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Management of type IIB and IIIB olecranon fractures. Case series

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ABSTRACT

OBJECTIVES: to report and evaluate the functional outcome of plate fixation in comminuted olecranon fractures (Mayo types IIB and IIIB).**METHOD:** 23 consecutive patients with comminuted fractures of the olecranon presenting to our unit between Feb 2011 and Jan 2015, at a mean follow-up of thirty-six months. Main outcome measurements include radiographic healing, post-operative range of motion, complications, outcome score and patient satisfaction.**RESULTS:** Our study included thirteen females and ten males with a mean age of 55 (18–97). Fourteen were Mayo type IIB and nine were Mayo type IIIB. Eighteen patients had no complications post-operatively with good outcome with mean oxford score of 45, full rotational ROM and mean flexion arc of 20–130°. Five patients had range of motion between 40–90° with full rotational ROM and mean oxford score of 24. Two patients out of five required metal work removal. No non-unions were noted in our series.**CONCLUSION:** Plate fixation of complex olecranon fracture is an effective, reliable method of treatment with low risk of non-union. Restoration of a functional flexion arc of movement can be expected with application of correct technique.© 2017 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group 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

Olecranon fracture is a fairly common injury. Olecranon fractures account for 5–7% of elbow fractures in adults but are much rarer in children [1]. It generally happens due to a direct force to the point of the elbow or a tumble onto an extended arm. Its subcutaneous location makes it vulnerable to direct trauma. Olecranon fractures could also take place following a strong triceps contraction against a fixed ulna. It can be as simple as non-displaced fractures or complex fractures with dislocation of the elbow joint. In most of the cases, plain radiographs are sufficient to confirm the diagnosis and plan the management. CT scan may be required, in some cases, to assess the severity of the injury and to plan fixation [2]. Fixation with Plate and screws is the gold standard treatment for comminuted fractures, fractures of Monteggia, fractures associated with dislocations and oblique fractures with distal extension affecting the coronoid [3,4]. Good recovery is anticipated with surgical fixation though the final outcome may depend on the

intra-articular nature of the injury, multiple fracture fragments and the extent of the soft tissue injury.

We evaluated locking plate fixation of comminuted olecranon fractures in terms of bone union, surgical complications, long term outcomes and patients' satisfaction.

This case series has been reported in line with the PROCESS criteria [5].

2. Materials and methods

We retrospectively studied 23 patients with comminuted fractures of the olecranon. The mean follow-up period was 36 months ranging from 24 to 52 months.

There were thirteen females and ten males with mean age of fifty five years [range, 18–97 years]. The twenty-three patients had an open reduction and internal fixation using plate and screws, between February 2011 and January 2015. We use The Mayo classification system which classifies these fractures based on the stability, the displacement and the comminution of the fracture [6]. It is comprised of three types, and each type is divided into a comminuted and a non-comminuted subtypes (Fig. 1).

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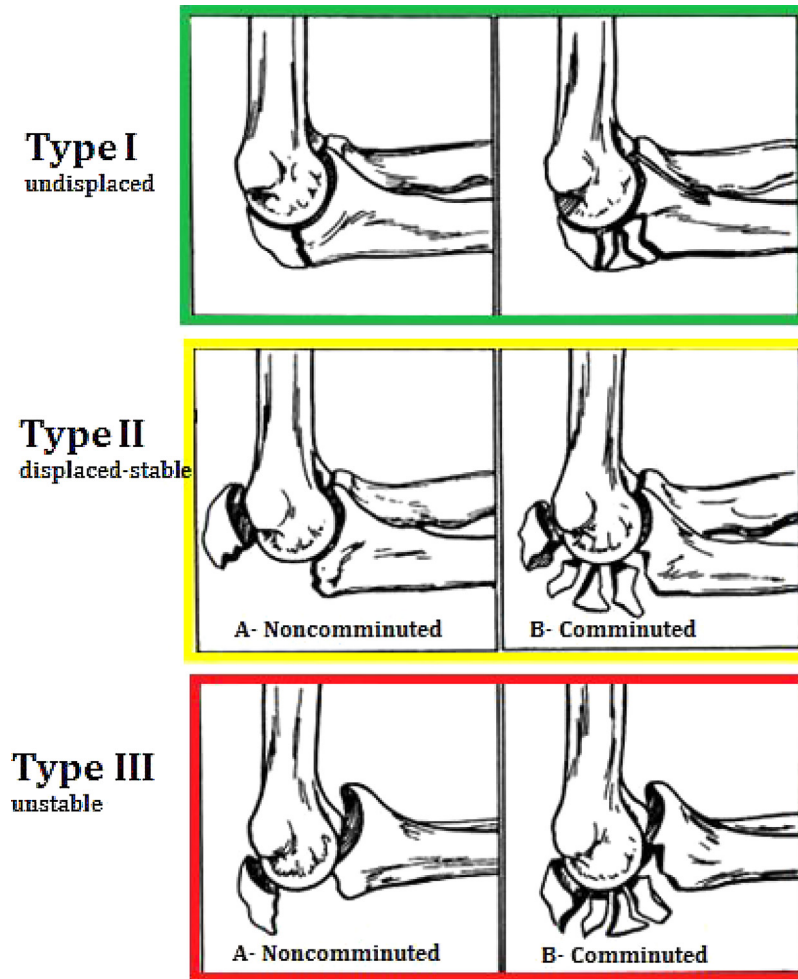


