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Chronic Galeazzi Fracture Treatment with Ulnar Shortening Osteotomy Methods: A Case Report

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ABSTRACT

Introduction: Upper extremity fractures, especially Galeazzi fractures, are common problems. A Galeazzi fracture is a distal third-radius fracture with disruption of the Distal Radioulnar Joint (DRUJ), often caused by high-energy trauma. The clinical features of a Galeazzi fracture include pain, swelling, and deformity at the wrist, along with an inability to rotate the forearm. In this patient, the complication was more challenging to treat due to improper initial treatment, leading to a neglected fracture of the right wrist.

Case Presentation: A 26-year-old male, presented to the Trauma Center at a General Hospital. He complained of being unable to move his arm freely, difficulty rotating his distal forearm (supination and pronation), and diminished grip strength, symptoms he had experienced for 8 months. Despite these challenges, the patient was eager to undergo proper treatment to restore his activity and daily tasks to normal.

Clinical Discussion: Our surgical intervention, including ulnar shortening, transfixing wire placement, and bone grafting, led to a remarkably successful outcome. The patient showed improved pronation, supination, and grip strength, as evidenced by the DASH (Disabilities of the Arm, Shoulder, and Hand) score. This outcome instills optimism for similar cases and reassures the effectiveness of our treatment.

Conclusion: The Darrach procedure, Sauve-Kapandji treatment, and ulnar shortening are among the sophisticated methods required for patients with malunion issues. Effective diagnostic and surgical techniques can significantly improve patient outcomes.

Keywords: Galeazzi Fracture, Malunion, Ulnar Shortening, Transfixing Wire, Case Report

INTRODUCTION

The lower arm, a crucial part of the body, facilitates essential daily activities such as pronation and supination. A fracture in this area can lead to temporary or permanent disability, underscoring the significance of the Galeazzi fracture. First described by Sir Astley Cooper in 1822 and later elucidated by Riccardo Galeazzi in 1934, this fracture, if not properly managed, can have profound implications on a patient's life. [1]

A Galeazzi fracture, a middle-to-distal third-radius fracture associated with dislocation or subluxation of the distal radioulnar joint (DRUJ), can have profound implications if not managed properly. This case report

details a malunion Galeazzi fracture resulting from a traffic accident 8 months prior. The patient, who had not sought hospital treatment but instead consulted a bone setter, experienced a significant decline in his quality of life. We performed ORIF (Open Reduction Internal Fixation) on the radius and ulna, ulnar shortening, temporary transfixing wire placement on the ulna, and bone grafting. This report underscores the importance of adhering to the SCARE 2023 guidelines, which ensure a structured and transparent approach to reporting surgical case studies. [2]

CASE PRESENTATION

A 26-year-old male presented with complaints of restricted movement in his lower arm diminished grip strength, and difficulty in pronation and supination, which developed after a traffic accident 8 months earlier. These issues significantly impacted his work as a mechanic and his ability to perform daily tasks. He visited the Trauma Center at a General Hospital in Pekanbaru, Riau. The patient had been riding a motorcycle at a speed of around 40–60 km/h when another vehicle unexpectedly turned, causing him to fall. His right hand was outstretched and twisted, hitting the asphalt while supporting his body.

After the accident, the patient experienced pain, swelling, and difficulty moving his right arm. He did not go to the hospital, opting for bone setter. As a mechanic, he found that the improper treatment interfered with his work and daily tasks. Physical examination revealed an angulation deformity, limited pronation and supination (0–20° compared to the unaffected side at 0–80°), and pain during flexion and extension of the right wrist. The Visual Analog Scale (VAS) score was 3. Neurovascular examination was routine, and there was no history of smoking, drug use, or allergies. X-ray examination is shown in (Figure 1).

Figure 1. The initial x-ray of the patients shows there is Malunion in distal radius and ulnar site.

The patient was diagnosed with a Chronic Galeazzi Fracture of the Right Distal Radius. In this patient, the ulnar fracture was only disrupted at the lateral aspect of the cortex (incomplete fracture), and it does not effecting the DRUJ. In this case, the DRUJ was dislocated, which is related to Galeazzi Fracture definition. We decided to proceed with reconstructive ORIF surgery, temporary transfixing wire placement, and bone grafting.

The patient underwent ORIF on the radius and ulna, ulnar shortening, temporary transfixing wire placement, and bone grafting. The patient was positioned supine under general anesthesia, with aseptic and antiseptic preparation of the operating field. The first incision was made using the Modified Henry Approach for the radius to expose the fracture site. An open wedge osteotomy of the radius, approximately 20 mm, was performed, followed by reduction and fixation with a Dynamic Compression Plate (DCP) at the osteotomy site.

