



E-ISSN: 2707-8353

P-ISSN: 2707-8345

IJCRO 2022; 4(1): 147-155

Received: 05-01-2022

Accepted: 10-03-2022

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Case report: Case of complex elbow injury in young lady

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DOI: <https://doi.org/10.22271/27078345.2022.v4.i1c.109>

Abstract

The radial head plays a critical role in the stability of the elbow joint and its range of motion. Injuries may occur across a spectrum of severity, ranging from low energy non-displaced fractures to high energy comminuted fractures. Multiple classification systems exist to help characterize radial head fractures and their associated injuries, as well as to guide treatment strategies. Depending on the type of fracture, non-operative management may be possible along with early range of motion is initiated. Other options include open reduction and internal fixation or excision followed by arthroplasty. A lateral approach is typically used for adequate surgical exposure. Controversy still remains regarding operative management of more severe fractures, but studies have shown good outcomes after radial head replacement for these fractures. We will review the current treatments available for radial head fractures, highlighting gaps in knowledge, as well as providing recommendations for the care of these injuries.

Keywords: Radial head fracture, radial head replacement, arthroplasty, internal fixation, elbow fracture

Introduction

Complex fracture dislocation of the elbow, most commonly termed terrible triad, involves radial head fracture, coronoid fracture and elbow dislocation with various degrees of ligamentous injuries. Late sequelae of improper management could be complicated with residual instability, development of traumatic arthrosis and joint stiffness^[1]. Since the first introduction by Speed in 1941^[2], radial head prosthesis have been widely adopted to replace the irreparable radial head fracture and to re-establish a stable elbow joint allowing ligamentous healing^[3, 4]. With evolution of implant design and technical refinement, short to mid-term functional results in radial head arthroplasty (RHA) are good to excellent. However, complication rates in the literature vary widely, with reoperation rates ranging from 0 to 45%^[5]. Late complications of RHA in terrible triad injuries including painful loosening, osteolysis, capitellar erosion and progressive ulno-humeral arthrosis are commonly described^[6, 7]. However, most articles have inadequate follow-up and underestimate the failure rate^[8]. Long-term outcome following RHA has yet to be further investigated. The aim of this study was therefore to evaluate the long-term outcomes of primary RHA through objective functional survey and self-reported questionnaires in patients of elbow fracture dislocation at a single institute. Complications and radiographic analyses at more than 6 years after surgery is reported and hypothesized to be correlated with objective functional outcomes.

Case report: A 26 years old female admitted with the complaints of pain and difficulty in right elbow following fall while walking (DOI:04/04/2016). She was diagnosed right elbow dislocation with radial head fracture. Initial management was done by closed reduction of right elbow dislocation followed by above elbow plaster of paris cast application for 2 weeks. There was no history of head or other injury associated with it and no known co-morbidities was there. After 2 weeks of post injury cast was removed. On examination there was a lateral bulge of displaced radial head seen/felt and range of motion was 45*-90* flexion and distal pulsation was felt with prompt capillary refill present. Check x-ray was done where displaced fracture right radial head noted and planned radial head replacement.



Dated: 29/4/2016 (Clinical examination after cast removal: ROM- 45* to 90*)



X-Ray: Standard Ap/Lat of Right elbow was done on the date of injury (DOI: 04/04/2016)