Fig. 1. shows Mayo Classification.

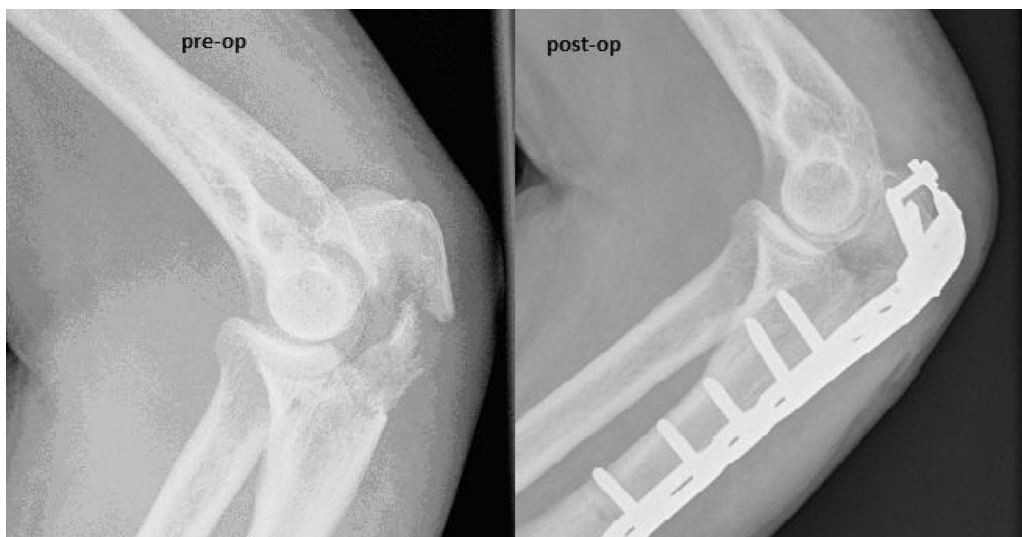


Fig. 2. type IIB fracture, had open reduction and internal fixation using plate and screws.

According to The Mayo classification system; fourteen patients had Mayo type IIB and nine had Mayo type IIIB (Figs. 2 and 3). All the radiographs were reviewed by the senior author.

Operations were performed either under general anaesthesia with local anaesthetic infiltration or regional block. The mean

tourniquet time was 48 min. The fracture was exposed through a posterior curvilinear incision while the patient is in a lateral position. The C-arm was used intra-operatively to assess the reduction and the congruency of the joint. Ulnar nerve was protected throughout the procedure although not explored. For antimicro-

