

CASE REPORT

Use of anatomic locking plate and coracoclavicular cerclage for the management of unstable distal clavicle fracture.

Case report

Uso de placa de bloqueo anatómica y cerclaje coracoclavicular en el manejo de fractura de clavícula distal inestable. Reporte de caso

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Abstract

Introduction: Unstable distal third clavicle fractures are rare, most frequently found in men, and usually caused by high-energy trauma.

Case report: A 38-year-old woman fell from her own height onto her left shoulder and attended the emergency department of a tertiary care hospital in Trujillo, Peru, due to severe pain, moderate edema, and joint restriction. An X-ray confirmed a displaced left distal clavicle fracture with joint involvement (3B2 fracture according to the Robinson classification), which was surgically treated with anatomic locking plate fixation and coracoclavicular cerclage. Satisfactory functional and radiological outcomes were achieved during follow-up (last follow-up performed 18 months after surgery).

Conclusions: The use of anatomic locking plate fixation and coracoclavicular cerclage in this case proved to be a safe and effective option for the treatment of unstable distal clavicle fractures with joint involvement.

Resumen

Introducción. Las fracturas del tercio distal clavicular inestables son inusuales, se presentan con mayor frecuencia en hombres y en su mayoría son causadas por un trauma de alta energía.

Presentación del caso. Mujer de 38 años quien, tras caída desde su propia altura sobre el hombro izquierdo, asistió al servicio de urgencias de un hospital de tercer nivel de Trujillo, Perú, por dolor severo, edema moderado y restricción del movimiento de la articulación. Mediante radiografía se confirmó fractura de clavícula distal izquierda desplazada con compromiso articular (fractura 3B2 según la clasificación de Robinson), la cual fue tratada quirúrgicamente con fijación con placa de bloqueo anatómica y cerclaje coracoclavicular, obteniéndose resultados funcionales y radiológicos satisfactorios durante el seguimiento (último control a los 18 meses posoperatorios).

Conclusiones. En el presente caso el uso de fijación con placa de bloqueo anatómica y cerclaje coracoclavicular demostró ser una opción segura y eficaz para el tratamiento de fracturas de clavícula distal inestables con compromiso articular.

Introduction

Clavicle fractures account for 2.6% to 4% of all fractures in adults¹ and occur predominantly in men (approximately 70% of cases).² As for their location, 72.8%, 25.48%, and 1.72% are found in the lateral, middle, lateral and medial thirds, respectively.²

Distal clavicle or lateral third clavicle fractures occur after a direct blow or fall onto the acromion during sports activities or traffic accidents,³ when force is distributed medially to the clavicle and the bone fails superiorly with tension and inferiorly with compression.¹

The present article reports the case of a middle-aged woman with an unstable distal clavicle fracture treated surgically with anatomic locking plate fixation and coracoclavicular cerclage, achieving satisfactory functional and radiological outcomes.

Case presentation

A 38-year-old woman of short stature (1.50m) attended the emergency department of the Hospital Víctor Lazarte Echegaray de Trujillo (tertiary level of care in Trujillo, Peru) due to severe pain, moderate edema in the left shoulder, and restriction of movement, after suffering a fall from her own height. The patient had a history of idiopathic granulomatous mastitis and was being treated with methotrexate (2 years).

No neurovascular injury was noted on physical examination. An X-ray of the left shoulder (anteroposterior view) taken during evaluation revealed a displaced distal clavicle fracture with unstable joint involvement (yellow arrow), superior displacement of the medial fragment with detachment from the coracoclavicular ligament (green arrow), and an undisplaced lower fragment (light blue arrow). These findings were compatible with a 3B2 fracture according to the Robinson classification (Figure 1).

