with a radial head fracture and a concomitant capitellum fracture were included. Based on the operative reports, nine radial head fractures were classified as Hotchkiss modification of the Mason classification type II, and one was classified as type I. Based on the available radiographs and computed tomography, three capitellum fractures were type I, and seven were type II according to the Grantham classification.

Conclusion Surgeons have to be alert to capitellar damage in case of a Hotchkiss type II radial head fracture.

Level of Evidence This is a level IV, therapeutic, retrospective study.

Keywords
- radial head
- capitellum
- concomitant
- fracture

Introduction

Radial head fractures are among the most common fractures of the adult elbow and can occur with a variety of associated injuries.[1–3] In general, radial head fractures are caused by axial force transmission to the extended elbow with the forearm in pronation.[1,2] This can also lead to radial head compression against the capitellum, which can result in a concomitant capitellum fracture.[2,4] A radial head fracture with a concomitant capitellum fracture—representing the form of a mouth on a radiograph—is a rare event.[4]

Concomitant capitellum fractures are often not diagnosed, and when this happens, the missed capitellum fracture can lead to complications, such as avascular necrosis (AVN), loss of elbow function, malunion, and nonunion.[5–8]

A few prior studies have reported on this combination of injuries.[4,9] However, these studies were relatively small case series, and therefore, it remains uncertain if the type of radial head fracture is associated with the presence of a concomitant capitellum fracture. Therefore, we used a large database of five hospitals to investigate if the type of radial head fracture is associated with capitellum fracture.

Patients and Methods

Study Design and Participants

Institutional Review Board approved this retrospective study. We identified adult patients who were diagnosed with a radial head fracture in five area hospitals between January 2002 and January 2013 with the International Classification of Diseases, 9th edition (ICD-9) codes (codes: 813.05, 813.15) using the institutions' Research Patient Data Registry (RPDR) database. Medical records, demographics, and operative and radiology reports of patients with these ICD-9 codes were retrieved

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through the institutional RPDR. The first two hospitals are level I trauma centers, the third is a community hospital tied to a level I trauma center, and the latter two hospitals are community hospitals. In total, we identified 4,306 patients with ICD-9 codes for radial head fracture. We text searched with Stata 13 (StataCorp LP, College Station, Texas, United States) in RPDR for different variations on capitellum fracture. After text search, we found 62 patients with a possible radial head fracture with a concomitant capitellum fracture.

The radiographs of those 62 patients were reviewed for a radial head fracture with a concomitant capitellum fracture. We excluded 52 patients based on the following exclusion criteria: patients who had no concomitant capitellum fracture, patients who had surgery but had no operative reports, and patients who had a trochlea or olecranon fracture. In total, we included 10 patients in our study. The radiographs were assessed by a research fellow and checked by an orthopedic surgeon specialized in hand and upper extremity surgery.

Outcome Measures and Explanatory Variables

We evaluated the demographic and fracture characteristics from the medical records including age at the time of operative treatment, sex, race, type of capitellum fracture, type of radial head fracture, and side of injury. The surgeon who performed the surgery assessed the patients clinically postoperatively. The range of motion and possible adverse events were assessed. The range of flexion, extension, pronation, and supination at the latest follow-up were evaluated. The radial head fractures were classified according to the Hotchkiss modification of the Mason classification consisting of type I: nondisplaced or mildly displaced fractures of the radial head or neck, type II: displaced (> 2 mm) fractures of the head or neck (angulated), and type III: severely comminuted fracture of the radial head and neck.[9] Capitellum fractures were graded according to the classification of Grantham et al,[7] which consisted of grade I when a thin osteochondral portion is fractured, grade II when a larger capitellum fragment displaces anterosuperiorly, and grade III when the capitellar fragment is comminuted.

Results

A total of 10 patients with a radial head fracture and a concomitant capitellum fracture were included in this study (0.2% of radial head fractures). These 10 patients were operated on by three different surgeons, who each took care of five, four, and one patients, respectively.

The mean age of the patients was 35 years (range: 19–51 years) at the time of injury (►**Table 1**). Of the 10 patients included, 6 were male and 4 were female.

The mechanism of injury in all patients was falling on an outstretched arm. In six patients, the left elbow was affected. Based on the operative reports and radiographs, the data were assessed by a research fellow and checked by an orthopedic surgeon specialized in hand and upper extremity surgery. They then classified nine radial head fractures as type II and one as type I. Furthermore, three capitellum fractures were graded as type I, and seven were graded as type II (►**Figs. 1** and **2**). Besides the radial head fracture with a concomitant capitellum fracture, three of these patients sustained an extra-articular lateral column distal humerus fracture as well. No additional description of bony and/or ligamentous injuries diagnosed intraoperatively was documented in the operative notes.