The second incision was made using the Medial Ulnar Approach. An open wedge osteotomy of approximately 20 mm was performed at the proximal ulna, aligned with the radial fracture site. Following the osteotomy, DRUJ reduction was achieved under fluoroscopic guidance. The osteotomy site was fixed with a DCP, and the

osteotomy bone was used as an autograft for grafting to promote healing, aiming for a similar length alignment with the radial site. Temporary transfixing wire fixation with K-wire was applied to encourage fibrotic tissue formation and strengthen the DRUJ. The wire was removed after 5 weeks. The ulnar side was shortened to achieve proper radial height and inclination. The wound was closed in layers. Postoperatively, an X-ray examination was conducted for evaluation, as shown in (Figure 2).

Figure 2. X-ray of the right antebrachii shows the implant such as Transfixing Wire, Plate and Screw was inserted.

Five weeks after surgery, the transfixing wire was removed (Figure 3). The patient was advised to continue rehabilitation and physiotherapy to restore forearm function, including supination and pronation. Fifteen months after the initial surgery, follow-up X-rays (Figures 4 and 5) were performed, and the patient was scheduled for implant removal. The successful outcome of the surgery and the patient's dedication to rehabilitation were promising signs for his full recovery.

Figure 3. Antebrachii X-ray after transfixing wire removal.

Figure 4. The Xray shows good radiographic union of the bone.

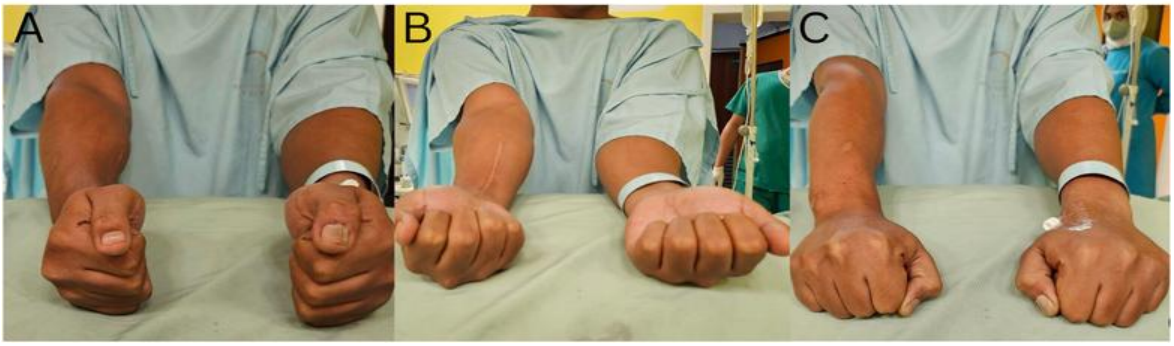

Figure 5. Grip position of the forearm (A). Perfect supination movement (B) and (C) Perfect Pronation movement.

The patient completed follow-up at the orthopedic facility 5 months after implant removal and continued physiotherapy. The regimen focused on improving range of motion, strength, and forearm function. After implant removal, the patient diligently followed the rehabilitation regimen and was able to use his forearm normally. Nonunion complications could arise if the patient does not follow the rehabilitation regimen. The patient provided informed consent, including permission for case-related images.

CLINICAL DISCUSSION

The most common upper extremity fractures in the emergency unit are the distal ulna and radius injuries. [3] One of them is the Galeazzi fracture. A Galeazzi fracture is a fracture of the middle to distal third of the radius associated with dislocation or subluxation of the distal radioulnar joint (DRUJ). Fractures of the distal ulna and radius are usually caused by falls on an outstretched hand. The dominant wrist position is dorsiflexed. In older individuals, the fracture pattern usually occurs extra-articularly due to low-energy trauma, whereas in younger patients, the injury often occurs intra-articularly due to high-energy trauma. [4,5]

Good management of Galeazzi fractures is determined by several factors: performing anatomical reduction on the radius bone, restoration of the radial bow, reduction of the DRUJ, and restoration of the rotational function of the forearm. The difference in length between the radius and ulna will interfere with the movement between those two bones. [6]

Surgical intervention is the recommended intervention in adult patients compared to conservative management. Management of radial shaft fractures is initially carried out by immobilization and then continued intraoperatively. This patient's approach to the radius uses the Volar Approach (Henry) because it is technically easier and has better soft tissue coverage. [6]

Management of cases of distal radius ulna fractures can be done with non-operative management. If the joint is stable, it can be treated with a long-arm cast for 2 to 4 weeks. If the DRUJ is unstable, perform closed reduction and immobilization with a long-arm cast for the first 6 weeks to limit pronation-supination. [7,8]

