

# Minimally Displaced Distal Radius Fracture Treated with Closed Reduction and Percutaneous Fixation Resulting in an Iatrogenic Galeazzi Lesion

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## Abstract

### Keywords

- Galeazzi
- fracture
- radius
- children
- surgery

Galeazzi fracture in skeletally immature patients is a relatively uncommon injury. No previously published case has been associated with an iatrogenic mechanism. Here, we report a case of a 10-year-old boy with a minimally displaced distal radius fracture evolving into a Galeazzi lesion after unnecessary surgical treatment. Unnecessary surgical procedure associated with poor knowledge of bone growth and physiology contributed significantly to the reported condition.

## Introduction

Fractures of the distal third of the radius associated with distal radioulnar joint (DRUJ) dislocation are known as Galeazzi fractures (GFs).<sup>1–3</sup>

Overall, fractures of the forearm are relatively common in children and adolescents, comprising approximately 20% of all fractures. However, the incidence of GF in skeletally immature patients is low, ranging from 0.3 to 2.8% of all forearm fractures.<sup>4–8</sup> GFs are more common in adults, comprising 2.7 to 6.8% of all forearm fractures, and are most often secondary to high-energy trauma with rapid forced loading of an outstretched radially deviated, dorsally flexed wrist.<sup>2,9,10</sup>

To date, relatively few studies dealing with GF in skeletally immature patients have been reported in the orthopedic literature. Most importantly, none of the GFs reported in children and adolescents has been associated with an iatrogenic mechanism.<sup>5,6,8</sup>

In the pediatric population, good to excellent outcomes have been reported after prompt closed reduction and long arm cast immobilization,<sup>2,6</sup> and long-term instability of DRUJ following conservative treatment has seldom been observed.<sup>4</sup>

This report presents the case of an iatrogenic GF in a child initially treated for a minimally displaced distal radius fracture, and goes on to discuss the mechanism of injury and the

treatment modalities, pointing out the importance of remaining growth and remodeling potential in skeletally immature patients.

## Case Report

A 10-year-old boy presented to the emergency department of another institution with a left wrist injury after a fall while playing football. Clinical examination found pain and swelling of the left wrist in an otherwise healthy patient. Anteroposterior (AP) and lateral radiographs of the left wrist found a minimally displaced distal metaphyseal radius fracture with intact ulna (►Fig. 1). The fracture was immobilized in a long arm cast with the wrist in the neutral position and the elbow flexed 90 degrees.

AP and lateral radiographs taken approximately 12 days after initial casting revealed a 22-degree volar displacement of the fracture (►Fig. 1). Closed reduction and percutaneous fixation with two 2 mm Kirschner (K) wires was performed; the patient was immobilized in a long arm cast. Postoperative AP and lateral radiographs showed the radioulnar index at 0.5 mm<sup>11</sup> and dorsal subluxation of the ulnar head, respectively. No further treatment was given at this point. The cast was removed 6 weeks after surgery; AP and lateral radiographs of the injured wrist showed worsening of the radioulnar

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**Fig. 1** (A) Anteroposterior and (B) lateral radiographs of the forearm at presentation. (C) Anteroposterior and (D) lateral radiographs of the forearm showing 22-degree volar displacement of the fracture (12 days after injury).

index,<sup>11</sup> dorsal dislocation of the ulnar head, and poor consolidation of the fracture, with 30-degree volar displacement of the distal fragment of the radius (**►Fig. 2**). K-wires were removed under general anesthesia after 1 week.

Four months after the initial injury, the patient was referred to our institution. Clinical examination revealed volar deviation of the radius, dorsal displacement of the ulnar head, 80 degrees lack of wrist extension, and full wrist flexion. Flexion–extension of the elbow and pronation of the forearm were within normal limits, although active and passive supination of the forearm were limited (range of movement, 90–0–0 degrees) (**►Fig. 3**). Moreover, the patient complained of recurrent wrist pain at rest and during daily life and sports activities.

A computed tomography scan of the forearm was performed to assess the anatomy of the lesion and confirm the diagnosis of an iatrogenic GF (**►Fig. 4**).

An extension osteotomy of the distal radius with locking compression plate and screws (LCP 2.4 Synthes, Etupes, France) was performed to correct the deformity, restore the radioulnar index, and reduce the ulnar head dislocation (**►Fig. 5**). Intraoperative findings showed full recovery of forearm pronosupination, full wrist flexion–extension, full elbow flexion–extension, and normalization of the radioulnar index.<sup>11</sup>

The LCP plate was removed 11 months after surgery, and range of movement of wrist and elbow remained within normal limits, comparable to the contralateral side (**►Fig. 6**). The patient resumed full sport activities 1 month after the last surgery.



**Fig. 2** Postoperative, (A) anteroposterior, and (B) lateral radiographs of the forearm immediately after closed reduction and percutaneous fixation. (C) Anteroposterior and (D) lateral radiographs of the forearm at cast removal showing a low radioulnar index, dorsal dislocation of the ulnar head, and 30-degree volar displacement of the distal radius.



**Fig. 3** Range of movement of both forearms before corrective surgery: (A) neutral position, (B) pronation, and (C) supination.

## Discussion

This study reports a case of iatrogenic Galeazzi lesion secondary to surgical treatment of a minimally displaced distal radius fracture with intact ulna in a 10-year-old boy. This case points out the negative effects of unnecessary surgical treatment for a fracture that would eventually have remodeled spontaneously.

To the best of our knowledge, this is the first case to date describing an iatrogenic Galeazzi lesion in a skeletally immature patient. No similar injuries have been reported in adult orthopedic literature either.