All 10 patients had surgical repair. Eight patients had open reduction and screw fixation alone, one patient had a capitellar screw fixation combined with excision of the radial head fragment, and one patient had both fracture fragments excised. Devices used for fixation included K-wires, Herbert screws (Zimmer Biomet Inc., Warsaw, Indiana, United States), minifragment screws, and headed or headless cannulated screws.

Preoperative radiographs were available in seven patients. All preoperative radiographs were performed in our included hospitals. In five of those seven patients (71%), complete loss of cortical contact of the radial head fragment was seen (►**Table 1**). In three patients, fracture classification was determined by operative reports and postoperative radiographs because no preoperative radiographs were available.

The mean follow-up was 9 months (range: 2–22 months). Due to the varying times of follow-up appointments, we were unable to conclusively demonstrate or identify a time to fracture union. Postoperative range of motion could be assessed in 8 out of 10 patients. The average arc of flexion–extension was 128 degrees (range: 110–135 degrees). A flexion contracture was found in three patients (mean: 17 degrees, range: 10–20 degrees). The range of supination–pronation was almost full in comparison to the contralateral side in all patients. No patients required any subsequent procedures. All fractures healed uneventfully. Due to the retrospective nature of our study, we were unable to apply any scoring systems or outcomes tools to our outcome data.

Discussion

Fractures of the radial head usually occur because of an axial load transmitted through the radiocapitellar joint that accepts 60% of load transfers across the elbow.[10–13] The greater the force being exerted on the radial head, the more likely the capitellum is to be damaged.[10] Treatment of radial head fracture can be complicated if a concomitant capitellum fracture occurs. The capitellum is at risk for impinging on the radial head, and a missed capitellum fracture can lead to AVN, elbow instability, elbow stiffness, degenerative changes, chronic pain, malunion, and nonunion.[5–8,14] Therefore, operative restoration of the radiocapitellar surface and the lateral column buttress is essential to optimize outcomes.[4,15–18]

Caputo et al described that Mason type II radial head fractures are most commonly associated with capitellum cartilage injuries.[19] Nalbantoglu et al reported that more severe radial head fractures increase the risk of capitellum cartilage injury.[4] Since both studies were relatively small case series, it remains uncertain if the type of radial head fracture is associated with the presence of a concomitant capitellum fracture. In our retrospective study of 10 patients with radial head fractures and a concomitant capitellum fracture, 9 radial head fractures were classified as type II of Hotchkiss modification of the Mason classification, and 1 was classified

Table 1 Details of patients and their injuries

Case no	Age	Sex	Side injury	Type of radial head fracture[a]	Type of capitellum fracture[b]	Complete loss of cortical contact radial head fragment	Treatment	Type and number of screws capitellum	Type and number of screws radial head	Follow-up (mo)	Arc of motion	E/F	Pro/sup
1	40	F	L	II	II	Yes	Excision radial head fragment and screw fixation	3 headless	–	2	120	20–140	85/85
2	37	F	L	I	I	Yes	Excision radial head and capitellum	–	–	–	–	–	–
3	25	F	R	II	II	Yes	Screw fixation	2 headed	1 headless	6	135	0–135	90/86
4	36	M	R	II	II	No	Screw fixation	2 Herbert	1 Herbert	4	135	0–135	90/90
5	51	M	L	II	II		Screw fixation	2 Herbert	2 headed	2	–	–	–
6	34	M	L	II	II		Screw fixation	2 Herbert	2 headed	22	130	0–130	90/90
7	26	M	R	II	II		Screw fixation	2 headless	1 headless	2	135	0–135	90/90
8	43	F	R	II	I	No	Screw fixation	2 headless	2 headless	8	110	30–140	90/90
9	19	M	L	II	II	Yes	Screw fixation	2 headless	1 headless	11	120	10–130	90/90
10	36	M	L	II	I	Yes	Screw fixation	1 headed	2 headed	11	115	20–135	90/80

Abbreviations: E/F, extension and flexion; Pro/Sup, pronation and supination.
[a]Hotchkiss modification of the Mason classification.
[b]Grantham classification.

Fig. 1 (**A** and **B**) Anteroposterior and lateral views of the elbow showing type II radial head fracture with concomitant type I capitellum fracture.

