

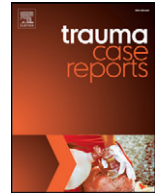


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### Case Report

# Comminuted distal humeral fracture treated using the Ilizarov technique in a patient with rheumatoid arthritis and osteoporosis

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#### ABSTRACT

The goal of treatment for distal humeral fractures in patients with rheumatoid arthritis (RA) is to obtain sufficient bone union and good elbow function. However, treating comminuted distal humeral fractures in patients with RA and osteoporosis is challenging. We present the case of a 58-year-old woman with RA and osteoporosis who suffered a comminuted distal humeral fracture and was successfully treated with the Ilizarov technique. The Ilizarov technique is minimally invasive compared with conventional open surgery, can obtain good stabilization, and allows earlier rehabilitation, even if the fractured bone is severely osteoporotic. The patient exhibited good elbow function and alignment at the final follow-up examination (18 postoperative months). To the best of our knowledge, the present case is the first in which a comminuted distal humeral fracture in a patient with RA and severe osteoporosis was successfully treated with an Ilizarov external fixator.

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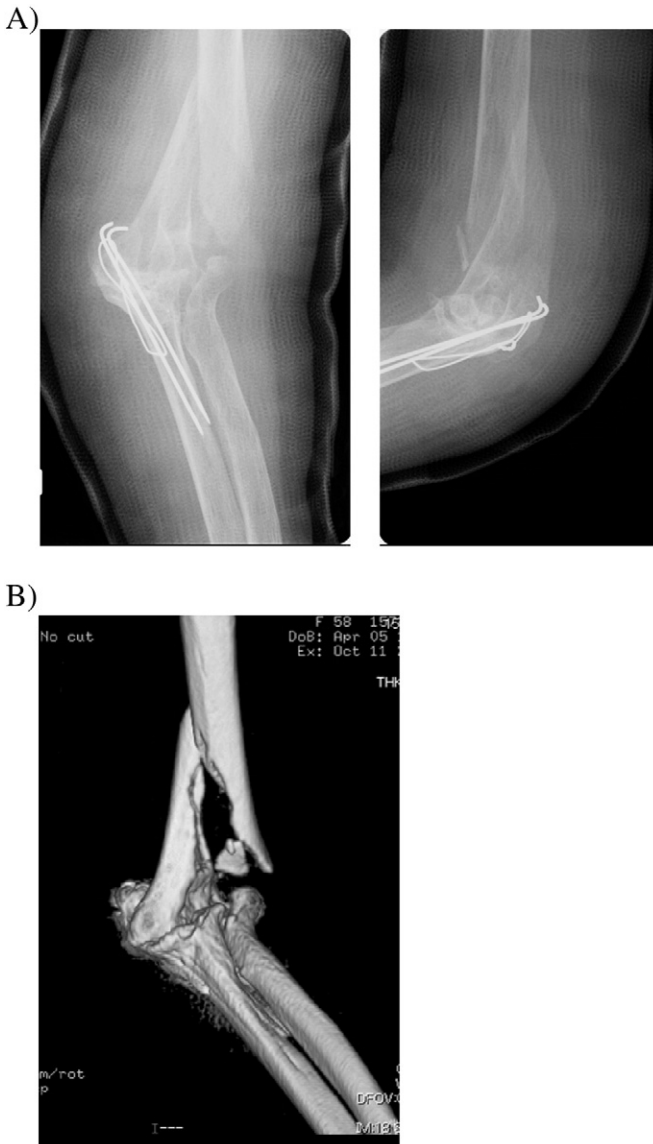
#### Introduction

Patients with rheumatoid arthritis (RA) often have fragile osteoporotic bones and dysfunctions of the articular joints. The elbow is one of the joints that are commonly affected by RA. Thus, distal humeral fractures,

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especially comminuted fractures, are difficult to treat in patients with RA [1], and the utility of surgery for treating distal humeral fractures in such patients is disputed. For example, contradictory results have been reported regarding the effectiveness of internal fixation using conventional plating techniques (open reduction and internal fixation: ORIF) for repairing distal humeral fractures in osteoporotic patients [2–4]. Herein, we present the case of a patient with RA and osteoporosis who suffered a comminuted distal humeral fracture and was successfully treated using the Ilizarov technique; i.e., using an Ilizarov external fixator. The Ilizarov technique could be an effective treatment for comminuted distal humeral fractures in patients with RA.

