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# Case Series of Comminuted Olecranon Fracture Treated by Plate Fixation; Do We Have to Remove the Plate?

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**Comminuted olecranon fracture requires surgical intervention. Plate fixation has been performed on the majority of cases. We reviewed the cases of comminuted olecranon fracture in young and middle age treated by plate osteosynthesis and analyzed the functional outcome, complications and ratio and timing of hardware removal. Fifteen cases of comminuted olecranon fractures treated by plate fixation were reviewed. Bone union was achieved in all cases, the average range of motion at the final follow up was -11° in extension, 133° in flexion, 89° in pronation and 88° in supination. Hardware removal performed in 12 cases in average 8.3 months postoperatively, in 2 cases elbow joint contracture release was performed during the hardware removal. In the co-payment (+) group, 4 cases (67%) removed the plate at average six months postoperatively. On the other hand, no co-payment group (workman's compensation insurance or automobile liability insurance) underwent hardware removal surgery in 8 cases (89%) at 9.6 months postoperatively. There was no statistical difference between the timing or prevalence of hardware removal between the groups. The present study showed high removal rate of hardware despite the excellent clinical result. The surgeons should be aware that plate fixation of the olecranon fracture requires the removal of a plate in the majority of cases.**

## INTRODUCTION

Olecranon fractures comprise up to 10% of all upper extremity fractures [3]. It happens due to a direct force to the point of the elbow or a tumble onto an extended arm [2]. This fracture in adolescent and middle age usually occurs due to high energy injuries, such as traffic accident or fall. In these cases, the fracture can be associated with radial head injury or dislocation of the elbow joint [7].

Tension band wiring using K-wire and the soft wire has been used for the treatment of olecranon fracture [10]. However, in a case of comminuted fracture, this method cannot maintain the length of the ulna. The loss of reduction can occur after the tension band wiring [2]. Therefore, plate fixation is widely accepted treatment of the comminuted olecranon fracture such as Mayo type 2b and 3 [2]. The intramedullary screws from the tip of olecranon can hold the small bone fragment of the articular surface into a correct position. Although good functional results of plate osteosynthesis have been reported, hardware irritation and loss of range of motion are also known as a complication after the surgery [7]. Especially in the young and middle age population; these complications prevent them from returning to work even though after the bone union. For time and cost-effectiveness, the precise schedule of rehabilitation including removal of hardware is needed. We reviewed the cases of comminuted olecranon fracture in young and middle age treated by plate osteosynthesis and analyzed the functional outcome, complications and ratio and timing of hardware removal.

## MATERIALS AND METHODS

We retrospectively studied 15 cases of comminuted olecranon fractures treated by open reduction and plate fixation. There were three females and twelve males with mean age of 52.4 years (range, 17–65 years). The mean follow-up period was 14 months (range, 8-22 months). We used Mayo's classification system which classifies these fractures based on the displacement and the comminution of the fracture. [11] Type 1, undisplaced fractures is subdivided into type 1A, noncomminuted fractures, and type 1B, comminuted fractures. Mayo type 2 fractures which are stable fractures without collateral ligament injury having greater than 3 mm of displacement. Type 2 is subdivided into noncomminuted (type 2A) or comminuted (type 2B). Mayo Type 3 fractures are unstable, displaced fractures and represent a fracture-dislocation. Type 3 fractures also can be

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subclassified into noncomminuted (3A) or comminuted (3B) types. According to The Mayo classification system; one patient was Mayo type 2A, nine patients were Mayo type 2B, two cases were 3A, and three cases were 3B. The clinical and radiological findings were analyzed postoperatively. For clinical assessment, range of elbow motion, Mayo elbow performance score (MEPS) and Japanese Orthopaedic Association score of the elbow (JOAS) were analyzed. The removal of the plate was performed based on patient's request after the bone union. When the hardware irritates the soft tissue or limited joint motion, the surgeon recommended the plate removal. The type of health insurance and additional surgery was also assessed. Finally, the prevalence of the additional surgery was compared between own health insurance (co-payment group) and workman's compensation insurance or automobile liability insurance group (no co-payment group).