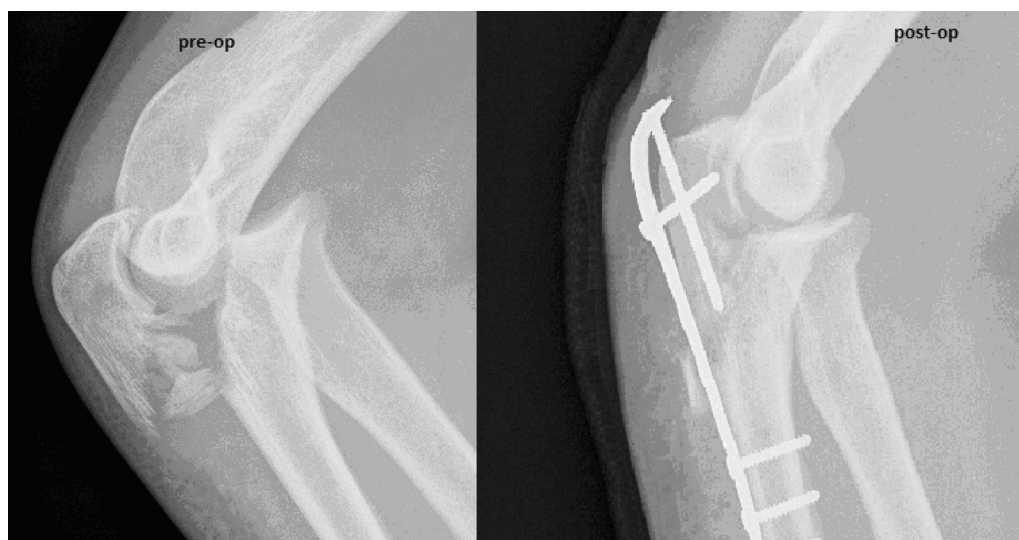


Fig. 3. Type IIIB had open reduction and internal fixation using plate and screws.

bial prophylaxis, Cefuroxime was used intravenously, with 1.5 g injected intra-operatively and 0.75 g injected after 8 and 16 h. None of the patients developed a wound infection or a wound breakdown post-operatively.

All the patients were put in a broad arm sling post-operatively. They were allowed wrist and hand exercise immediately post-operatively. Patients were seen two weeks after the surgery in the outpatient clinic, had a wound check and started gentle elbow exercise.

The outcome was assessed with regard to clinical and radiological findings. We utilised The Oxford elbow scoring system which has twelve components with five answer options each. Each answer is scored zero to four, with zero corresponding to greater severity. Underlying the twelve components are three spheres: Elbow pain, Elbow function and Social-psychological. Scores are converted to a metric of zero – 48 (lower score corresponding to greater severity) [6]. Anterior-posterior and lateral elbow radiographs were used during follow-up to evaluate reduction, union and failure of metal work.

3. Results

These fractures were deemed to be unsuitable for Tension band fixation by virtue of their fracture configuration. There were no infections, wound leakages or wound break-downs reported on any of these cases. Full union was observed in all patients during the follow-up period.

One patient had a grade II open fracture that was debrided and fixed internally at the same time. All operations were performed within seventy-two hours from the initial injury. The majority (Nineteen cases) was performed within 24 h.

A congruent Ulna-humeral articulation was achieved in all the patients; the reduction obtained during surgery was maintained in all cases when seen for follow-up. There were no implant failures.

No complications were noted post-operatively in eighteen patients with a mean Oxford score of 46. Two patients (out of eighteen), had a transient Neuropraxia of the ulnar nerve which was diagnosed pre-operatively and had resolved fully within the first six weeks.

Five patients had a range of motion between 40–90° with a full rotational ROM and a mean Oxford score of 24 (Table 1). Two of those five patients needed a metal work removal. The first, a 57 years old female with a Mayo type IIB, developed stiffness with a

flexion arc of 45–85 and an Oxford score of 23. She required removal of the metal plate as a part of an arthrolysis. The second patient was a 34 years old male with a Mayo type IIIB. He developed heterotopic ossifications and needed a metal work removal with an arthrolysis and a long term physiotherapy. The plate was removed as it was prominent subcutaneously. These five patients had a significant comminution of the articular surface. The articular surface fragmentation involved more than 50% of the joint surface. We found these five, in particular, to have more than two, smaller and comminuted intervening fragments in addition to the major fragments and these were not seen in the other eighteen patients who did well after the surgery.

One case of a type IIB was an open fracture that was debrided and fixed in the same sitting, and had an uneventful recovery with no acute or late surgical complications.

One patient had a closed comminuted fracture with a 4.7 mm articular defect after reduction. At 24 weeks the fracture had healed fully with a flexion arc of 110° and full rotational movements. (Fig. 4)

4. Discussion

All olecranon fractures are intra-articular and present a challenge when they are multi-fragmented. The outcome of the surgical treatment always depends directly on the precision of the joint reduction, restoration of mechanical stability that permits prompt mobilisation, respect for the soft tissues, and maintaining an intact extensor mechanism [2,4].

