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Clinical Faceoff

Clinical Faceoff: Slightly Displaced, Isolated, Partial Articular Fracture of the Radial Head

David C. Ring MD, PhD, Neal C. Chen MD, George S. Athwal MD

Fractures of the radial head are common. The vast majority either are isolated injuries (meaning no other fractures or ligament injuries) that cannot be seen on radiographs (occult), nondisplaced, or are displaced less than 2 millimeters. Most fractures displaced more than a few millimeters are associated with other fractures or ligament injuries. Once it is determined that the fracture is stable and isolated, the focus of treatment becomes retaining elbow range of motion. It can be counterintuitive to stretch an injured joint, but the average patient achieves normal or near-normal motion during stretching—some more quickly than others.

Fractures with 2 mm or 3 mm articular step-off at worst on radiographs are considered for surgery. Fracture displacement might block forearm rotation, but radiocapitellar and proximal radioulnar arthrosis only rarely occur following these injuries. When forearm motion is limited, it is usually related to pain and protectiveness. Confident stretching typically restores motion, and true bony blocking of ROM is uncommon in patients with nondisplaced or minimally displaced fractures. If forearm motion seems blocked, the first step is to wait a few days to allow the intra-articular pain and hematoma to dissipate. If the possibility of a bony block persists a week after the injury, injecting anesthetic into the joint can usually rule it out.

It is not clear what to do if a patient has full motion but also has crepitation. Nonunions are an occasional incidental finding; in 16 years of practice I have only seen it when we recalled patients for research purposes. There is general agreement that the vast majority of people with slightly displaced fractures do not benefit from surgery, but the occasional patient with crepitation or a bony block to motion leaves us wondering where to draw the line.

I asked George S. Athwal MD from the Hand and Upper Limb Centre at the University of Western Ontario and Neal C. Chen MD, Interim Chief of the Hand and Upper Extremity Service at Massachusetts General Hospital to debate these issues. If experts like these cannot agree on a clear path forward, then we should use decision aids and help patients discover their

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D. C. Ring MD, PhD (✉)
Department of Surgery and Perioperative Care, Dell Medical School, The University of Texas at Austin, 1400 Barbara Jordan Blvd., Suite 2.834; MC: R1800, Austin, TX 78723, USA
e-mail: david.ring@austin.utexas.edu

N. C. Chen MD
Department of Orthopaedic Surgery, Massachusetts General Hospital, Boston, MA, USA

G. S. Athwal MD
Hand and Upper Limb Centre, University of Western Ontario, London, ON, Canada

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treatment preferences based on their values.

David C. Ring MD, PhD: *The long-term outcomes of stable, slightly (2 mm to 3 mm articular step off at worst on radiographs) displaced partial articular fractures of the radial head with no associated fractures or dislocation are quite good. How can we be sure that surgery provides a benefit that outweighs the risks, discomforts, and inconveniences?*

George S. Athwal MD: First off, the words "stable" and "slightly displaced" need to be defined objectively. In an ideal world with limitless resources, the best way to scientifically ensure that surgery provides a substantial clinical benefit is with a large multicenter randomized controlled trial. Unfortunately, a study of this design would demand substantial resources and require long-term followup. For such a study, a return on investment analysis would have to be done to determine if there is a net benefit to society over time. For example, a randomized controlled trial may cost USD 5 million to conduct. However, the net benefit to society could be a 50x return on investment, which would indicate a study of high societal value. Based on my assessment of the current and historical evidence, I believe, at best, surgery would demonstrate equivalence. It would be highly unlikely that surgery would be substantially better.

Neal Chen MD: In an ideal situation, where we can define the problem perfectly, run the perfect randomized controlled trial with large numbers, get the perfect outcome measures, and demonstrate a statistical difference between surgery and no surgery, would the difference in the means be clinically meaningful? Perhaps not. But I worry about the outlier—the occasional patient with uncomfortable grinding or catching with forearm rotation. I worry about the patient who may have benefitted from open reduction and internal fixation.

