

## Radiohumeral Arthrodesis for Severe Open Communitated Fracture Using External Fixation: A Case Report

Naoki Kato<sup>1,2,3\*</sup>, Tetsuya Torio<sup>2,3</sup>, Hiromi ODA<sup>2</sup> and Hiroya Sakai<sup>1</sup>

<sup>1</sup>Department of Orthopaedic Surgery, Saitama Medical Center, Saitama Medical University, Japan

<sup>2</sup>Department of Orthopaedic Surgery, Saitama Medical University, Japan

<sup>3</sup>Department of Emergency and Trauma Care, Saitama Medical University International Medical Center, Japan

### Abstract

Recently, prosthetic replacement has been commonly applied as a standard procedure for the elbow joint destruction by arthritis or trauma, and elbow arthrodesis has been used only for patients who are unsuitable for other conventional treatment methods. In most cases, ulnohumeral arthrodesis is performed, considering the geometry and the amount of surface area of the distal humerus and proximal ulna. In this report, we present a successful case of the radiohumeral arthrodesis using unilateral external fixation without bone grafting for a patient who sustained severe open communitated fracture with transarticular massive bone loss. We decided to fuse the elbow at 70 degrees of flexion, and the forearm was fixed at 80 degrees of pronation. At 13-month after the operation, radiographic evidence of solid enlarged right elbow fusion was gained. At more than three years after operation, we evaluated patient-oriented quantitative functional disability using Disabilities of the Arm, Shoulder and Hand (DASH) to confirm that radiohumeral arthrodesis fixed at this angle could be accepted. This technique can be recommended as a salvage procedure in the face of significant bone loss of the proximal ulna.

**Keywords:** Elbow arthrodesis; Radiohumeral arthrodesis; External fixation; DASH

### Introduction

Recently, reconstructive surgery for the arthritic elbow, such as rheumatoid arthritis, has been performed by prosthetic replacement; however, we also encountered patients who require surgery but are unsuitable for this arthroplasty occasionally. For these patients, elbow arthrodesis can be used as a salvage procedure. Elbow arthrodesis, as one of the reconstructive surgeries of the upper extremity, have been reported by several authors previously [1-7] and most of these articles described successful ulnohumeral arthrodesis using bone grafting. As far as we know, there has been no report describing radiohumeral arthrodesis without bone grafting. In the case of radiohumeral arthrodesis, it is of importance to know what position of the forearm would be more functional for the patient, since supination and pronation should be abandoned by this procedure. However, there is no report discussing what position of the forearm would be acceptable.

In this report, we present the case of a patient who sustained severe open communitated fracture with transarticular massive bone loss, and was treated by radiohumeral arthrodesis using unilateral external fixation without bone grafting. To evaluate patient-oriented quantitative functional disability, we performed limb-specific measurement questionnaire: Disabilities of the Arm, Shoulder and Hand (DASH) at more than three years after operation.

### Case Report

A 65-year-old, right-handed man drank and drove his car, and was involved in a side-impact collision with an oncoming car while his right elbow was leaning on the car window ledge. He sustained severe high-energy "sidewipe" injury to his dominant elbow, and was transferred to our medical center immediately. Initial clinical and radiographic evaluations demonstrated Gustilo-Andersen grade 3B severe open communitated fracture of the right elbow with transarticular massive bone loss including the distal humerus as well as the olecranon. Superficial soft tissue around the elbow was damaged and contaminated

severely (Figure 1). Fortunately, median and ulnar nerves were intact and no remarkable vascular deficit of the right hand was shown. He underwent copious irrigation and meticulous debridement of all contaminated bony and soft tissues. Because of his uncontrolled severe diabetes mellitus, we firstly considered amputation of his right elbow, however, he and his family strongly desired us to salvage his hand. Therefore, we attempted to perform elbow arthrodesis using unilateral external fixation as a salvage procedure. Exposure of the elbow revealed massive bone loss of the proximal fragment of the ulna and distal fragment of the humerus, indicating that arthrodesis from the humerus



**Figure 1:** Open communitated fracture of the right elbow with damaged soft tissue around the elbow.

**\*Corresponding author:** Naoki KATO, Department of Orthopedic Surgery, Saitama Medical Center, Saitama Medical University, Saitama, 1981 Kamoda, Kawagoe City, Saitama, 350-8550, Japan, Tel: 81-49-228-3627; Fax: 81-49-223-8426; E-mail: [drkato@saitama-med.ac.jp](mailto:drkato@saitama-med.ac.jp)

