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Results of radial head fractures treated with surgical fixation

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Abstract
Purpose: Our study aims to report the functional outcomes of the patients with radial head fractures treated using surgical technique and benefits of surgery over conservative management.
Materials and Methods: 20 Patients were operated at a mean age of 45.3 years and patients were reviewed at a follow up on 3 weeks, 1 month, 3 months, 6 months. Functional outcome assessed using DASH score, Ballottement test for DRUJ instability, Neurological assessment using test for Posterior Interosseous Nerve Palsy. Supination and pronation measured clinically and compared to normal side.
Results: The mean preoperative DASH score was 80.5 which reduced to 25 at final review Supination and pronation possible to maximum range at final review. No patient presented with ballottement test positive and PIN involvement.
Conclusion: Early fixation of radial head fractures using Kocher's approach to dissect and fix radial head fractures with Minimal chances for injury to Posterior interosseous nerve, early mobilization gives good functional outcomes, there is no DRUJ instability, there is no limitation of durability as we fix the radial head instead of replacing.

Keywords: Radial head fractures, kocher's approach, treatment, associated injuries

Introduction
Radial head fractures are the most common fracture of elbow in adults [1] with a female preponderance. Isolated fractures of radial head are usually simple while communited fractures are usually associated with other fractures and dislocations of the affected extremity. Majority of the radial head fractures are un-displaced and can be treated non operatively with good functional outcome. Indications for operative interventions include displaced fractures, high demand individuals and other associated fractures or dislocations in the involved extremity.
With the development of advanced techniques in open-reduction and internal fixation (ORIF), the radial head can often be rigidly fixed and the stability of the elbow can be maintained [2]. Several comparisons among ORIF, prosthetic arthroplasty, excision, and nonoperative treatment have been investigated [3, 4, 5]. Commonly radial head fractures are conserved due to operative complications like Posterior Interosseous Nerve palsy, if conserved it takes 6 weeks of immobilization and leads to elbow stiffness. Excision is also an option but it can cause proximal migration of radius and positive ulnar variance and distal radio-ulnar joint (DRUJ) instability and wrist pain, excision of radial head also causes difficulty in pronation and supination. And this points out towards the fact that preservation of native radial head provides better elbow function than metal prosthesis or resection of radial head. Advancement in implant design have led to use of headless or buried screws with/without low profile plates.

Classification
The most commonly used classification system is Mason's [6] which describes fractures of radial head into three types.

1. Type I fractures were described as un-displaced characterized by minimal displacement, with forearm rotation limited by acute pain and swelling, intraarticular displacement of less than 2 mm, or a marginal lip fractures that were treated most successfully by closed (nonoperative) means.

2. Type II fractures were displaced fractures involving only a portion of the radial head, with some remaining head continuous with the radial shaft or minimally displaced neck fractures, with more than 2 mm of displacement of the head or neck, usually with blocked or incongruous motion. There is minimal comminution, but there is more than just a simple marginal lip fracture of the radial head. These fractures are usually amenable to ORIF.
3. Type III fractures are communited fractures involving the entire radial head whose treatment options were historically limited to excision or arthroplasty but now can be fixed using mini plates.

Materials and Methods

It is a retrospective study, A total of 20 patients were operated. Surgeries were performed by single surgeon who is professionally trained. Patients with congenital deformity were excluded.

Operative indications

Fracture with greater than 15 degrees of angulation or greater than 25% displacement, intra-articular fractures greater than 25% of the radial head with more than 2 mm of articular step-off or that create a mechanical block to movement are indications for surgical fixation. Other factors suggesting operative fixation include patient's age, hand dominance, occupation and physical dependence on the elbow. The only contraindication is old age or medical co-morbidities precluding surgery.

Preoperative planning

Examination of elbow for tenderness, neurovascular status, soft tissue condition and range of motion is essential. Tenderness at medial joint line may suggest injury to medial collateral ligament whereas tenderness at the Distal Radioulnar joint indicates longitudinal instability of the elbow. Examination of radial, ulnar and median nerves is mandatory with special attention to Posterior Interosseous Nerve. Forearm rotation is checked to assess for any mechanical block to movements. Standard Anteroposterior and Lateral views of elbow joint are taken. Computed Tomography may be needed for further evaluation of fracture type and pattern. Magnetic resonance imaging helps to look for status of soft tissue around the joint.

Intraoperative assessment

Careful and systematic assessment of elbow is necessary in the operating table before deciding on fixation method for the fracture. Each elbow is examined in the following manner. Axial migration is tested with the elbow stabilized on the hand table, the forearm in neutral rotation, and load placed by the surgeon on the fisted hand. If the radial shaft migrates into the capitellum, it suggests proximal migration of radial head. Also, the radial shaft can be grasped with a tenaculum and pulled proximally and radial shortening can be observed at the DRUJ on fluoroscopy. Medial collateral ligament integrity should be evaluated with the forearm in pronation and the elbow flexed to 30 degrees. The degree of opening, the feel of the end point, and radiographic appearance are all observed with this stress manoeuvre. Radial head incompetence will increase posterolateral instability, which is tested with elbow in supination, valgus, and axial load. Finally, AP stability should be evaluated in progressive extension. If posterior subluxation of the elbow is seen at more than 30 degrees of flexion, then the radial head should be repaired or replaced.

