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## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# A case report of an isolated fracture through the radial bicipital tuberosity



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## ARTICLE INFO

### Article history:

Received 21 July 2017

Received in revised form 18 October 2017

Accepted 22 October 2017

Available online 27 October 2017

### Keywords:

Radial bicipital tuberosity

Posterior approach

Posterior interosseous nerve

Shaft fracture

## ABSTRACT

**INTRODUCTION:** Generally, anatomical reduction of shaft fractures through operative treatment is necessary to restore the anatomical relationship of the forearm bones. However, a number of nerves and vessels are located in the proximal radius, which complicates surgery. In this study, we aimed to reduce postoperative complications by using a posterior approach.

**PRESENTATION OF CASE:** We describe an isolated fracture through the radial bicipital tuberosity in a 69-year-old man caused by direct blunt force and our management of the fracture. The patient underwent an operation for the fracture under brachial plexus block. The injury was explored using the posterior approach, and plate fixation was performed after confirming the absence of obstacles to rotation on pronation and supination. One year later, the patient did not have any difficulties in activities of daily living.

**DISCUSSION:** Since an isolated fracture through the radial bicipital tuberosity is more distal than the radial head and neck and more proximal than a common radius diaphysis fracture, we had to consider a different operative approach. The nerve and blood vessels of the forearm, such as the radial nerve and artery, run in a complicated fashion around the proximal radius; thus, we chose the posterior approach because of its simpler surgical technique and lower complication risk, compared with the anterior approach.

**CONCLUSION:** Surgeons can obtain a favorable treatment result using the posterior approach to the fracture and reduce complications by ensuring with rigid fixation using a locking plate.

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## 1. Introduction

Forearm shaft fractures in adults occur in 1.35 per 10,000 people per year, and 80% of the forearm shaft fractures in male patients occur between the ages of 15 and 39 years [1]. The forearm plays an important role in rotation owing to the anatomical relationships between the radius and the ulna. A forearm fracture can disrupt this anatomical relationship, and if the treatment is ineffective, the patient might have a significant functional disorder of the forearm. Generally, anatomical reduction through operative treatment of shaft fractures is necessary to restore the anatomical relationship of the forearm bones [2].

There are many reports on forearm shaft fractures, but to the best of our knowledge, there is no report on isolated fractures through the radial bicipital tuberosity in the English literature. We

report a case of an isolated fracture through the radial bicipital tuberosity.

The work has been reported in line with the SCARE criteria [3].

## 2. Presentation of case

A 69-year-old man was struck on the right side of the body by a tree branch (~50 cm in diameter) after it was cut by a co-worker. He was transferred to our hospital from a secondary emergency hospital. The patient was on anti-hypertension medication (calcium antagonist) in the past. Informed consent was obtained from the patient, and this case report was approved by our institutional review board.

On physical examination, he was in a good state of consciousness, but he complained of right elbow pain, headache, and chest pain. His right temporal region, right chest, and right elbow had bruising, swelling, and tenderness. There was no wound or deformation. Because of the pain, he could not move his right elbow, and it was impossible to measure the range of motion of the joint. The sensory and motor functions of his right fingers and wrist were intact, and he did not have evidence of neural damage. Radiographs

*Abbreviations:* PIN, posterior interosseous nerve; IM, intramedullary.

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<https://doi.org/10.1016/j.ijscr.2017.10.037>

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**Fig. 1.** (a,b) In the initial X-ray scan, the white arrow indicates the shaft fracture of the radial bicipital tuberosity; (c,d) at 1 year after surgery, the fracture of the radial bicipital tuberosity demonstrates bony union.

revealed an isolated fracture through the radial bicipital tuberosity as well as osteoarthritis of the distal radioulnar joint (Figs. 1 and 2). The patient also sustained skull fracture and multiple right rib fractures, and right hemothorax was noted using computed tomography. He was hospitalized after the insertion of a thoracic catheter and was evaluated by neurosurgeons and thoracic surgeons on the day of admission.