The DRUJ is the specific anatomic area damaged in Galeazzi-type injuries, and is composed of joints and soft tissue stabilizers.<sup>12–14</sup> It is part of the complex functional unit of the forearm,<sup>15</sup> along with the proximal radioulnar joints, the interosseous membrane, and the muscles (i.e., pronator quad-

ratus, distally), that allows movements such as pronosupination, which is important for correct function and positioning of the hand in space.<sup>15,16</sup>

This case shows that the balance of the DRUJ and its integration within the functional unit of the forearm have been altered by an attempt to correct mild secondary displacement of the initial fracture (►Figs. 1 and 2). The reduction maneuver was performed 12 days after the injury. We hypothesize that the relatively advanced consolidation process was not taken into account. The attempt to reduce the relatively rigid and locally deformed radius initially triggered the ulnocarpal subluxation, which subsequently evolved into a dislocation (►Fig. 2). However, it is also possible that there was already an injury of the DRUJ at the first presentation subsequently worsened due to the surgical treatment.

Biomechanically, the effort to reduce the volar displacement of the radius pushed the ulna dorsally. It has been shown that when a distal radius fracture is located within 7.5 cm of the radiocarpal joint, DRUJ injuries are more likely to occur.<sup>17</sup> Overtime, the dorsally displaced ulna continued to grow behind the carpal bones, making the dislocation definitively irreducible.

The dorsal dislocation of the ulnar head, the volar displacement of the radius in association with torn soft tissues and damaged muscles, and interosseous membrane contributed to mechanically obstruct both the extension of the wrist and the supination of the forearm. This hypothesis is further supported by the failure of the attempt to reduce the fracture, and the unchanged volar displacement of the radius, while the ulnar head was pushed dorsally.

Not all distal radius fractures in skeletally immature patients require surgical treatment. It is essential to accept orthopedic treatment in such injuries,<sup>18</sup> giving the bone time to remodel and realign spontaneously, whenever possible.<sup>19–21</sup>

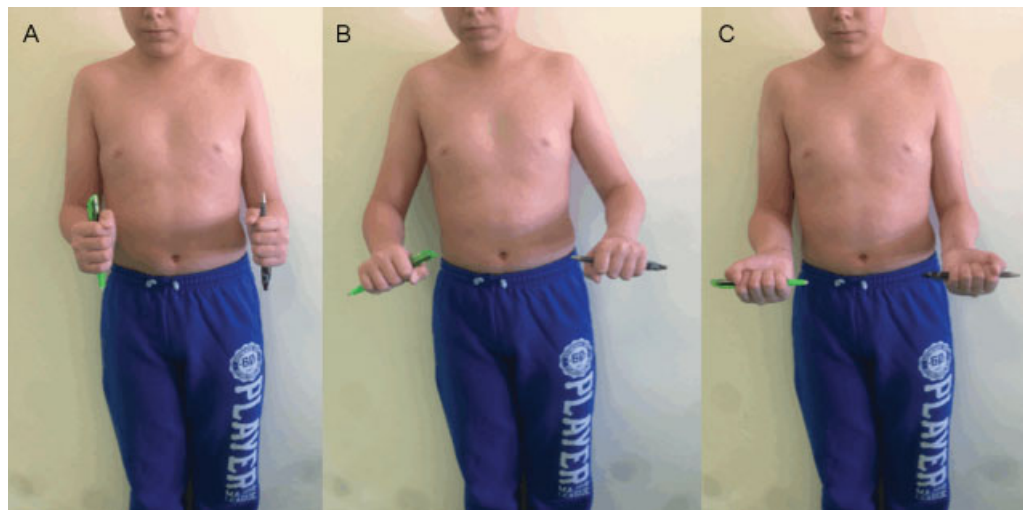
The initial fracture was located in the distal metaphysis of the radius, close to an active growth plate providing approximately 80% of forearm growth. Growth of the limbs stops at Risser 1 or 15.5 years bone age in boys; therefore, the patients had at least 5 years of remaining growth left.<sup>21</sup> Moreover, the amount of displacement that prompted the surgeon to attempt a closed reduction and percutaneous fixation of the distal radius fracture was mild, with the bone segments well aligned overall. It is important to state that the most remodeling occurs when displacement is located close to an active growth plate, and when it is within the axis of the physiological range of movement of the joint, that is, flexion–extension for the wrist.<sup>20–22</sup>



**Fig. 4** (A) Anteroposterior and (B) lateral and computed tomography scan with (C) three-dimensional reconstruction of the wrist showing volar deviation of the radius and dorsal displacement of the ulnar head.



**Fig. 5** Postoperative (A) anteroposterior and (B) lateral radiographs of the forearm after corrective osteotomy and postoperative (C) anteroposterior and (D) lateral radiographs of the forearm after hardware removal.



**Fig. 6** Range of movement of the two forearms after corrective surgery (1 year after initial injury): (A) neutral position, (B) pronation, and (C) supination.

A corrective osteotomy was necessary, as spontaneous reduction of the ulnar head was not possible at this stage because the bone was growing in a dislocated position.

## Conclusion

In conclusion, this work reminds us that distal radius fracture with displacement up to 25 to 30 degrees can remodel spontaneously. Surgical treatment is therefore seldom indicated, unless the patient is skeletally mature. On the contrary, ulnar dislocation cannot reduce spontaneously, as the bone continues to grow.

Finally, it is important to bear in mind that remaining growth has to be considered before any treatment is started.

## Note

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