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## From radial head to radiocapitellar to total elbow replacement: A case report

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## ABSTRACT

**INTRODUCTION:** Radiocapitellar arthroplasty represents a possible treatment option for isolated osteoarthritis of the radial column. We report the first case of early failure of this procedure.**PRESENTATION OF CASE:** We present the case of a 41-year old male who sustained a terrible triad injury to his right elbow and subsequently underwent radial head arthroplasty. Due to overstuffing of the radial head prosthesis, capitellar erosion occurred and radiocapitellar arthroplasty was thus performed. Only one year later, conversion of the radiocapitellar replacement to total elbow arthroplasty was required as a result of progressive ulnohumeral osteoarthritis.**DISCUSSION:** According to the currently limited clinical data, radiocapitellar arthroplasty provides satisfactory results. However, biomechanical analysis shows that available prostheses do not sufficiently reproduce the radiocapitellar anatomy. The design of the prosthesis might thus have contributed to the rapid progression of ulnohumeral erosion following radiocapitellar arthroplasty although the poor outcome may also be attributed to the trauma itself along with the inadequate initial treatment.**CONCLUSIONS:** The indication for radiocapitellar arthroplasty warrants careful consideration given the results of biomechanical analysis and the early failure due to progressive ulnohumeral erosion seen in the present case.© 2015 The Authors. Published by Elsevier Ltd. on behalf of Surgical Associates Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

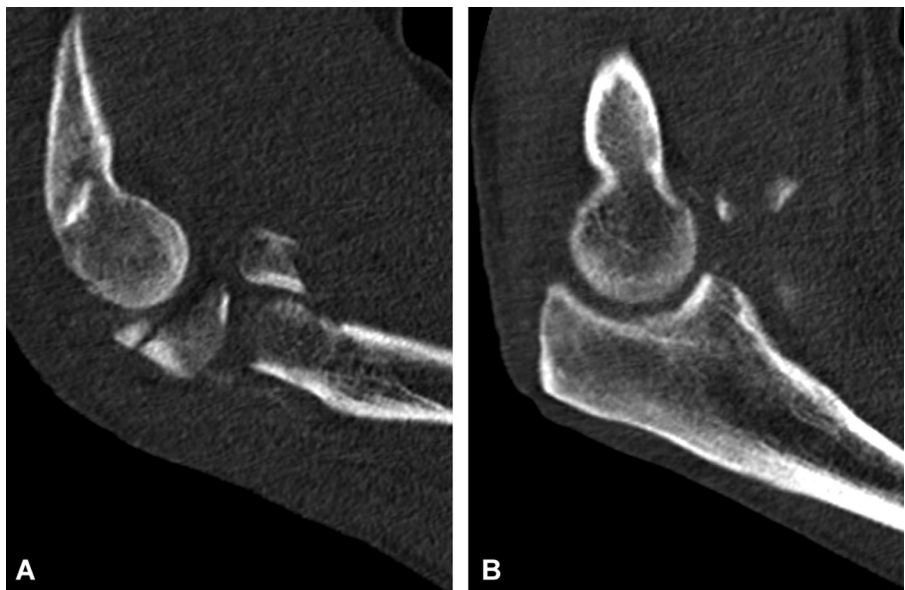
Unicompartmental elbow arthroplasty represents a potential treatment option for posttraumatic osteoarthritis of the radial column and for acute fractures – especially of the radial head – not amenable to open reduction and internal fixation (ORIF). Isolated radial head arthroplasty offers promising mid- to long-term results [1,2], but little is known about the outcome of radiocapitellar replacement. While the limited amount of clinical data indicates good short-term results [3–6], we describe – to our knowledge – the first case of early failure of radiocapitellar arthroplasty. Thereby, we would like to raise awareness for this possible complication.