Operative technique

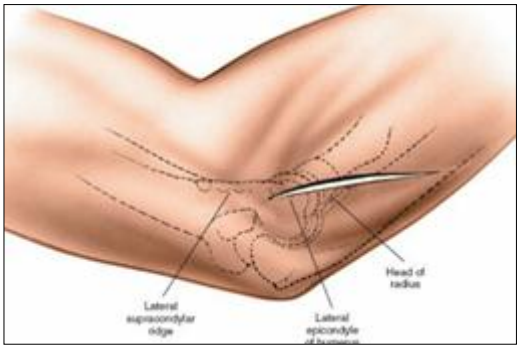

Fig 1: Incision of Radial head exposure.

Kocher's approach has been used to expose and treat radial head fractures. An oblique incision beginning over the posterior surface of the lateral epicondyle and continuing downward and distally to a point over the posterior border of the ulna, about 6 cm distal to the tip of the olecranon was taken. The inter-nervous plane lies between the anconeus muscle, supplied by the radial nerve proper, and the Extensor Carpi Ulnaris muscle, supplied by the Posterior Interosseous Nerve. Full pronation of the forearm moves the PIN away from the operative field [7, 8].

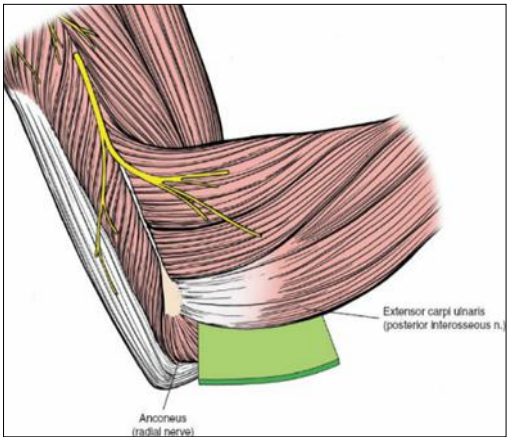

Fig 2: Plane between extensor carpi ulnaris and anconeus

Fig 3: Radial head after exposure.

Longitudinal incision is taken over the joint capsule to expose the radial head. The incision cannot be extended distally as the PIN runs anterolaterally over the distal part of the capsule of elbow joint

After exposure of the fracture under tourniquet, fixation of fracture can be done keeping in mind the "safe zone" (non-articular) of the radius so rotation is not limited. This zone comprises approximately 100 degrees and is on the dorsal aspect of the radius, in line with the Lister tubercle of the wrist. Small headless screws (Herbert) or 2.4/2.7mm low profile plates can be used to fix the fracture. Care must be taken not to over penetrate these screws past the far cortex, or joint impingement may occur at the proximal radioulnar joint

Fig 4: Fractured radial head.

Fig 5: Herbert's screw insertion.

Fig 6: Temporary fixation using k wire.

After appropriate reduction and fixation, soft tissue repair and closure is done. Forearm is evaluated in full range of motion to check for any impingement or instability.

Post-operative protocol

Immobilisation of elbow in above elbow splint for 2 weeks

Passive gradual flexion extension at 2 weeks.

Active flexion extension at 3 weeks along with passive pronation supination movements

Active pronation supination at 4 weeks with full return to activities at 6 weeks

Results

Out of the 20 cases operated using the above mentioned technique, follow up was done for 3 weeks, 1 month, 3 months, 6 months wherein 14 patients had excellent outcome, 5 had good outcome and 1 had acceptable outcome using the DASH score, ballotment test for DRUJ instability, test to assess PIN palsy. The mean preoperative DASH score was 80.5 which reduced to 25 at final review. Supination and pronation possible to maximum range at final review. No patient presented with DRUJ instability and PIN Palsy. Patients were started on early range of motion, so there was no evidence of any stiffness.

Fig 7: Pre-operative x-ray

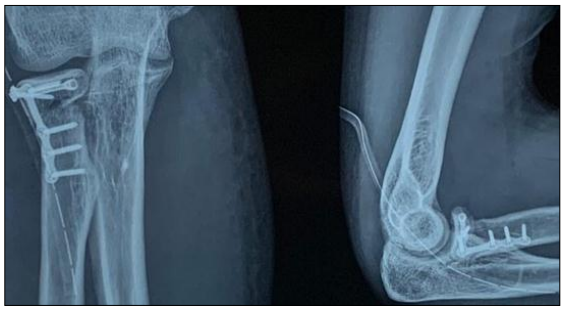

Fig 8: Post-operative X-ray

Fig 9: Follow up at 3 weeks

Discussion

Radial head fractures often are neglected which causes stiffness in elbow, Radial head excision leads to proximal migration of radius and distal radio-ulnar joint instability which leads to positive ulnar varience and causes wrist joint pain. According to Masons, type 1 can be conservatively managed, type 2 and 3 should be fixed. Kocher's approach allows excellent exposure to adequately reduce and fix the radial head fracture using miniplates and Herbert screws. Careful dissection prevents injury to posterior interosseous nerve. Fixation also allows early mobilisation facilitating good functional outcome. Replacement of radial head fractures is limited by shorter durability of prosthesis, greater cost of surgery and more surgical skill.

Conclusion

In conclusion, Early surgical fixation of radial head fractures using Kocher's approach to dissect and fix radial head fractures; If done skillfully there are following benefits:

1. Minimal chances for injury to Posterior interosseous nerve. As exposure was done in full pronation to avoid PIN injury.
2. Early mobilization gives good functional outcomes.
3. No DRUJ instability which is seen in radial head excision.
4. There is no limitation of durability as we fix the radial head instead of replacing.

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