Post reduction x-ray was done which shows displaced radial head fracture

Discussion

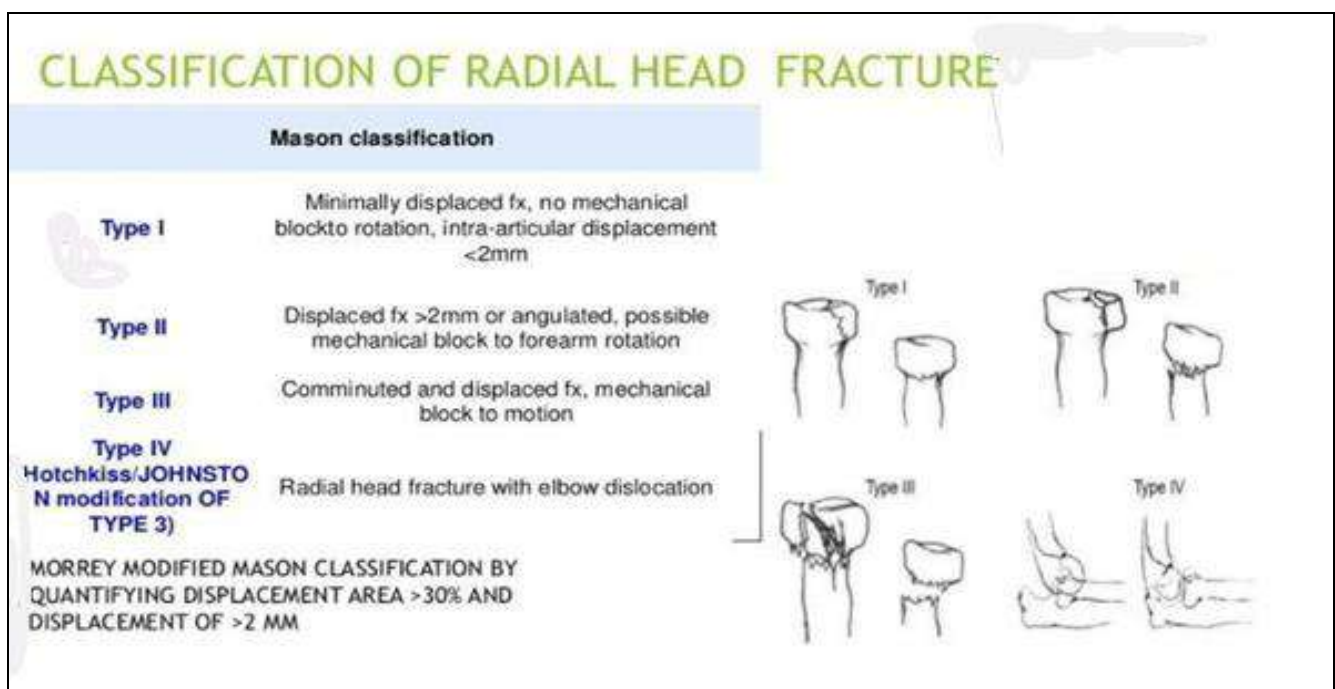
Comminuted fractures of the radial head where internal fixation is not possible, simple excision is good option, if there is no other lesion affecting stability of the elbow [9]. It is difficult to diagnose associated damage to the interosseous membrane and radio-ulnar instability in comminuted radial head fracture [10]. Posterior dislocation of the elbow and laxity of the medial ligament are easy to diagnose, as is obvious disruption of the inferior radio-ulnar joint, which should always be part of the radiological assessment of such injuries. The inappropriate excision of the radial head results symptomatic weakness and instability of the elbow, late cubitus valgus, secondary subluxation or dislocation of the elbow joint and proximal migration of the radius, which will have further consequences for the inferior radio-ulnar joint. In the long-term cases of inappropriate excision of radial head surgery may accelerate the onset of osteoarthritis. Therefore, radial head arthroplasty is indicated if there is instabilities in elbow. Speed in 1941

first proposed prosthetic replacement of the radial head [11]. Acrylic radial head prostheses were introduced but were discarded due to fractures of the prosthesis itself. After that Silastic prosthesis was introduced in the 1970s. It acted as a spacer only without giving any biomechanical advantage in weight transmission and also caused synovitis [12-15]. The search for a stiffer material for prosthesis manufacture resulted in the use of various metals such as vitallium, stainless steel, and most recently titanium.

Literature supports metallic radial head replacement as it restores the axial stiffness of the forearm to normal whereas excision allows abnormal proximal migration, especially under load [16-17].

Treatment Goal

Treatment goals for radial head fractures are to restore elbow stability and forearm rotation, to preserve elbow motion and to maintain the length of the radius.



Treatment options

- Non operative treatment
- Fragment excision
- Radial head excision
- Internal fixation
- Arthroplasty

Decision-making?

