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Case Report

A rare case of peri-implant distal radius fracture[☆]

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ABSTRACT

A peri-implant fracture near the volar plate of distal radius represent a very rare injury. The main factor of this lesion is high energy trauma on the wrist. We report a case of a 61-year-old woman with a peri-implant fracture located just proximally to the plate and a fracture of the ulnar head that occurred after a simple fall. The patient was surgically treated by plate and screws removal. The fracture was fixed using a longer volar plate for the radial fracture and a plate for the head ulnar fracture. Different factors such as osteoporosis, BMI and screw position could influence the fracture pattern. However, considering growing use of plates for distal radius fracture fixation, the frequency of these kind of fracture will probably increase.

Introduction

Forearm fractures are amongst the most common fractures in the adult population, with a variable incidence between genders and age groups, while distal radial fractures (DRF) are more frequent in the elderly [1,2]. Generally, DRF are treated non-operatively with closed reduction and cast immobilization, but in the last two decades surgical management with volar locking plate has gained popularity to allow early rehabilitation and the improvement of functional outcomes [3,4]. However, this surgical technique can be associated with complications and failures which are widely reported in medical literature [5,6].

In this article, we describe a rare case of a peri-implant fracture due to a trauma near the volar plate of distal radius which was successfully treated without long-term complication.

Case presentation

A 61-year-old woman attended to our emergency room after a fall on her right (dominant) wrist. The patient was in good health with no known comorbidities, with a BMI of 31. Her medical history showed that four years previously the patient had undergone on

[☆] All patients provided the informed consent for the publication of the clinical history. The study was authorized by the local ethical committee and was performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000.

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an open reduction and internal fixation with a stainless-steel volar locking plate for ipsilateral distal radius fracture. The patient reported good clinical outcome without any local complications.

At the physical examination the wrist showed a volar angulation deformity. The patient was unable to actively move the wrist, with aggressive pain at passive movements. No vascular or neurological deficiencies were found. An X-ray examination revealed a peri-implant fracture of the radius just proximally to the plate, and a fracture of the ulnar head; the plate was still affixed to the distal radius and the radiocarpal joint had a dorsal tilt (Fig. 1). The following day, the patient was surgically treated. A volar approach was performed with a skin incision placed over the previous surgical scar. The plate and screws were removed and the reduction was performed. Internal fixation was performed using a longer volar plate for the radial fracture and a plate for the head ulnar fracture (APTUS Distal Radius System, Medartis, Basel, Switzerland). Reduction maintenance and articular alignment were restored to a neutral volar tilt. The x-rays images after the procedure showed a good reduction of the fractures (Fig. 2a). Postoperatively, the forearm was splinted for 10 days. After removing the stitches, the patient started rehabilitation to improve the range of motion in the forearm and wrist, using active and gentle active-assisted exercises. Clinical and radiological follow-up was scheduled at 1, 3 and 6 months. At the 30-day follow-up, the ROM was 25° of dorsiflexion, 30° of palmar flexion, 45° of pronation and supination. At 3 the month follow-up, the DASH score was 23.3 and the Mayo Wrist Score was 65, with ROM of 45° of dorsiflexion and 60° of palmar flexion and prono-supination. X-rays showed a good consolidation of the fractures (Fig. 2b). After 6 months, the DASH score was 14,2 and Mayo Wrist score was 75, the ROM was 55° of dorsiflexion, 80° of palmar flexion, 90° of pronation and 85° of supination. All movements were completely painless and normal daily activities were restored (Fig. 3). X-rays at 6 months showed a complete consolidation of fractures (Fig. 2c). During the follow-ups, the patient was studied with bone-density test: she resulted to have severe osteoporosis with a T-score of -3.1 at the femoral neck. No alteration related to the imbalance of calcium and sex hormones were observed, the only one value under the reference ranges was vitamin D. The patient was treated with 70 mg Alendronate orally once a week and monthly supplementation with 25000 UI vitamin D. Periodic follow-ups were scheduled every 6 months.



Fig. 1. X-ray shows fracture of the radius proximally to the plate and fracture of the ulnar head in antero-posterior and lateral views.



Fig. 2. X-rays in AP and LL: postoperative reduction of fractures using a longer volar plate for the radial fracture and a plate for the head ulnar fracture (a), good consolidation of fractures at 3 months follow-up (b), complete consolidation of fractures at 6 months follow-up (c).



Fig. 3. Clinical results at 6 months follow up: complete restoration of flexion-extension and pronosupination.

Discussion

The peri-implant wrist fractures are very rare, but probably the number of these fractures will increase more and more due to incremental use of plates for the treatment of wrist fractures [7]. In the literature, only one [8] similar case of fracture occurred proximally to the volar radius plate is reported. In that case, the radius fracture was associated with an ulnar shaft fracture, after a traffic accident in a 34 years old patient. The patient was treated with the old implant removal and a new internal fixation with longer plate for the radius and a plate to the ulnar fracture. However, if in this case the fractures were due to a high energy trauma, in our case a simple fall was enough to create the fracture. The cause of this is probably attributable to the high degree of osteoporosis of the patient: the poor bone quality can compromise strength and eventually lead to bone fragility [9]. In fact, osteoporotic bone is

characterized by thinned cortex, decreased trabecular density, and decreased stiffness [10]. Further, it could be observed a resistance reduction at the level of the tip of the osteosynthesis implant that could act as a stress riser. Consequently, peri-implant fractures could occur as complications of osteoporotic fracture treatment [11,12].

Analyzing the hardware construction, we observed that cortical screws were inserted in the proximal hole of the plate in both cases. A recent biomechanical study [13] shows that longitudinal shaft fracture and peri-implant fractures seemed to be a more relevant problem using locking screws in the proximal holes rather than cortical screws. For this reason, the cause of these atypical fractures must be sought in others mechanical problems. In literature is widely accepted that the midline of the bone is the best site for fixation, since screws have an optimal bi-cortical hold at this level [14]. When a screw track is completely in cortical bone, more bone has been drilled through increasing the risk of fracture. Analyzing the proximal screw position of the primary implant in our case (Fig. 1), it is clear that the position of the screw was not perfectly placed in the midline of the bone, but it was in a “off-centre” position on the transverse plane. That screw position probably created a *locus minoris resistentiae* of the radius shaft. Therefore, despite the simple fall, severe osteoporosis in addition to the high weight of the patient, increased the load near that weak point proximally to the plate creating the shaft fracture.

Thus, with this type of fracture, it is necessary to investigate the presence of osteoporosis through blood tests and DEXA examination, and set an adequate therapy. It will also be necessary to monitor the healing process of the fracture, periodically evaluating the disease parameters to follow the effectiveness of therapy for osteoporosis.

Conclusion

A peri-implant fracture near the volar plate of distal radius represents a very rare injury. The increase of the use of plates and screws could increase the incidence of this type of fracture. A trauma of high energy associated with poor bone quality can determine a new fracture around the plate.

Declaration of competing interest

All authors have disclosed all financial support for this work and other potential conflict of interests related to the publication of this manuscript.

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