For statistical analysis, the prevalence of additional surgery was analyzed by chi-square test. Comparison between the groups was analyzed by the U-test of man Whitney. $P < 0.05$ was considered as statistically significant.

## RESULTS

Bone union was achieved in all cases, the average range of motion (ROM)at the final follow up was -11° in extension, 133° in flexion, 89° in pronation and 88° in supination. Average MEPS was 91 points (range; 55-100), and JOAS was 91 points (range; 59-100). Hardware removal performed in 12 cases in average 8.3 months postoperatively, in 2 cases elbow joint contracture release was performed during the hardware removal. The removal of hardware gained 2° in extension and 10° in flexion. However, the statistically significant difference was not observed. In one case, the radial head replacement was performed for the treatment of the radial head nonunion in addition to contracture release.

Regarding the insurance type, 6 cases used their health insurance, 5 cases used workman's compensation insurance, and 4 cases used automobile liability insurance. In the co-payment (+) group, 4 cases (67%) removed the plate at average six months postoperatively. On the other hand, no co-payment group (workman's compensation insurance or automobile liability insurance) underwent hardware removal surgery in 8 cases (89%) at 9.6 months postoperatively. There was no statistical difference between the timing or prevalence of hardware removal between the groups.

### Case presentation

Forty-seven years old male fell off from the deck of the truck while handling luggage. He injured his elbow and transferred to the hospital. Plane X-ray examination revealed Mayo 3B olecranon fracture associated with coronoid and radial head fracture (Fig. 1). Twelve days after the injury, plate fixation of olecranon fracture with headless screw fixation of the coronoid and radial head was performed. He underwent rehabilitation for four months to gain elbow range of motion. However, the joint became stiff then he was referred to our institute. On physical examination, the ROM was -45° in extension, 60° in flexion, 0° in pronation and 0° in supination (Fig. 2). Five months after the injury, removal of the plate, contracture release and a radial head replacement was performed. He continued rehabilitation immediately after the surgery up to 9 months after the injury then returned to work. At 12 months after the injury, the ROM of the elbow was -30° in extension, 120° in flexion, 40° in pronation and 40° in supination (Fig. 3). The MEPS was 55 points, and JOAS was 59 points.


Fig. 1. The plain X-ray of the representable case at the time of injury

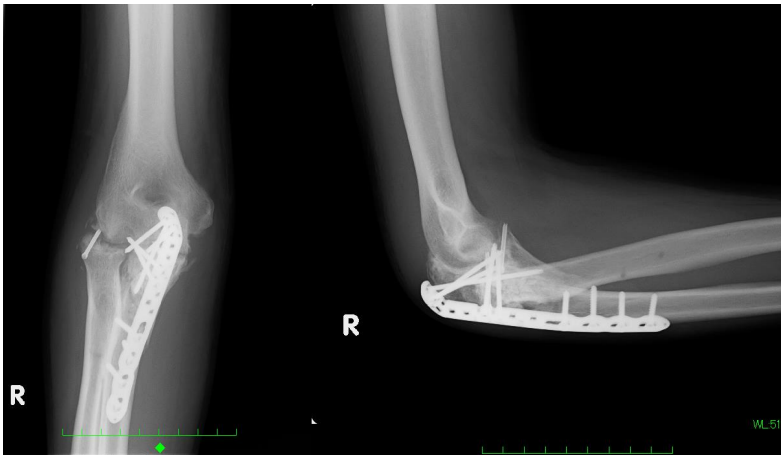


Fig. 2. The plain X-ray four months after the initial surgery.