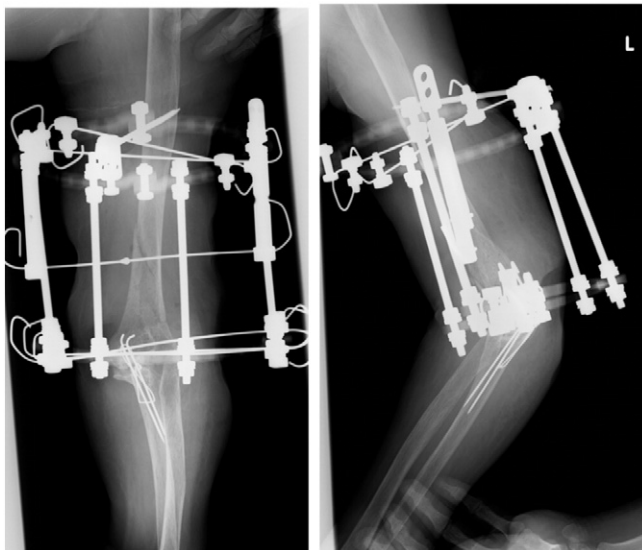


**Fig. 1.** Preoperative X-rays (A) and a 3D-CT image (B) of the left elbow. A comminuted distal humeral fracture of the left elbow was detected.

## Case report

A 58-year-old Japanese female with RA presented with left elbow pain after she had fallen on the floor while walking in her home. Radiological examinations including X-rays and a 3-dimensional computed tomography (3D-CT) scan revealed a comminuted distal humeral fracture (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopedic Trauma Association [AO/OTA] type 13-A2) (Fig. 1). The patient had been suffering with RA for 24 years and was currently being treated with methotrexate at a dose of 8 mg/week, bucillamine at a dose of 100 mg/day, tacrolimus at a dose of 2 mg/day, etodolac at a dose of 400 mg/day, and prednisolone at a dose of 1 mg/day. Her RA was classified as stage IV according to the Steinbrocker staging system [5] and Class III according to the American College of Rheumatology classification [6]. Her medical history included a left olecranon fracture 5 years earlier. The bone mineral density of her lumbar spine was evaluated with dual energy X-ray absorptiometry, which demonstrated severe osteoporosis (0.503 g/cm<sup>2</sup> or a T-score of −3.8). ORIF was initially considered; however, it was suspected that ORIF would not achieve sufficient stability because of the patient's fragile osteoporotic bone. In addition, earlier postoperative exercises aimed at minimizing elbow joint dysfunction were required in this case because the patient was also suffering from arthritis in her shoulders and wrists. Therefore, we decided to perform a closed indirect reduction technique involving the use of an Ilizarov ring fixator (Smith & Nephew Richards, Memphis, TN) in order to stabilize the osteoporotic bone without adversely affecting the patient's postoperative elbow movement.

The Ilizarov ring fixator surgery was performed without a tourniquet while the patient was in the supine position and under general anesthesia. We used a full ring for the proximal Ilizarov frame and a 5/8 ring for the distal frame to allow movement around the elbow. Two straight wires were inserted into each frame. The wires were inserted via skin incisions from the medial side to avoid the ulnar and radial nerves. In the distal frame, two wires inserted from medial epicondyle to lateral epicondyle. The crossing angle between these two wires was 20°. Regarding the Ilizarov procedure itself, a closed indirect reduction technique was performed under fluoroscopy, in which ligamentotaxis was used to compress the fracture ends. The repositioning was simple and complete. We placed an olive wire across the fracture site, a titanium half pin (4 mm) in the proximal frame, and a straight wire in the distal frame to fix it rigidly in place (Fig. 2). There was no need to open the fracture site. Physical therapy involving range of motion exercises was started immediately after surgery. Treatment with a low intensity pulsed ultrasound (LIPUS) stimulation device (SAFHS 4000), Exogen, Inc.,

