International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(2): 265-267

www.orthopaper.com
Received: 09-02-2019
Accepted: 13-03-2019

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A rare case presentation of monteggia variant fracture treated by Boyd's approach: A case report and review of literature

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DOI: https://doi.org/10.22271/ortho.2019.v5.i2f.34

Abstract
Complex elbow fractures are among the most difficult to treat due to the multiple articulations requiring reduction and the density of neurovascular structures limiting exposure. Frequently multiple approaches are required to access all bones involved without sacrificing important surrounding structures. Some of the most complex injuries include fractures of the olecranon, radial head, and coronoid arising from fracture/disruptions of the elbow. In these instances, the ulno-humeral, radio-capitellar, and proximal radioulnar joints are all disrupted and require visualization for appropriate treatment. Boyd first described a single-incision approach that allowed access to all these joints safely in 1940. This is a very versatile approach for treating elbow trauma that otherwise would require multiple incisions. With appropriate technique, the surrounding neurovasculature can also be preserved. The Boyd's approach, however, fell out of favor given reports of synostosis. In this case report we are presenting a case of Proximal One Third Ulna Shaft fracture with radial neck fracture treated with 3.5 Dynamic Compression Plate in bridge mode for ulna and Radial Head Plate 2mm by Boyd's approach and having functional range of motion without any active complaints in a one year follow up.

Keywords: Boyd's, monteggia, elbow, approaches, synostosis

Introduction
Various approaches to the elbow are described in the literature. Frequently in complex traumatic injuries, multiple approaches are used to access the ulno-humeral, radio-capitellar, and proximal radioulnar joints. The Boyd's approach, first described in 1940, allows access to all 3 of these joints and proves a versatile approach for treatment of terrible triad injuries, complex Monteggia fractures, and other elbow disruptions and dislocations through a single incision. Use of a single incision can decrease operative times as well as need for repositioning in polytrauma or fragile elderly patients. Given the density of nerves and vessels about the elbow, this approach also preserves all important structures when appropriate technique is used. Most concerning is the posterior interosseous nerve (PIN) which is near the area of exposure but can be protected throughout the procedure [1, 2].

Case report
A 30/F presented to us with pain and swelling over the Right elbow and forearm. She had a history of road traffic accident. On examination tenderness was elicited over radial head and proximal ulna shaft with restriction of range of motion. X-Rays showed a proximal one third shaft ulna fracture with radial neck fracture (Fig 1). There was no neurovascular deficit or open wound. There is no trauma to abdomen or pelvis or evidence of head injury. Patient was immediately immobilized in an above elbow splint, and started on anti-inflammatory drugs, Injectable Pain killers and local Ice fomentation. After 72 hours of monitoring when the swelling settled down we proceeded with the planned surgery. Under Supraclavicular Block, Boyd's approach was performed with elbow positioned in left lateral position and the incision was made slightly dorsal to subcutaneous ulnar border to avoid scar pain with forearm rest. The anconeus and extensor carpi ulnaris were reflected laterally allowing access to ulno-

humeral, radio-capitellar, and proximal radioulnar joints. The lateral ulnar collateral ligament is left intact with the capsule and annular ligament reflected as single tissue mass and later repaired primarily. Supinator fibers are sharply incised directly from the bone of the crista supinatorus to prevent damage to the PIN. Holding the forearm in pronation also serves to protect the PIN, which is a safe distance from the area of concern. The radial head was fixed with a 2mm radial head T plate on safe zone so that the hardware does not obstruct in supination and pronation. We used a 3.5 Dynamic compression plate for ulna fracture in Bridge mode as there was little bit of comminution around the fracture site. Immidiate Post-Operative X- Rays showed well reduced fracture anatomy with appropriate placement of implant. (Fig 2). Successful union was achieved as assessed on follow up X rays (Figure 3) without any perioperative complications with functional range of motion(Flexion-130 degrees, Supination-Pronation-80 degrees and terminally restricted Extension) (Fig 4). No synostosis of the radius and ulna occurred as confirmed on sequential X rays. No secondary procedures were required.

Fig 1: Pre- operative X ray (AP and Lateral) showing proximal ulna shaft fracture with radial neck fracture

Fig 2: Immediate post-operative AP and lateral X rays showing 3.5 DCP Plate for ulna fracture and 1.5mm T- Plate for radial neck fracture

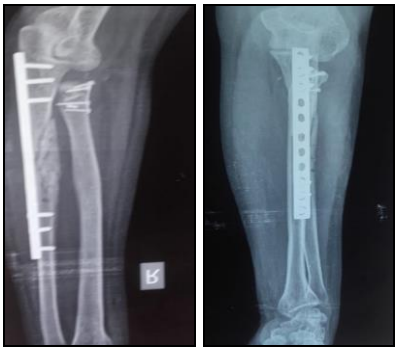

Fig 3: 1 year follows up X- Ray showing good consolidation at the fracture site with implant in situ

Fig 4: Showing pronation, supination of 80 degrees as compared to normal side, flexion of 130 degrees as compared to normal side and extension lag of 10 degrees as compared to normal side

Discussion

Complex elbow fractures are seen in 2 populations: High energy in trauma patients and low-energy in elderly patients. Minimizing operative time is important for both of these populations. Repositioning may not be feasible with trauma patients who have spinal or other injuries. The Boyd's approach allows a single patient position while maintaining spinal precautions. This single approach allows for decreased operative time without sacrificing exposure. Another possible single-incision approach for this type of injury is to approach the coronoid and radial head through the olecranon fracture. When using this method, the approach is different every time as the fracture morphology and location affect visualization. This approach may also make fixation of a radial head fracture with a plate difficult. Conversely with the Boyd's approach, both radial head plating and arthroplasty are easily performed. Intraoperatively, the PIN must be protected by keeping the forearm pronated and dissecting the supinator directly off the bone. Dilberti and colleagues have found the PIN safe zone to be 52±7.8mm along the lateral border of the proximal radius [3] with proper technique PIN injury can be avoided. Postoperatively, the Boyd approach has been associated with increased rates of synostosis of the radius and ulna [2]. Further, by virtue of the access provided by the Boyd's approach, we can obtain stability of the elbow joint by doing coronoid and olecranon fixation, ligamentous repair, and radial head arthroplasty/fixation thus allowing an immediate active range-of motion protocol. We allow immediate range of motion in a hinged elbow brace on end postoperative day. This immediate active motion aids in synostosis prevention and eventual return of functional motion.

Conclusion

There are many approaches described in literature for elbow fractures. For complex elbow fractures involving the distal humerus, olecranon, radial head, Coronoid there is no particular single incision approach through which we can access the ulno-humeral, radio-capitellar and superior radio-ulnar joint together except Boyd's approach. This approach is a single incision approach without much risk of damage to neurovascular structures of elbow except posterior interosseus nerve which can also be protected from injury intraoperatively by keeping the arm pronated and detatching the supinator muscle from the ulnar border. The development of synostosis

on proximal radio ulnar joint is the described complication of Boyd's approach in literature which we prevented by encouraging early range of motion post operatively.

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