- Fragment number
- Displacement
- Articular surface
- Age and bone quality
- Dislocation and associated ligamentous injury

Non-operative treatment

- Mason type I fractures
- Mason type II, without block or articular incongruity

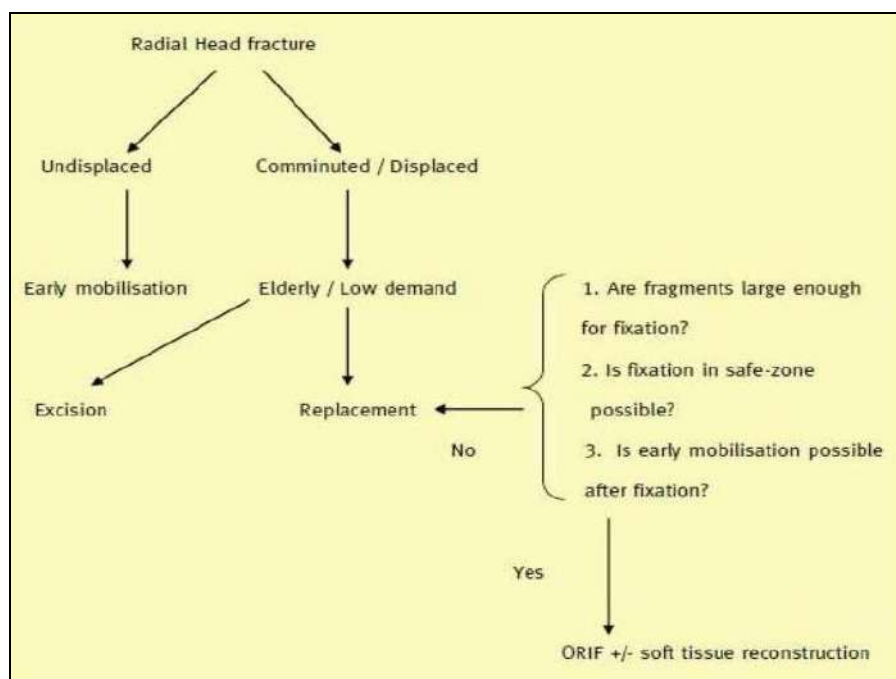
The results of survey showed a marked variation in practice with regards to the management of Mason type 1 radial head

fractures [18]. Based on this literature review on the subject, we believe that the best protocol of treatment would be joint aspiration within 6 hr of injury [19]. This should be followed by immobilization in broad arm sling for 48 hr [20] after which active mobilization and extension stretching exercises should be encouraged [21]. The patients should then be reviewed in fracture clinic at 1 week following the injury for a further clinical assessment to exclude an injury to the collateral ligaments. Provided it is an isolated injury, patients can be discharged to physiotherapy at this stage with an advice to attend a further clinical and radiological review in 6 weeks in case there is no improvement.

Guidelines

- **Type I**-conservative
- **Type II**-Fix

Type-III and IV-Fix with ligamentous repair, Replace or Partially excise with ligamentous repair

Radial Head -Resect, Fix or Replacement?? [22].**Fig 1****Surgical approach**

Preoperative: On admission, a detailed evaluation of the mode of trauma, mechanism of injury and the complaints of the patients were noted. The patient was evaluated for clinical examination including swelling, deformity, skin condition, and general examination. The plain Radiographs include anteroposterior and lateral views of affected limb elbow joint were taken to confirm the fracture. Then CT scan was done to confirm the Modified Masons Classification type and for the planning of surgery. The primary treatment, immobilization was given in the form of above elbow posterior slab. All routine investigations were done.

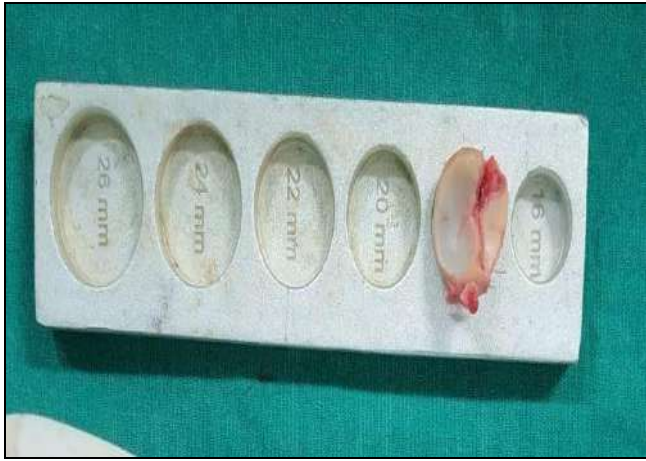
Surgical fitness was obtained from anesthetics (PAC) prior to surgery.