The aim of surgery is to achieve an adequate stability to the fracture and to reconstruct the joint surface to enable range-of motion exercises in the early post-operative period [7]. A considerable number of the published literature have described positive results with locking-plate in fragmented olecranon fractures [8–10].

Fyfe et al. conducted a biomechanical study on methods of fixation of olecranon fractures and concluded that fragmented osteotomies had best stability when fixed using the contoured plates [9]. Following that, Gordon et al. performed a cadaveric study comparing plating methods on comminuted olecranon fractures [11]. The study concluded that plate fixation along with an intramedullary screw had the most attainable stability when fixing these fractures. Ramazan et al. retrospectively studied 18 cases of comminuted olecranon fractures, type IIB and IIIB, all underwent locking plate fixation [12]. although those with type IIB fractures

Table 1

Shows five patients had unsatisfactory outcomes.

Age	Sex	Open/Closed	Mayo	Union	ROM	Score	Further Management
66	M	closed	IIB	united	40–90	24	Physiotherapy
57	F	closed	IIB	united	45–85	23	Metal work removal and arthrolysis and physiotherapy
46	M	closed	IIB	united	40–75	24	Physiotherapy
34	M	closed	IIIB	united	45–85	19	Metal work removal and arthrolysis and physiotherapy
67	F	closed	IIB	united	45–90	24	Physiotherapy



Fig. 4. shows 4.7 mm defect, healed nicely in 6 months.

had slightly better results when compared with type IIIB group, the difference was not statistically significant. They recommended osteosynthesis system for fragmented fractures to guarantee more secured fixation, to provide better joint restoration and to guard against loss of elbow range of motion.

Hard ware irritation is often reported with plate fixation and hardware removal rates are reported to be 0% to 20% in the literature [13–15]. Painful hardware is more frequent in tension-band wiring than plate fixation and our literature search revealed rates to be from 9% to 91% for the tension band technique [16–22].

Hume and Wiss in 1992 studied the outcomes of plate fixation against tension band wiring in variable patterns of olecranon fractures and found superior results clinically and radiologically with lower complication rate in the plate fixation group [23]. Bailey et al. in 2001 evaluated the functional outcome of plate fixation in twenty-five cases of complex olecranon fractures (Mayo type II and III) at an average of thirty-four months' follow-up. Again, they reported a good or excellent outcome in 94% patients with a mean DASH and MEPS score of 10 and 89, respectively [24]. Wilson et al. conducted a biomechanical study in 2011 revealed a considerably greater compression using locking plates than tension band wiring in the fixation of transverse olecranon fractures, both over the whole fracture and specifically at the articular side of the fracture, suggesting a lower risk of post-traumatic osteoarthritis [25]. Buijze and Kloen evaluated the results of pre-contoured locking

plate and intramedullary screw fixation for an acute fragmented olecranon fracture in sixteen patients. At a minimum of twelve months over ninety percent of the patients had a good or excellent outcome [26]. Anderson et al. reported mean MEPS score of 89, with also over ninety percent good or excellent results, and a mean DASH of 25 at a mean 2.2 years following locking plate fixation for the fixation of comminuted and non-communited olecranon fractures. The mean flexion contracture reported in their study was 13.5° [27].

Based on the previous biomechanical studies and the published case series, we believe that Plate fixation is mandatory in fragmented, unstable olecranon fractures. Using the pre-contoured locking plates helps to maintain the olecranon height and restoring the articular arc which is very important to avoid flexion-extension stiffness and enable commencing early movements. Furthermore, low profile pre-contoured plates reduce the need for metal work removal. We have mostly used a spanning type of fixation construct but in some complex fractures, we have used sub-articular screws to buttress the articular surface. We found that; fractures with multiple small and comminuted intervening fragments in addition to the major fragments, they may not do well after surgery. Thus, further detailed imaging and planning before the surgery might help getting better results.

The limitations of our study include its retrospective nature, the small number of patients and the relatively short duration of follow-up.

5. Conclusion

Plate fixation should be considered as the method of choice in comminuted olecranon fractures where tension band wire technique will not provide the required reduction and stability. The plate acts as a posterior buttress/template, supporting the articular fragments till fracture consolidation is complete. Plate fixation is an effective and reliable way of treatment with a very low risk of non-union.

Conflict of interest

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Consent

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Author contribution

1st Author contributed to design, data collection, data analysis and interpretation and writing of the paper. Co-authors contributed in data collection and writing of the paper.

Guarantor

Mohammed Ali.

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