## 2. Presentation of case

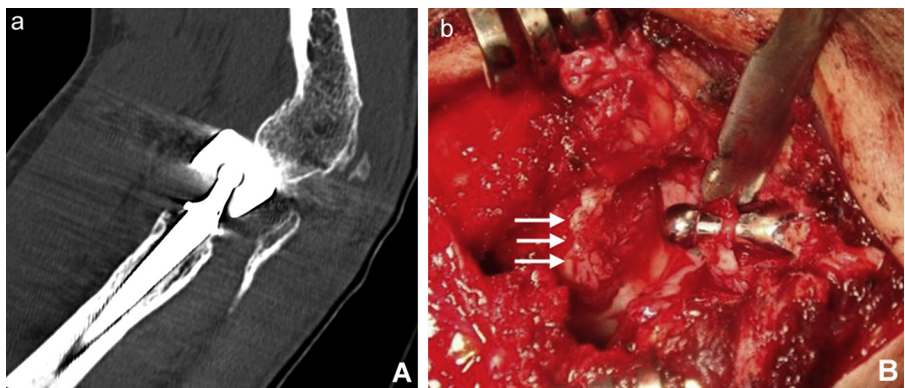
A 41-year old, male patient fell from a ladder on the outstretched and pronated right arm with his wrist in dorsiflexion. He immediately felt severe pain in his right elbow and was taken to a nearby hospital. Plain radiography and a subsequently performed computer tomography (CT) scan revealed a terrible triad injury with posterior dislocation of the elbow joint, a severely comminuted radial head fracture and a coronoid tip fracture, type I according to Regan and Morrey [7] (Fig. 1). As a result, the patient had to undergo surgery for replacement of the radial head because ORIF was not feasible. Additionally, re-fixation of the coronoid tip along with the ventral capsule was performed using suture anchors.

10 months later, the patient was referred to another surgeon (BH) due to persisting painfully restricted range of motion of the right elbow joint. Flexion was limited to 100° and an extension deficit of 30° was present. Moreover, the patient reported ulnar nerve paresthesia. Plain radiography and a CT scan revealed overstuffing of the radial head arthroplasty which led to erosion of the capitellar cartilage (Fig. 2). Hence, revision surgery was performed

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**Fig. 1.** CT scan following closed reduction. A: Sagittal view through the radiocapitellar joint revealing a comminuted, displaced radial head fracture. B: sagittal view through the ulnohumeral joint showing a coronoid tip fracture, type I according to Regan and Morrey [7].

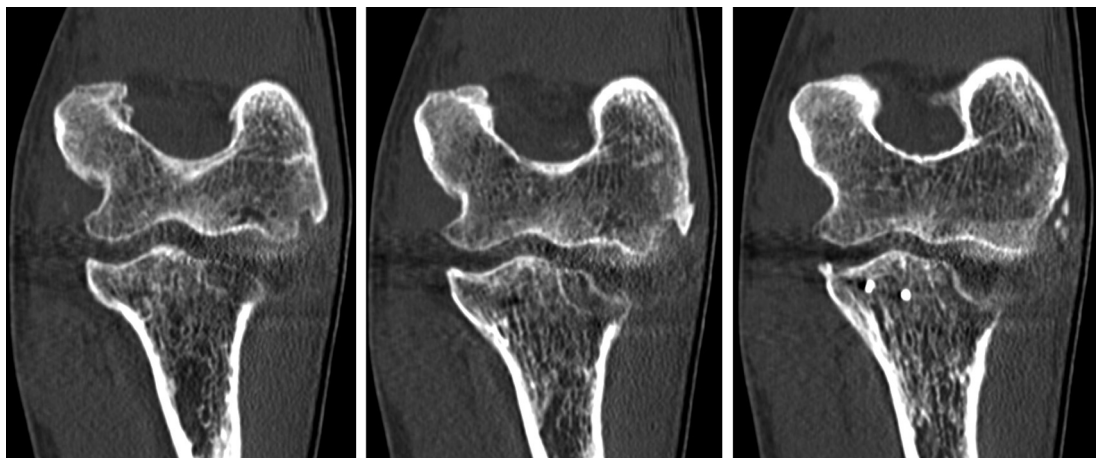


**Fig. 2.** Overstuffing of radial head replacement. A: CT scan in sagittal view 10 months postoperatively revealing overstuffing with capitellar erosion. B: intraoperative view through a lateral Kocher approach. The head of the bipolar prosthesis has been removed to show the damage of the capitellar cartilage (arrows).

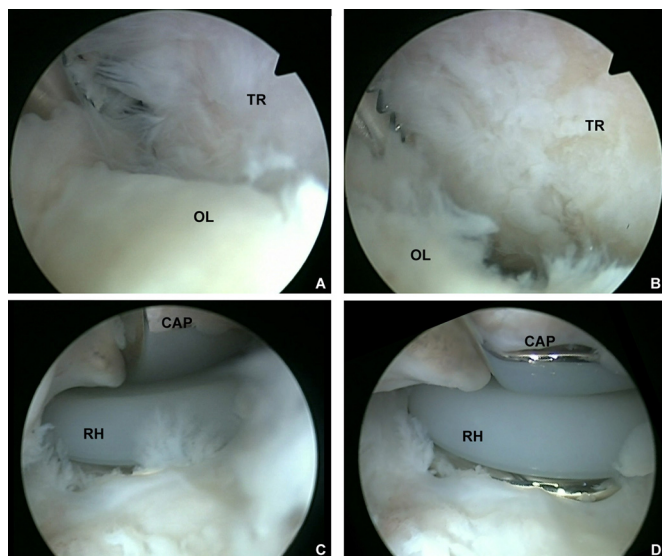
with open arthrolysis, replacement of the radial head prosthesis and anterior transposition of the ulnar nerve. Pronounced medial instability was observed intraoperatively and therefore a hinged external fixator was used for six weeks. Nonetheless, medial insta-

bility persisted and ulnar collateral ligament reconstruction with a gracilis tendon autograft had to be performed five months later.