Operative: After informed, written and video consent, patients were taken for surgery. The operation was performed by a senior surgeon/consultant, and two junior surgeons under regional anesthesia. Supine position with abducted arm on hand table and tourniquet applied. After routine preparation, painting and draping, Kocher's postero-lateral approach was made to expose the radial head. The interval between the anconeus and extensor carpi ulnaris (Kocher interval) is relatively more posterior and thus risks injuring the lateral collateral ligament complex. The fractured radial head was excised and all loose bony pieces removed and care taken not to leave any fragment in the elbow joint. Copious joint irrigation was performed to remove all loose intraarticular debris. Then after removal of the radial head, elbow instability was checked. Valgus, Varus and axial stress tests were performed using an image intensifier to evaluate the competency of the MCL, LCL and interosseous ligament. The broken radial head were reassembled on the table to ensure that the whole head had been resected and to choose the approximate size of the prosthesis. A very small amount of radial neck was resected at a right angle to the medullary canal of the radial neck.

The appropriate diameter and height of radial head implant were selected for trial implantation. The medullary canal of the radial neck was gently reamed using the hand reamers. Then rasp was used to smoothen the neck cut, ensuring that it was at 90° to the neck and the trial radial head prosthesis. The diameter, height, and congruency of the prosthesis were assessed visually with the help of image intensifier. The head had to reach the limit between the trochlear notch and the radial notch of the ulna. Checked for the flexion and extension movement. The trial prosthesis was removed and the final implants were inserted. This device has different head diameter with stem, which allows for a close enough approximation to normal anatomy. The different head heights accommodated for the extension of fractures into the proximal neck and also accounted for observed variability in head height. After radial head replacement, the annular ligament was repaired. Then checked for stability of the joint. Closure was done in layers, tourniquet deflated. Dressing was done. Postoperative X-ray was taken.

**Fig 2**

(Kocher's postero-lateral approach: Interval between ECU and anconeus and Radial head found under anconeus. Excised and sized)



(Radial head size :18mm)

Fig 3



Fig 4

(Resected radial head and neck fragments and preserve the annular ligament for repair, if possible. Trim the radial neck to fit the prosthesis with a small rongeur).

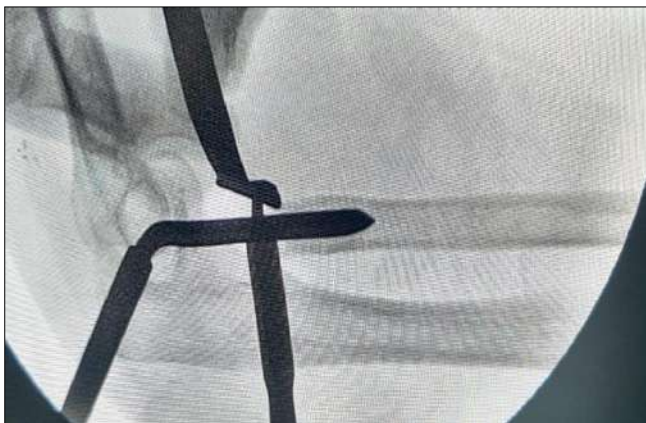


Fig 5

(Opening the medullary canal with an awl to fit the trial prosthesis stem).



Fig 6

(Sizing of the prosthesis: Reconstruct the radial head and neck with the excised fragments to identify the appropriate diameter and length of prosthesis. If the size of the native radial head is in between available prosthetic sizes, select the smaller one. Insert the chosen prosthesis. Assess its length and stability)

Note: Radial head mono block prosthesis (2016) was used



Fig 7

(Definitive radial head implant inserted)

To avoid lengthening and overstuffing of the radio-capitellar joint, or shortening and instability, the prosthesis should fit as follows:

- The articular surface of the radial head prosthesis should be at the level of, or slightly proximal to the lateral edge of the coronoid articular surface.
- Check tracking of the prosthesis in flexion, extension, pronation and supination. Check elbow stability. If the elbow is too stiff or too unstable, change the size of the prosthesis accordingly.
- Check the contralateral wrist with fluoroscopy and compare it to the wrist of the involved upper limb.