**Received** November 18, 2011; **Accepted** December 26, 2011; **Published** January 05, 2012

**Citation:** Kato N, Torio T, Hiromi ODA, Sakai H (2012) Radiohumeral Arthrodesis for Severe Open Communitated Fracture Using External Fixation: A Case Report. J Trauma Treat 1:105. doi:10.4172/2167-1222.1000105

**Copyright:** © 2012 Kato N, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

to the ulna would not be possible without bone grafting to preserve the length of his right forearm. We therefore decided to fuse the radius to the humerus, as the radius had no remarkable fracture and was of reasonable quality. A notch was created in the distal humerus and the proximal end of the radius was prepared to fit the distal humerus by resection of the radius head. Percutaneous two Kirschner-wires were inserted to fix the humerus and the radius, and skeletal stabilization was achieved by the application of a unilateral external fixation frame (Smith&Nephew JET-X). We attempted to fix the elbow at 90 degrees of flexion, however, deemed inappropriate due to severe swelling of the soft-tissue around the elbow. We therefore decided to fuse the elbow at 70 degrees of flexion clinically to preserve the blood circulation. The forearm was fixed at approximately 80 degrees of pronation, considering that the function of his right hand to hold and grasp objects might have priority in his daily life (Figure 2).

After the operation of the right elbow, the patient's course was complicated by continued seropurulent drainage around the Kirschner wires used for fixation of the proximal radius and the distal humerus. These wires were removed at one month after the operation and sent for culture; the culture grew *Staphylococcus aureus*, with multiple sensitivities. Thereafter, intravenous antibiotics were initiated for consecutive two weeks. Six months after the operation, radiohumeral fusion was radiographically achieved, the external fixation was removed and the patient was kept in a hinged brace for support for approximately one month.

At the most recent follow-up evaluation, three years and seven months after radiohumeral fusion, he was doing well with radiographic evidence of solid enlarged right elbow fusion (Figure 3). He reported complete resolution of pain and was able to use his right hand as a support for two-handed carrying and holding (Figure 4). We performed



Figure 4: He was able to use his right hand as a support for two-handed carrying and holding.

a standardized clinical assessment of this patient using a patient-oriented and limb-specific measurement questionnaire: Disabilities of the Arm, Shoulder and Hand (DASH), which revealed that he had 55 points. He could not bring his right hand to his face for feeding or grooming, but was able to use his contralateral left hand for fine-motor activities in his daily activities.

The patients gave the informed consent prior being included into the study.

## Discussion

Elbow arthrodesis is a salvage procedure that was firstly indicated to treat those with tuberculosis arthritis. The current indications for this procedure include persisted infection, arthritic disease with contraindications for arthroplasty, and severely comminuted intra-articular fractures [2,7,8]. To our knowledge, only a few cases of arthrodesis of the radius to the humerus have been reported [1,3]. Especially, radiohumeral arthrodesis using external fixation without bone grafting has not been reported. Advantages of ulnohumeral arthrodesis could be considered as follows: the proximal ulna is much larger than the proximal radius, the ulnohumeral articulation presents a much more favorable geometry for arthrodesis than does the radiohumeral joint, and the possibility of maintaining supination and pronation of the forearm. Although, it has been considered by many authors that the optimal position for a unilateral elbow arthrodesis is 90 degrees of flexion if the shoulder and wrist are not involved, there is little objective data that proves this position is best. O'neil et al. [9] investigated compensatory motion in the upper extremity after elbow arthrodesis and concluded that there is not a single optimal elbow position for all activities. In our case, we decided to fuse the elbow at 70 degrees of flexion to preserve the blood circulation. Considering satisfactory clinical result of this case, we consider that arthrodesis at 70 degrees of flexion could be accepted. In the respect of supination and pronation of the forearm, there is no report commenting what angle is the best position for radiohumeral arthrodesis. Although, Presnal et al. [3] described that the loss of supination and pronation with this fusion can generally be overcome with shoulder motion, we consider that limited range of motion of supination and pronation could not be fully compensated by the shoulder motion. In our case, the forearm was fixed at approximately 80 degrees of pronation, considering that the function of his right hand to hold and grasp objects might have priority in his daily life. Hildebrand et al. [10] reported that the mean values for the DASH Questionnaire of the patients who underwent semiconstrained total elbow arthroplasty due to traumatic or posttraumatic condition was 38 point. The elevated