In the end, one cannot be sure that the benefits of surgery will outweigh the risks. Still, given the low rate of adverse events with operative treatment—it is reasonable for patients with slightly displaced isolated radial head fractures to consider surgery. It may be relatively appealing for people who place extreme demands on their arm—an acrobat for example.

Dr. Ring: *Do operative techniques matter? Is surgery only the best choice with a certain technique? Do all orthopaedic surgeons have the expertise to perform open reduction and internal fixation of a stable partial articular fracture of the radial head or is this best reserved for specialists?*

Dr. Athwal: Operative techniques do matter. To obtain ideal outcomes, surgeons and techniques should respect the unique anatomy of the radial head, the "safe zone" of fixation, and understand the proximity of the posterior interosseous nerve and the lateral collateral ligament. Additionally, fixation techniques that use lower profile implants are better suited to the tolerances of the adjacent soft tissues. For example, countersunk screws would be better than proud screws, and if amenable, angled head-neck screws would be better than plates.

I suspect that orthopaedic surgeons, upon graduation from residency, have the expertise to perform open reduction and internal fixation of displaced radial head fractures. However, over time, surgeons specialize and develop comfort zones. As such, for any surgical procedure, surgeons must evaluate their training, experience, and available resources to decide if a given procedure is one they can perform reliably. Simple two-part fractures without associated fractures of the coronoid and the lateral collateral ligament are more straightforward than multifragmented radial head fractures in the setting of complex instability. Surgeons should make a careful assessment of the injury and decide if they have the requisite skills and

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resources to fix the fracture or whether surgery would be better executed by a subspecialty orthopaedic surgeon with an interest in these injuries.

Dr. Chen: As Dr. Athwal noted, if the fundamental principles are respected, the technical elements of this surgery can be performed by most orthopaedic surgeons. Adequately informing patients so that they do not choose a treatment option based on misconceptions is the most difficult part of treatment. In addition, while elbow fracture-dislocations are obvious, but forearm interosseous ligament injuries (Essex-Lopresti lesion) can be subtle and may initially go unrecognized.

The keys to safe and effective internal fixation are preservation of the lateral collateral ligament, adequate reduction, and stable fixation that does not interfere with the proximal radioulnar joint.

Dr. Ring: *What type of data would you need to be confident in routinely offering operative or nonoperative treatment for a stable partial articular fracture of the radial head? In the absence of such data, how do you decide on treatment?*

Dr. Athwal: Presently, I am satisfied with the retrospective data available supporting nonoperative management for stable partial articular fractures of the radial head. For me to change my opinion and offer surgery, I would have to see compelling Level 1 evidence supporting open reduction and internal fixation. As such data do not exist, presently I offer nonoperative management to patients with stable partial articular fractures of the radial head without a block to motion, instability or mechanical symptoms (such as joint clicking or catching).

Dr. Chen: In vivo kinematic data might identify fractures that meaningfully alter the congruity of stability of the elbow (the moves during elbow motion or in which the elbow moves abnormally. This data would give us insight into understanding who is an outlier from the mean, and more importantly, why a patient is an outlier). Currently, I do as Dr. Athwal and try to determine if the fracture is causing crepitation or blocking motion (beyond pain or stiffness). I have encountered such fractures five times in 8 years of practice.

Patients whose occupation or avocation places high demands on the arm and are comfortable with surgery might err towards restoring anatomy with internal fixation. I make inferences about the mechanics of the injured elbow based on the radiographs and exam findings (catching or crepitation), evaluate the demands placed on the elbow, and share treatment decisions with the patient. The tricky part is that leaving things out of place and unrepaired can be quite counterintuitive, even when the prognosis is good. It is important to be sure that decisions are not based on misconceptions.