Two weeks after he recovered from his multiple injuries, he underwent an operation for the fracture under brachial plexus block (0.25% bupivacaine 37.5 mg and 1% mepivacaine 150 mg) in supine position. A hand surgical specialist with more than 15 years of experience administered the anesthesia and performed the surgery.

The injury was explored using Boyd's approach (posterior). The forearm was pronated in order to move the posterior interosseous nerve (PIN) away from the operative field. The PIN was protected by subperiosteally reflecting the supinator that arises from the ulna. No dissection of the PIN was performed. The annular ligament was detached from the ulna. Reduction was performed. Then, the placement of the plate was determined after confirming that there was no obstacle to rotation on pronation and supination (Fig. 3), and it was placed opposite to the attachment point of the biceps tendon. This was followed with fixation with six screws using the LCP distal radius system 2.4 dorsal plate (Synthes Holding AG, Solothurn,

Switzerland). The annular ligament was then repaired by suturing it to the periosteum and surrounding soft tissues.

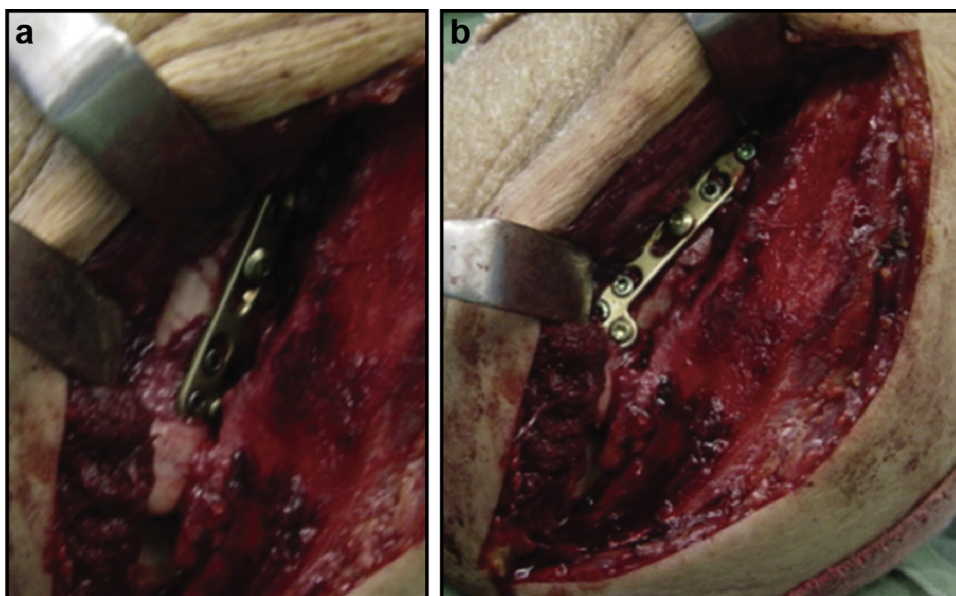
His right upper extremity was placed in a long arm splint immediately after operation, and he began rehabilitation on the fifth day. There was no evidence of PIN paralysis. Follow-ups on the condition of the bone and the implant, using X-ray to check for loosening of the screw and presence of callus formation, were done once a week. The splint was removed 6 weeks after surgery. He underwent rehabilitation 2 times a week for 5 months. One year later, the patient did not have any difficulties in activities of daily living, but the range of motion of his elbow joint was limited to  $-10^{\circ}$  extension,  $110^{\circ}$  flexion,  $10^{\circ}$  supination, and  $45^{\circ}$  pronation (Fig. 1); his Disabilities of the Arm, Shoulder and Hand score was 19.4, and he was satisfied by the treatment.