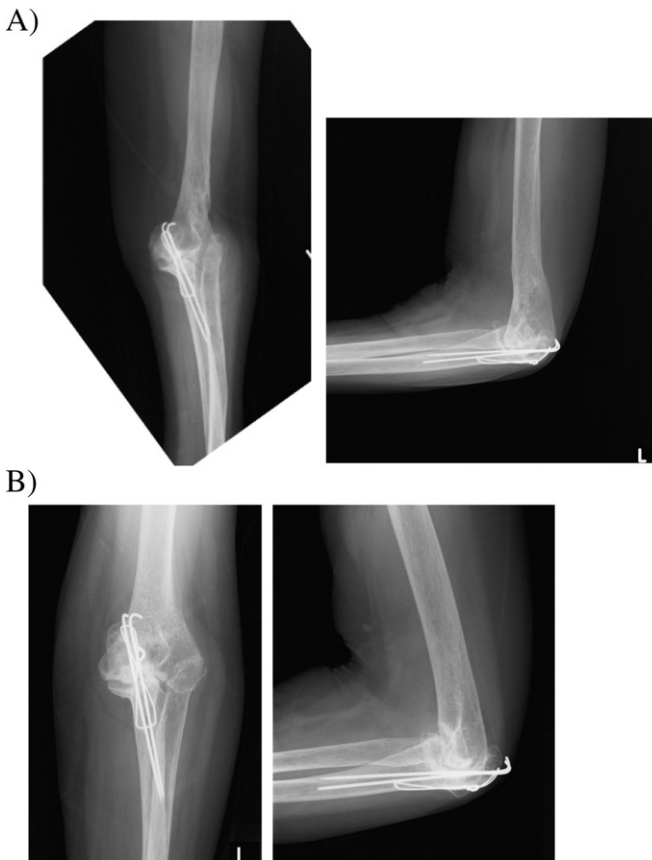


**Fig. 2.** Postoperative X-rays of the left elbow obtained immediately after surgery. Closed indirect reduction was performed with an Ilizarov fixator.

Piscataway, NJ) and teriparatide (Forteo®; Eli Lilly Japan, Kobe, Japan), a recombinant human parathyroid hormone, at a dose of 20 µg/day were also started to promote bone healing after surgery. Solid bone union was achieved at 9 postoperative weeks, and the frame was removed in the 10th postoperative week. The patient's postoperative course was uneventful, and no pin site infection or nerve injuries occurred. At the latest follow-up examination (18 postoperative months), no angular malalignment was observed on X-rays (Fig. 3A, B). The affected elbow exhibited range of motion values of  $-20^{\circ}$  during extension and  $95^{\circ}$  during flexion, respectively, which were the same as those seen before the injury.

## Discussion

Distal humeral fractures account for less than 2–4% of all fractures and are rare in patients with RA [1–3]. The standard treatment for such fractures is ORIF and double plating [7]. However, this technique is invasive because extensive soft tissue dissection and an olecranon osteotomy are often required. The surgical outcomes of ORIF procedures are disputed, but approximately 2% to 5% ORIF procedures for such fractures result in non-union [3]. In younger patients, ORIF can achieve good fixation; however, in elderly individuals with osteoporosis it can be unsuccessful because such patients have reduced bone volumes and weaker bones [2,4]. Patients with RA often also have significant osteoporosis (like in the present case) as well as joint distortion due to arthritis, and so their bones offer little purchase to screws. Therefore, we suggest that it is doubtful whether ORIF should be indicated for such fractures in patients with osteoporotic RA.



**Fig. 3.** Comparison of X-rays obtained at the final follow-up examination and before the injury. The alignment of the left elbow at 18 postoperative months (A) was comparable with that seen before the present injury (B).

Primary total elbow arthroplasty (TEA) is another surgical option for patients with severe osteoporosis. A previous study reported that among women aged  $\geq 65$  years who suffered distal humeral fractures, 92% of those that underwent primary TEA achieved excellent of Mayo elbow performance scores, whereas this was only the case for 33% of the patients treated with ORIF, and another 33% of the patients that underwent ORIF exhibited poor or fair scores, including 75% of the cases in which conversion to TEA was required [8]. Some studies have concluded that primary TEA is better than ORIF for treating distal humeral fractures in RA patients with severe articular involvement [1]. However, TEA can cause various complications such as aseptic loosening, infection, [9,10], and periprosthetic fractures that are particularly common in patients with RA [9].

The original principle of the Ilizarov technique involves closed indirect reduction performed under fluoroscopy. The Ilizarov procedure enables anatomical joint surface reduction and stable fixation to be achieved in bones of all qualities. In addition, the early recovery of the patient's range of motion is possible because of the stable fixation brought about by the procedure. Another advantage of this technique is that it causes minimal soft tissue damage, thereby preserving the blood supply around the fracture site and promoting bone healing [4]. Regarding distal humeral fractures, the Ilizarov technique is indicated for open, complex fractures and salvage treatment in cases of non-union [3,4]. To the best of our knowledge, there are no articles about the outcomes of circular external fixator-based treatment for distal humeral fractures in RA patients. However, there has been a report about the use of Ilizarov external fixators to treat distal humeral fractures in elderly patients with osteoporotic bone [4]. The latter study obtained good functional results and a low complication rate. In the present case, good stabilization, early mobilization of the elbow, and good bone union and alignment were achieved, even though the patient had poor quality bone and a distractive elbow joint due to RA. The range of motion of the patient's elbow recovered to its pre-injury level. Therefore, we strongly recommend that this technique should be employed instead of ORIF or TEA for treating distal humeral fractures in patients with RA and osteoporosis.

### Conflict of interests

The authors of this case report have no conflicts of interest to disclose.

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