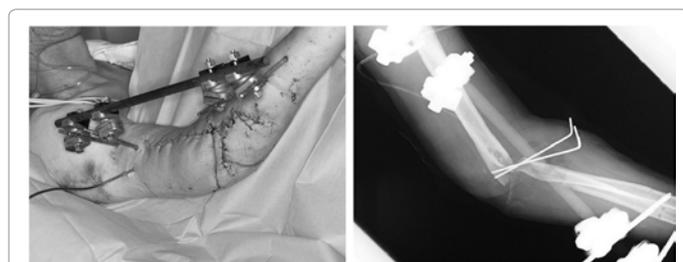


Figure 2: Radiohumeral arthrodesis was performed using unilateral external fixation frame. Elbow was fixed at 70 degrees of flexion.



Figure 3: At the most recent follow-up evaluation, radiographic evidence of solid enlarged right elbow fusion could be observed.

scores of our case reflected the functional limitations in activities of his daily living, however, he adapted his perceived disability despite consistent objective limitations. Further studies should be required to conclude whether radiohumeral arthrodesis at 70 degrees of flexion and 80 degrees of pronation would be appropriate position or not, but we consider that this position was acceptable for the function of his hand. He was satisfied with the outcome and did not ask for corrective osteotomy.

Achieving a solid bone fusion between humerus and radius remains a surgical challenge. To gain successful bone union, it is of importance to fix humerus and radius rigidly. Previous reports presenting radiohumeral arthrodesis were performed by plate-fixation with iliac bone grafting [1,3]. As far as we know, this is a first report of radiohumeral arthrodesis using unilateral external fixation without bone grafting. The external fixation offers the advantage of local stabilization with lower potential risks of postoperative infection, comparing with immediate internal fixation. In this case, we chose the external fixation, taking into account severe contamination and damage of soft tissue around the elbow, and his uncontrolled diabetes mellitus. This technique can be recommended as a salvage procedure for the patient like this case.

#### References

1. McAuliffe JA, Burkhalter WE, Ouellette EA, Carneiro RS (1992) Compression plate arthrodesis of the elbow. *J Bone Joint Surg Br* 74: 300-304.
2. Koller H, Kolb K, Assuncao A, Kolb W, Holz U (2008) The fate of elbow arthrodesis: indication, techniques, and outcome in fourteen patients. *J Shoulder Elbow Surg* 17: 293-306.
3. Presnal BP, Chillag KJ (1995) Radiohumeral arthrodesis for salvage of failed total elbow arthroplasty. *J Arthroplasty* 10: 699-701.
4. Song DJ, Wohlrab KP, Ingari JV (2007) Anterior ulnohumeral compression plate arthrodesis for revision complex elbow injury: A case report. *J Hand Surg Am* 32: 1583-1586.
5. Arafiles RP (1981) A new technique of fusion for tuberculous arthritis of the elbow. *J Bone Joint Surg Am* 63: 1396-1400.
6. Irvine GB, Gregg PJ (1989) A method of elbow arthrodesis: Brief report. *J Bone Joint Surg Br* 71: 145-146.
7. Lerner A, Stein H, Calif E (2005) Unilateral hinged external fixation frame for elbow compression arthrodesis: the stepwise attainment of a stable 90-degree flexion position. *J Orthop Trauma* 19: 52-55.
8. Gallo RA, Payatakes A, Sotereanos DG (2008) Surgical options for the arthritic elbow. *J Hand Surg Am* 33: 746-759.
9. O'neill OR, Morrey BF, Tanaka S, An KN (1992) Compensatory motion in the upper extremity after elbow arthrodesis. *Clin Orthop Relat Res* 281: 89-96.
10. Hildebrand KA, Patterson SD, Regan WD, MacDermid JC, King GJ (2000) Functional outcome of semiconstrained total elbow arthroplasty. *J Bone Joint Surg Am* 82: 1379-1386.