Post-operative and physiotherapy

- Right elbow was immobilized in above elbow pop slab for 2 weeks followed by ROM elbow brace for 4 weeks.
- Dressing was changed at post op day 2 and sutures were removed at day 14, ROM exercises started after suture removal.
- Physiotherapy after 2 weeks- Passive assisted ROM exercises 0-90° in elbow ROM brace followed by active exercises by 4 weeks.

The patient was followed up in outpatient department at 2 weeks, 1st month, 3rd month and 6th months then on yearly basis. Physiotherapy was continued till 3 months.

After eight weeks, active and passive stretching and strengthening exercises were initiated.

From 1st week up to 3 weeks of post-surgery the main goals were to continue to control pain and swelling as needed, regain range of motion within pain limits and prevent muscle atrophy.

During the post-operative period, early mobilization within a safe range is recommended for the first 6 weeks.

- After 6 weeks:
- Active flexion/extension/supination/pronation of the elbow
- Isometric: Flexion, extension, pronation and supination
- Gentle stretching using inhibition/elongation techniques or joint mobilization to increase ROM

After 12 weeks post-surgery

- Increase strength (especially at end range)

- Educate patient on proper joint protection and therapeutic exercises
- Gain adequate strength in the forearm flexors and extensors to increase stability at the elbow
- Strengthen the elbow flexors and extensors to gain full range of motion
- Self-stretching: flexion/extension, pronation/supination, shoulder flexion/extension, and wrist flexion/extension, ulnar deviation/radial deviation
- Advance elbow extension with radial deviation and elbow flexion with ulnar deviation.

At certain follow-ups, patient was examined clinically and radiologically. Functional survey was performed using the Mayo Elbow Performance Score (MEPS) and self-reported scales of shortened Disabilities of the Arm, Shoulder, and Hand (Quick-DASH) score. Grading of residual pain was done by visual analog scale (VAS) (ranges from 0 to 10).

Clinical investigation was based on both objective functional evaluation and patient self-reported questionnaires at more than 5-6 years after the index surgery. Radiographic analyses were obtained from high resolution images including x-ray right elbow ap/lateral in extension and maximum flexion. The prosthesis was found stable radiologically throughout the range of motion. There was no overstuffing, no degenerative change in radio-capitellar joint and no sign of implant loosening.

Post op X-ray on POD1

6 years Follow up X-ray



Six-year clinical follow-up showing maintenance of total ROM recovery: Mayo Elbow Score- 100 and QuickDASH- 0



Stability test was performed: valgus stress test was done and compared with left side which is normal



Conclusion

Radial head arthroplasty can be used successfully with most of excellent results for treatment of Comminuted radial head fracture (The Modified Mason classification type III and IV radial head fractures). Radial head fractures are fairly common (20% of all traumatic elbow injuries). Non-operative treatment is indicated in non-displaced fractures, and direct stable internal fixation allowing early elbow mobilization in most other cases. For severely comminuted fractures precluding stable fixation, replacement of the radial head was introduced in the 1970s as a better alternative to simple radial head resection, which can induce instability of the elbow and/or forearm, most notably in patients who have complex fractures with concomitant lesions to other structures. With contemporary implants (modular or monoblock, with or without a mobile cup), mechanical stability is close to that provided by the native radial head, although appropriate treatment of concomitant lesions remains crucial (e.g., re-attachment of the radial collateral ligament, or distal radio-ulnar stabilization in patients with Essex-Lopresti fracture). The key technical points are selection of implant size and determination of the optimal implantation height. The two most common complications are capitellar overloading due to excessively high implantation of the prosthetic head, which causes stiffness and pain, and loosening of the stem. These complications may require removal of the implant at later stage. Excision is not a suitable treatment for all comminuted fracture of the radial head. Radial head arthroplasty is more effective way of treating these fractures in a setting of ligamentous instability.

So, the aim of this paper is to study of functional outcome of radial head arthroplasty in comminuted radial head fracture (Modified masons type IV)/ Complex elbow injury in a young lady after 6 years of follow up.

Key Points

- Elbow fracture dislocation needs early detection and prompt management

- Proper planning of surgery is essential
- Restoration of soft tissue around elbow is of utmost importance to achieve stability and early motion
- Physical therapy should be aggressive to prevent stiffness

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