Initially, the patient's symptoms were greatly alleviated following revision radial head arthroplasty. However, progressive



**Fig. 3.** Preoperative CT scan prior to radiocapitellar arthroplasty. Congruent ulnohumeral joint space without signs of significant osteoarthritis.



**Fig. 4.** Intraoperative view during diagnostic arthroscopy showing progressive osteoarthritis of the ulnar column. A: through a mid-triceps portal the olecranon tip (OL) and dorsal part of the trochlea (TR) can be visualized. B: with an arthroscopic shaver the olecranon tip (OL) is pulled back to expose the severely damaged trochlear cartilage. C/D: dorsal view of the correctly implanted radiocapitellar replacement in flexion (C) and extension (D). RH = Radial head, CAP = Capitulum.

narrowing of the radiohumeral joint space due to capitellar erosion led to recurrence of the painfully restricted motion. Since significant osteoarthritis of the ulnar column was not present (Fig. 3), radiocapitellar arthroplasty was performed three years after the initial trauma (surgeon: SL). Postoperatively, the patient's pain level dropped significantly but – again – recurred only a few months after.

Diagnostic elbow arthroscopy one year after radiocapitellar arthroplasty revealed now severe osteoarthritis of the ulnohumeral joint (Fig. 4). As a consequence, total elbow replacement was performed (surgeons: LPM, KJB). The postoperative course was uneventful. The patient had good range of motion with flexion of 120° and no significant extension lag. He was satisfied with the result of the surgery as he was free of pain at rest for the first time since the accident (Fig. 5).

This work is reported according to the CARE criteria [8].

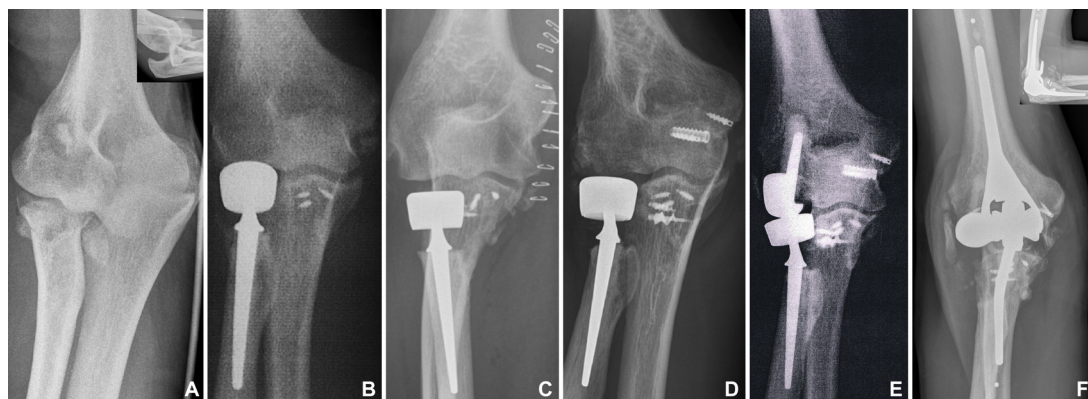
### 3. Discussion

With an incidence of 2.5 of 100.000 per year [9], radial head fractures represent a common pathology and comprise about one third of all elbow fractures in adults [10]. Since relevant concomitant soft tissue trauma occurs in up to 90% of cases, radial head fractures have to be considered as complex osteoligamentous injuries [11]. Reconstruction of the radial column is therefore crucial in order to restore joint congruity and stability [12,13]. In case of a severely comminuted fracture of the radial head, osteosynthesis might not be feasible and radial head arthroplasty has to be performed instead providing comparable clinical results [1,2,14].