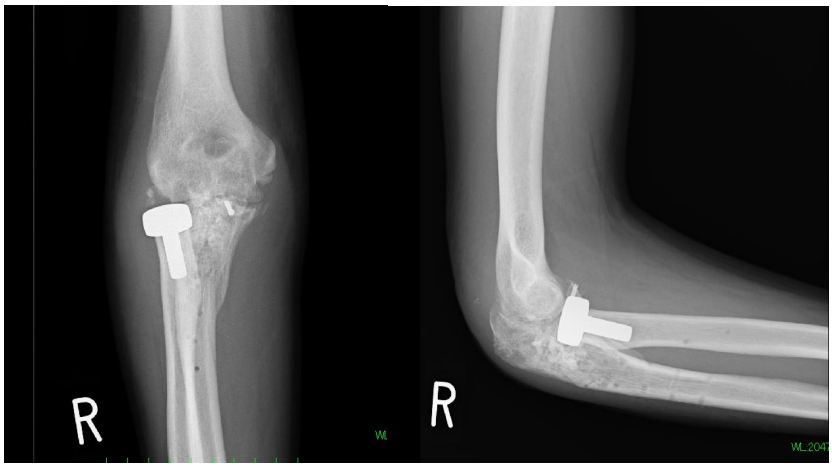


Fig. 3. The plain X-ray seven months after the second surgery.

## DISCUSSION

The aim of surgery in displaced olecranon fracture is to reconstruct the joint surface with adequate stability to enable range-of-motion exercises in the early post-operative period [6]. There are a number of the published literature that has described positive results with locking-plate in fragmented olecranon fractures [5; 13]. Gordon et al. performed a study comparing plating methods on comminuted olecranon fractures using cadavers [9]. They concluded that plate fixation along with an intramedullary screw had the most attainable stability when fixing these fractures. Comparison of Mayo type 2B and 3B fractures showed that type 2B fractures had slightly better results when compared with type 3B group [8]. In the present study, the average ROM was -11° in extension, 133° in flexion and the MRPS was 91 points. Although there is a slight deficit in extension, the result was compatible to a previous report [5; 7]. Overall, plate osteosynthesis for fragmented fractures is recommended to guarantee more secure fixation and better clinical outcomes.

Hardware irritation is often reported after the olecranon fracture treatment due to the thin subcutaneous tissue around the implant [2; 7]. Painful hardware is more frequent in tension-band wiring than plate fixation, and its prevalence is reported to be from 9% to 91% for the tension band technique [1; 2; 12; 14]. The plating reportedly had the rate of painful hardware to be as high as 47% with subsequent hardware removal in as many as 56% [3; 5; 7; 10]. Bailey et al. reported that 20% of patients treated for an olecranon fracture required plate removal for symptomatic hardware [4]. In a study by Anderson et al., there was an overall low rate of symptomatic hardware removal of 9% [3]. Other studies have reported higher rates of olecranon hardware removal, as seen in a study by Buijze et al. that reported 49% of patients underwent hardware removal [5]. They also noted improved elbow extension after hardware removal. The improvement in elbow range of motion was noted by hardware removal without a capsular release or manipulation under anesthesia [5]. In the present study, hardware removal gained the range of elbow motion. However, the statistically significant difference was not observed. One of the most extensive studies reported that after plate fixation 69% remained asymptomatic and 31% had symptomatic hardware than 15% underwent the plate removal [7]. In particular, they found that the use of a screw at the

corner of the olecranon plate led to a higher rate of symptomatic hardware. The rate of removal in patients who did not have this screw placed was only 13% [7]. According to the study regarding plate fixation in distal radius fracture, hardware removal rate differs by country [15]. The mean removal rate in studies from France, Norway, Japan, and Belgium was high as more than 19% while, the mean removal rate in studies from the US was low (3%). They concluded that medical insurance systems and out of pocket expenses might influence the number of routine removals and patient's request for hardware removal [15]. In this study, we hypothesized that hardware removal rate of olecranon fracture in our country is higher than the report from another country. The result of the current study showed plate removal rate was 86.7% which was higher than other reports (9~49%). We also expected that no co-payment group shows higher plate removal rate since the insurance usually covers the plate removal expense even though it is asymptomatic. The result from the study showed that the no co-payment group showed higher ratio (89%) compared to co-payment group (67%), however, there was no statistical difference. The average timing of plate removal was 8.3 months after the surgery. The no co-payment group underwent hardware removal surgery at 9.6 months postoperatively which was slightly longer than the co-payment group (6 months). The present study showed high removal rate of hardware despite the excellent clinical result.

In conclusion, plate fixation of comminuted olecranon fracture showed the satisfactory result. Hardware removal was performed in 80% cases regardless of insurance type.

The surgeons should be aware that plate fixation of the olecranon fracture requires the removal of a plate in the majority of cases.

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