Dr. Ring: *Advocates of operative treatment of a stable, slightly displaced (2 mm to 3 mm step, no gap) partial articular fracture of the radial head are concerned that some people will have painful crepitation or radiocapitellar arthrosis. Are these valid concerns?*

Dr. Chen: Among the small percentage of patients with crepitus, some may be transient due to soft tissue or perhaps clotted blood and some due to articular incongruity. It is safe to assume that the crepitation due to articular incongruity will lead to radiocapitellar arthrosis. On the other hand, while fractures of the radial head are common, it is unusual to meet someone with painful radiocarpal arthrosis.

The larger issue is whether the cumulative incidence of, and disability arising from, complications as a result of operative intervention in the selected injury population is outweighed by the incidence of and disability resulting from residual crepitation if these injuries are treated nonoperatively. In the absence of better evidence, physicians should be cautious not to overstate the residual disability that may arise from these injuries or understate the risks of surgery.

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Dr. Athwal: I agree with Dr Chen's response as it pertains to posttraumatic radiocapitellar arthrosis. Most patients with radial head fractures are discharged from care at 4 weeks to 8 weeks postinjury. Based a few long-term studies, the majority of the posttraumatic arthrosis is in the ulnohumeral joint with radiocapitellar arthrosis being relatively unusual. When present, radiographic radiocapitellar arthrosis seems to cause few if any symptoms. When one encounters a patient with notable radiocapitellar arthrosis after radial head fracture, it is not clear that the arthrosis is directly related to residual displacement. Radiocapitellar arthrosis after radial head fracture may be related more to chondral damage to the capitellum at the time of injury. As such, we cannot conclude at this time that surgery for displaced articular fractures of the radial head improves the health of the elbow cartilage in the long-term. I only offer surgery in the uncommon scenario where a radial head fracture causes snapping or crepitation with forearm rotation that can be clearly attributed to the displaced fracture or an interposed osteochondral fragment.

Dr. Ring: *Patients and surgeons are influenced by the lack of good options once this fracture heals. In other words, because there is no good "bailout", it is wise to err towards surgery within the first two weeks after injury? Do you agree with this line of thinking?*

Dr. Chen: There is a moral hazard in using this argument: Fear or uncertainty about the future can be manipulated to drive a patient's decision-making. It is commonly argued that this situation is analogous to an appendectomy, where surgery is recommended more frequently than necessary to avoid a "missed" appendicitis. A ruptured appendix might result in severe infection and death; whereas a "missed" radial head fracture is much less morbid in comparison. However, if surgery is chosen it is preferable to operate within 2 weeks because the fracture is easier to mobilize

Dr. Athwal: I disagree with this line of thinking, as I believe several reliable options exist to address malunion or nonunion many months after injury. Potential "bailouts" for management of a symptomatic nonunion or malunion after radial head fracture include radial head resection with or without prosthetic arthroplasty or osteotomy of a malunited radial head fracture fragment. As such, I reassure my patients that most will do well with nonoperative management, and in the unlikely event of persistent symptoms, surgery might be an option.

Dr. Ring: *A patient who presents with an acute fracture of the radial head may feel "broken" and in need of repair. The pain, swelling, and bruising reinforce the sense that the arm may not be dependable without surgery. How to you help patients balance this sense that repair is necessary with the evidence that the arm usually works well without repair?*

Dr. Chen: I think immediate stretching exercises and frequent evaluation is helpful. Typically, I will see a patient 1 day to 2 days after injury and again the following week. If a patient sees that the pain is decreasing and the ROM is increasing, (s)he likely will feel more confident about his or her recovery. This improvement seems much more convincing to a patient than any academic discussion. In addition, the serial examination can help identify those patients who are experiencing a block to motion or severe crepitus who may benefit from operative intervention.

Dr. Athwal: I completely agree with Dr Chen's statement. People recovering from radial head fracture tend to experience a relatively quick return to function. This relatively rapid return of ROM and pain control reinforces that nonoperative management was the correct decision.