Precise restoration of radial length is challenging [15], yet highly important to achieve the best possible clinical outcome when performing radial head arthroplasty. Van Glabbeek et al. found that over- or underlengthening of the radial head of 2.5 mm or more significantly alters elbow joint kinematics [13]. In particular, they reported that radial overlengthening increases the radiohumeral as well as the ulnohumeral joint pressure and decreases the varus-valgus-laxity of the elbow joint [12]. The present case stresses the crucial importance of accurate positioning of a radial head replacement. Initial overlengthening of the radial head prosthesis increased the radiocapitellar contact pressure and most likely caused the capitellar erosion seen in this patient (Fig. 2). To which extent the initial trauma caused damage to the capitellar cartilage cannot be evaluated retrospectively but according to a study by Nalbantoglu et al. severe capitellar cartilage lesions occur more frequently in low-grade radial head fractures while comminuted fractures only lead to limited chondral damage [16]. The results of their study correspond well to our theory that the initially overstuffed radial head prosthesis was the main cause of the capitellar erosion in this patient. Even though revision radial head arthroplasty was performed 10 months later, capitellar osteoarthritis progressed nonetheless—leading to the recurrence of the patient's symptoms.

Going forward, treatment options became severely limited. Total elbow arthroplasty was not considered at this stage given the high activity level of the rather young patient and because of the fact that the ulnohumeral joint did not show signs of significant osteoarthritis (Fig. 3). In our case of additional extensive collateral ligament injury, we believe that radial head excision was also not indicated and would have led to a poor result by dramatically increasing joint instability [12,13,17]—although Karlsson et al. reported good long-term results after this procedure [18].

Interposition arthroplasty of the anconeus could have been performed as a salvage procedure at this stage. Baghdadi et al. reported satisfactory long-term results of 29 patients [19]. After a mean follow-up of 10 years, the Mayo Elbow Performance Score aver-



**Fig. 5.** Chronological sequence. A: radiographs immediately following trauma revealing a terrible triad injury. B: initial overstuffing of the radial head replacement. C: revision and correct placement of the radial head replacement (10 months following trauma). D: progressive capitellar erosion with narrowing of the radiocapitellar joint space (17 months following trauma), E: radiocapitellar replacement (36 months following trauma), F: total elbow replacement (48 months following trauma).



aged 82 points. Yet about ¼ of their patients (24%) had to undergo additional surgery [19].

Aside from anconeous interposition arthroplasty, radiocapitellar replacement represented a possible salvage procedure in this case. So far, clinical results of radiocapitellar arthroplasty seem promising even though long-term results are missing [3–6]. Thus far, Giannicola et al. reported the largest case series of 20 patients. After a mean of 22.6 months, the Mayo Elbow Performance Score averaged 85 points [6]. At the time of the latest follow-up, none of the implants had to be revised but three revision surgeries (15%) had taken place as a result of elbow stiffness [6]. Similarly, Hejink et al. reported an implant survival rate of 100% in their case series of six patients [4]. At a mean follow-up of 50 months, the Mayo Elbow Performance Score averaged 92.5 points [4]. Unlike these cases, degeneration of the ulnohumeral articulation progressed rapidly after radiocapitellar replacement in our patient—which raises the question whether this circumstance might be partly contributed to the prosthesis itself.

Biomechanical analysis regarding radiocapitellar arthroplasty shows that available capitellar prostheses do not sufficiently reproduce the anatomy of the capitulum and the radiocapitellar joint [20]. This leads to a decrease in contact area and causes accelerated surface wear [20]. Moreover, the morphology of the capitulum provides significant variability making it difficult to predict which type of implant is suitable for each respective case [21].

The progression of ulnohumeral erosion following radiocapitellar arthroplasty in this case might be partly related to the prosthesis design. However, the prosthesis itself did not show signs of surface wear when conversion to total elbow arthroplasty was performed. Moreover, the trauma itself along with the initial overstuffing of the radial head replacement and the neglected ligamentous instability may have largely contributed to the patient's outcome.

#### 4. Conclusion

This case report shows that accurate placement of the prosthesis is crucial in radial head arthroplasty. Failure to do so may lead to non-salvageable disability despite adequate revision surgery.

Radiocapitellar arthroplasty represents a salvage procedure for unicompartmental osteoarthritis of the elbow joint. According to the limited amount of clinical data available thus far, this procedure provides satisfactory results. However, indication for radiocapitellar replacement warrants careful consideration given the results of biomechanical analyses and given the early failure due to progressive ulnohumeral erosion seen in the present case. Further investigation will be necessary to evaluate the clinical results of radiocapitellar arthroplasty.

#### Consent

Patient's informed consent has been obtained to publish this report.

#### Ethical approval

N/A

#### Conflict of interest

The authors declare that they have no conflict of interest.

#### Guarantor

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