In operative management, there is specific treatment for distal radius-ulna fractures. [9] Distal radius-ulna fractures that cannot be treated by reduction and are unstable can be treated operatively. If there is instability in the DRUJ, as proven by the piano key test, radiological images, and clinical condition in the pre-operative examination, surgery is indicated. If it is unstable, the ORIF of the radius can be stabilized by transfixing the ulna wire. If it is stable, ORIF can be done, and temporary immobilization can be done using a slab for 2–4 weeks. [8] The main purpose of Ulnar Shortening Osteotomy (USO) is to shorten the bone. Ulnar Shortening Osteotomy can strengthen the triangular fibrocartilage complex (TFCC), ulnocarpal ligament, and interosseous membrane. This procedure is indicated in cases where there is a positive ulnar variance. [10] Ulnar Shortening Osteotomy can also transform the morphology of the distal radioulnar joint (DRUJ). Malalignment of the inclination of the ulna and sigmoid notch is a relative contraindication for Ulnar Shortening Osteotomy, as it can lead to degenerative damage to the DRUJ. [11]

This procedure is indicated in patients with a positive ulnar variance of less than 4 mm if there are no signs of degenerative arthritis or DRUJ instability. [12] Absolute contraindications include DRUJ arthritis and dorsal dislocation of the DRUJ. [13]

The term for ulnar side wrist pain caused by an overlength ulna bone structure is called "Ulnocarpal Impaction." Primary Ulnocarpal Impaction occurs due to congenital ulnar overgrowth, while secondary Ulnocarpal Impaction usually occurs after post-traumatic shortening of the radial bone. Typically, this condition develops after a distal radius fracture but can also be caused by premature closure of the radius growth plate, though rare. [14]

Diaphyseal osteotomies of the ulna can be divided into three subgroups: transverse, oblique, and step-cut osteotomies. In this case, the operator used the oblique diaphyseal osteotomy method, which involves making two parallel oblique cuts and removing the cut bone (Figure 6). Compression is applied with or without a compression device. A lag screw is placed through the osteotomy site, followed by plate fixation." Reports have shown that oblique osteotomies have a faster healing rate and a lower nonunion rate than transverse osteotomies. [15-17]

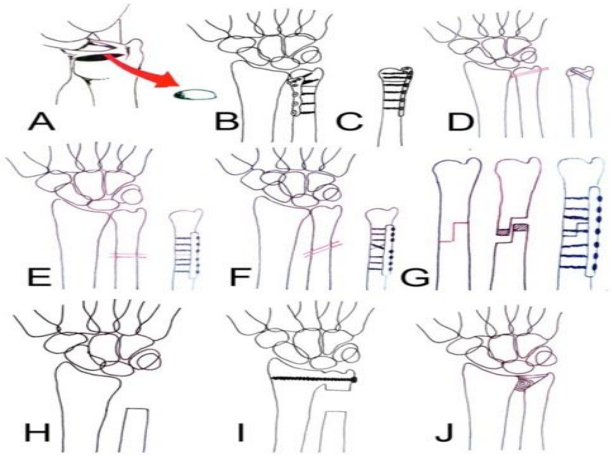

Figure 6. Methods of ulnar shortening. (A) Wafer procedure; (B) Subcapital osteotomy- fixation with a locking plate; (C) Distal osteotomy with screw fixation; (D) Diaphyiseal transverse osteotomy; (E) Diaphyseal oblique osteotomy; (F) Diaphyseal step-cut osteotomy; (G) Darrach procedure; (H) Sauvé-Kapandji procedure; (I) Hemiresection- interpositional arthroplasty.

The operator chose the Ulnar Shortening Osteotomy procedure to preserve the ulna and allow for alternative options in case the USO failed. Other methods, such as the Darrach and Sauve-Kapandji procedures, could still be performed. If the operator had initially chosen the Darrach Procedure or Sauve-Kapandji Procedure, no further options would be available, as the distal ulna would have already been removed.

After the procedure, the Range of Motion (ROM) was back to normal around 0-80º for both supination and pronation, and the score for Visual Analog Scale (VAS) is 1. The DASH score is a 30-item questionnaire that is reliable for evaluating physical function and disability in people with upper-extremity musculoskeletal conditions, including distal radius fractures. [18] The pre-operative DASH score for this patient was 35.8, while the post-operative score was 9.2, indicating significant improvement in daily activities and quality of life. Research by Robin shows that management using the Ulnar Shortening Osteotomy method in detail will provide good outcomes regarding range of motion, visual analog scale improvement in patient pain, and reducing the risk of arthritis in the wrist joint area. [14]

The case report we present describes a surgical intervention carried out using open reduction and internal fixation, followed by the installation of a temporary transverse ulna wire and the Ulnar Shortening Osteotomy procedure.

CONCLUSION

Galeazzi fracture is one of the most common fractures of the forearm. All Galeazzi fractures should be evaluated for distal radioulnar joint instability (DRUJ) before, during, and after surgery to achieve optimal functional results. Ulnar dislocations should be repaired if DRUJ instability is present. Chronic Galeazzi fractures are very rare in the literature, and late diagnosis can result in arthrodesis, prolonged rehabilitation, and poor functional outcomes if not treated appropriately. This patient showed excellent forearm and wrist function outcomes, evidenced by improvements in supination and pronation range of motion without obstructions and the return of wrist function for daily activities.

Declaration by Authors

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