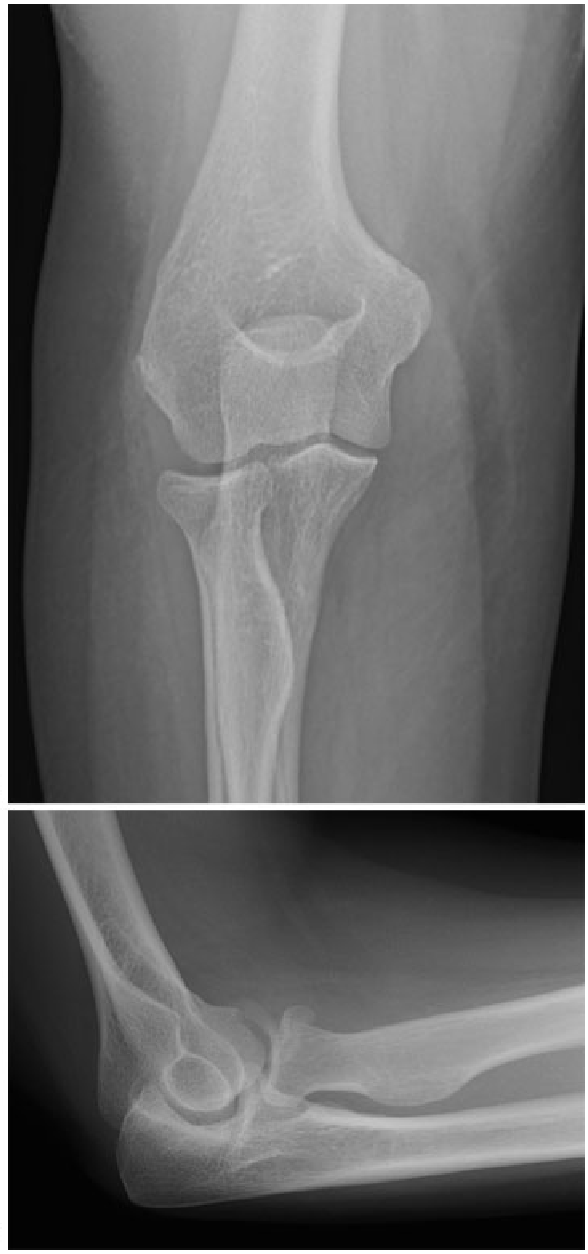

Fig. 2 (**A** and **B**) Anteroposterior and lateral views of the elbow showing type II radial head fracture with concomitant type II capitellum fracture.

as type I. Based on the available radiographs, three capitellum fractures were type I, and seven were type II according to the Grantham classification. The occurrence of a Mason type II radial head fracture in the present study, along with a concomitant capitellum fracture is consistent with earlier studies.[4,19,20] However, we do recognize that unlike prior studies, we did not have any patients with a type III radial head fracture (►**Table 2**).

Diagnostic challenges include the small size of the fracture fragments as well as overlapping of the radial head and capitellum fracture in plain radiographs. To avoid a missed diagnosis and to facilitate precise preoperative planning, in patients with suspected radial head fractures with a concomitant capitellum fracture, computed tomography (CT) scans of the affected elbow could be helpful (►**Fig. 3A, B**). A radial head fracture with a concomitant capitellum fracture represents the form of a mouth on a radiograph. Therefore, we propose to call this a "kissing lesion."

Some investigators showed that among Mason type II fractures, a complete loss of cortical contact of any fragment from the rest of the radial head is strongly predictive of an associated elbow fracture. Our study findings are aligned with this suggestion in that complete loss of cortical contact of the radial head fragment was found in 7 out of 10 preoperative radiographs in our study.[21]

In one patient, in our study, the anterior quadrant of the radial head was removed, but the remainder of the radial head stayed intact and the elbow was stable. Excision of radial head fragments should be avoided in unstable elbows[22] when the surface of the radial head fragments is greater than 25%

Table 2 Studies presenting the kissing lesion

Author	Year	Number of patients	Mean age (y)	Follow-up (mo)	Treatment of capitellum	Treatment of radial head	Pain free	Flexion	Extension	Pronation	Supination
Ward and Nunley	1988	7	31	29.4	3 ORIF, 4 excision	2 ORIF, 4 head excision, 1 conservative	6	137	(− 15)	87	84
Nalbantoglu et al	2008	10	33	No Follow-up	2 ORIF, 8 excision	10 ORIF	–	–	–	–	–
Caputo et al	2006	10	33	11	10 excision	10 ORIF	10	142	(− 5)	78	80
Our study	2016	10	35	9	9 ORIF, 1 excision	8 ORIF, 2 excision	–	Arc 128		Full	Full