### 3. Discussion

Avulsion fracture of the radial tuberosity has only been reported once in the literature [4], and to the best of our knowledge, isolated fracture through the radial bicipital tuberosity has not been reported in the English literature. Radial shaft fractures often occur with indirect force and are generally more distal to the radial bicipital tuberosity, but in our case, it resulted from a direct force. Our patient had range of motion restriction between the radius and ulna



**Fig. 2.** Radiographs of the shaft fracture: (a) anteroposterior and (b) lateral views. The distal radioulnar joint had osteoarthritis.



**Fig. 3.** (a) On supination, the plate does not impinge upon the proximal radioulnar joint; (b) on pronation, the posterior interosseous nerve was retracted away from the fracture while the plate was applied.

due to osteoarthritis of the distal and proximal radioulnar joints, which may have predisposed to this unusual fracture.

Since an isolated fracture through the radial bicipital tuberosity is more distal than the radial head and neck and more proximal than a common radius diaphysis fracture, we had to consider a different operative approach. The nerve and blood vessels of the forearm, such as the radial nerve and artery, run in a complicated fashion around the proximal radius, and Bartoníček et al. [5] reported using an anterior approach, but they noted that it should be performed carefully to avoid neurovascular damage during surgery. The anterior approach requires isolation and protection of the neurovascular structures and detachment of the bicep insertion for

plate placement. A lateral approach, as described by Kocher and Kaplan, is generally used for radial head and neck fractures, but Kim et al. [6] reported that plate fixation of radial shaft fractures near the radial bicipital tuberosity is difficult. Robinson et al. [7] reported that the posterior approach (Boyd's method) is useful for the treatment of radial head and neck fractures and it reduces the risk of PIN paralysis. Nasab et al. [8] found that the results and short-term complications of the anterior and posterior approaches used in the operative treatment of proximal radius fractures were similar.

We chose the posterior approach because of its simpler surgical technique and lower complication risk, compared with the anterior approach. We reduced the risk of PIN paralysis by allowing the

patient's forearm to pronate as much as possible and then separating the nerve from the surgical site [9]. We achieved a clear field of vision during the operation, which enabled us to perform plate fixation while protecting the proximal radioulnar joint.

To reduce the risk of PIN injury, intramedullary (IM) nailing may be used. A study recently reported that IM nailing achieves a good result for radial shaft fractures distal to the radial bicipital tuberosity while reducing soft tissue damage [5]. Because the distance from the radial bicipital tuberosity to the radial head is too short to provide adequate fixation if the surgeon cannot insert a sufficient length of the nail, the nail may not provide enough fixation for the radial bicipital tuberosity bone fracture. Therefore, we do not suggest the use of IM nailing for proximal radius fractures involving the radial bicipital tuberosity.

We consider surgery to be necessary in the anatomical reduction of radius shaft fracture. If the fracture site is not proximal, the anterior approach can be used, but in the case of proximal sites, the posterior approach should be used to reduce the risk of complications during surgery. Since anatomical reduction and fixation that can withstand rehabilitation on the early stage are necessary, we selected a locking plate for fixation. If firm fixation is possible, rehabilitation can be started during the early stage. When planning treatment, the approach should be considered in order to reduce the risk of complications as well as the fixation method needed to achieve functional recovery. The limitation of this study is that the number of cases is small, making it impossible to conduct sufficient verification. The weak point is that with a good surgeon, the risk of complications is low, even in the anterior approach. However, the posterior approach is considered the most promising in reducing intraoperative complications irrespective of years of experience.

#### 4. Conclusion

We described a very rare case of an isolated fracture through the radial bicipital tuberosity. We achieved a favorable treatment result using the posterior approach to the fracture and reduced complications through rigid fixation using a locking plate.

#### Conflicts of interest

None.

#### Sources of funding

We have no sources of funding for our research.

#### Ethical approval

The patient provided informed consent, and the study design was approved by Niigata Prefectural Shibata Hospital's ethics review board, with approval number 156.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

#### Author contribution

All the authors have been actively involved in the planning and performance of the study and have also assisted with the preparation of the submitted article.

#### Guarantor

Kanta Imao.

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