Abbreviation: ORIF, open reduction internal fixation.

because of the risk of painful clicking or symptomatic elbow instability.[23–25] Moreover, higher stress at the ulnotrochlear articulation after radial head excision leads to secondary arthritis in the majority of the patients.[23]

The strength of this study is the relatively large cohort compared with earlier studies. However, we do recognize that this study should be interpreted in light of several limitations. First, because of the retrospective nature of this study, some data are missing. All fractures healed uneventfully after follow-up; however, only five patients had a follow-up of 6 months or longer. We can speculate that the included kissing lesion patients did not have adverse events because they declined follow-up and they were still visiting patients in our hospital system. Second, we did not find lateral and medial collateral ligament injuries in our cohort while ligament injuries would be expected in some of the patients. We could not report on ligament injuries because no medial exposure was performed and no special modalities to diagnose ligament injuries were used. Third, we used ICD-9 codes to identify the initial diagnoses, which can be subject to miscoding. Finally, previous studies used Mason's classification for radial head fractures, while we used the Hotchkiss modification of the Mason classification instead.[4,19,20]

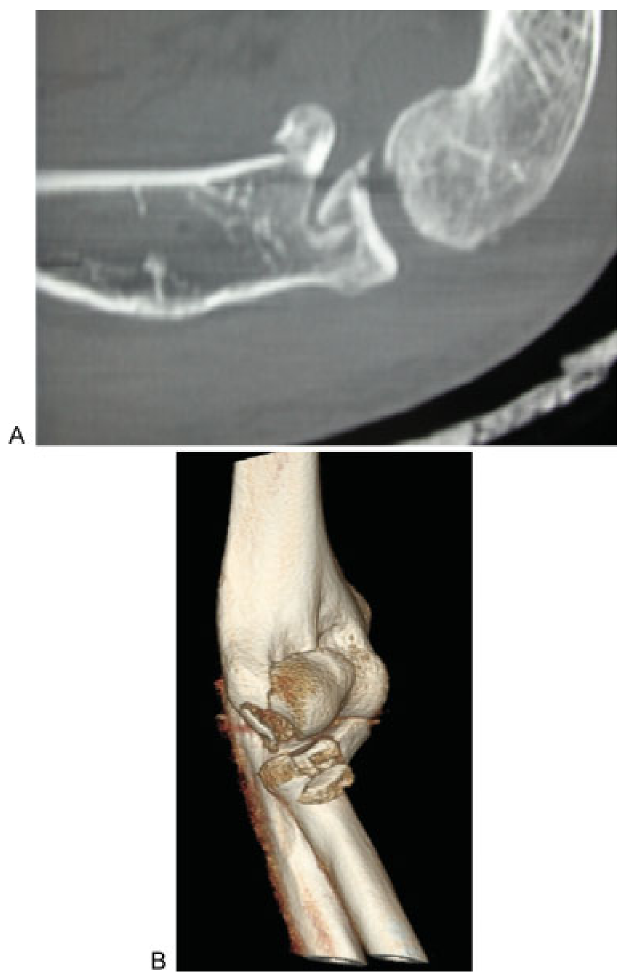

Fig. 3 (A and B) CT scan examples of concomitant fractures of the radial head and capitellum. (A) The capitellar fracture fragment is trapped within the radial head fracture, and (B) shows a 3D CT with fractures of the radial head, capitellum, and lateral column. CT, computed tomography; 3D, three-dimensional.

Based on our data, it appears that the management strategy suggested later could be considered by the treating surgeon. This is by no means an algorithm but constitutes our current management approach to these injuries. When a patient presents with a displaced radial head fracture (type II or type III), we routinely obtain a CT scan of the elbow with three-dimensional reconstruction. Specifically, we look for concomitant fractures of the capitellum and lateral column. Radial head fractures are treated with internal fixation (if three fragments or less) or replacement (if four fragments or more). Fractures of the capitellum are treated with internal fixation (types I and II) or excision (type III). Lateral column fractures are fixed internally with a buttress plate of the surgeons' choice.

Conclusion

In conclusion, 9 out of 10 patients had a Hotchkiss type II radial head fracture and a concomitant capitellum fracture was found in 0.2% of the radial head fractures. It appears that type II radial head fractures are more likely to be associated with a concomitant capitellar fragment. Although kissing lesions are rare, it is important for surgeons to recognize this injury pattern in the initial assessment and treatment. However, since we did not have any type III radial head fractures, the possibly increased concurrence of capitellum fractures in type III radial head fractures, while intuitive, still remains speculative.

Note
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