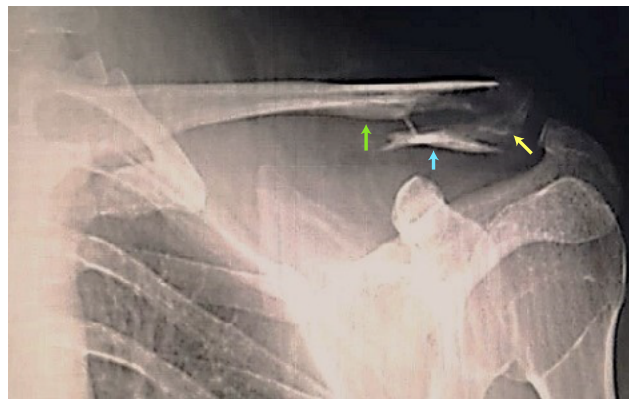


Figure 1. Type 3B2 distal clavicle fracture according to Robinson classification.

As this type of fracture requires surgical management, the patient was admitted to the hospital and the following day was taken to the procedure (anatomic locking plate fixation and coracoclavicular cerclage).

The surgery was performed with the patient under general anesthesia, placed in the beach chair position. A longitudinal incision was made on the anterosuperior border of the clavicle, which allowed visualization of the deltoid muscle tear at the site of the fracture and identification of the coracoid process. Then, the fracture ends were reduced in both the axial and coronal planes, and the fracture was temporarily stabilized with

K-wires. Next, the fracture was fixed with a 3.5-mm superior distal clavicle anatomic plate and coracoclavicular cerclage with nonabsorbable suture. For the coracoclavicular cerclage, once the coracoid process and its medial and lateral borders were identified, a nonabsorbable suture was passed under the coracoid process, underneath and behind the clavicle and over the locking plate using Satinsky clamps, thus avoiding damage to the trapezius fibers. Finally, the suture was tightened with a knot at the anterior inferior border of the clavicle (Figure 2).

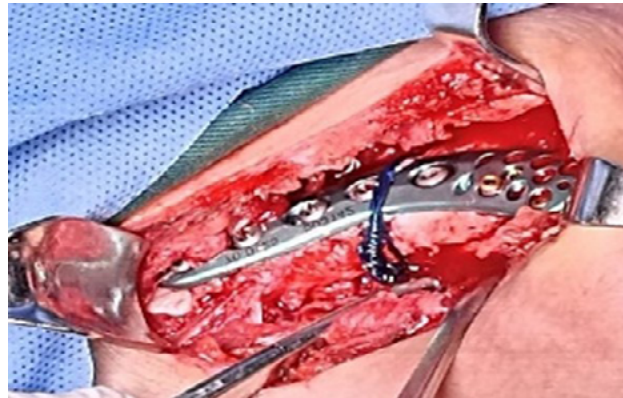


Figure 2. Stabilization with anatomic locking plate and coracoclavicular cerclage.

Subsequently, using fluoroscopy, it was verified that bone reduction and coracoclavicular distance reduction were maintained. Lastly, the deltoid-trapezius fascia was sutured over the plate, the wound was closed in layers, and a sling was placed to immobilize the operated shoulder and to be used postoperatively for 6 weeks. There were no intraoperative complications and pain was controlled in the immediate postoperative period with intravenous metamizole 1g every 6 hours.

Two days after surgery, when the pain subsided, the patient was instructed to start rehabilitation therapy, consisting of active elbow range-of-motion exercises and passive shoulder pendulum exercises. She was also discharged with an indication to take paracetamol 500mg every 8 hours for 5 days.

During postoperative outpatient follow-ups on days 3 through 7, a gradual increase in the range of motion of the shoulder (active abduction movements below 60°) with adequate pain tolerance was observed. Afterwards, between postoperative days 7 and 21, abduction movements were limited to less than 90°, with no weight bearing. Three weeks after surgery, the patient was instructed to begin active assisted anterior flexion and abduction exercises below 90° with weightlifting (<1kg) one hour per day. During the follow-up appointment at 8 weeks, an X-ray showed progression of bone consolidation and removal of the sling was indicated. At 12 weeks postoperatively, and since the patient showed satisfactory ranges of motion, she was advised to resume her daily domestic and work activities.

At the last follow-up, 18 months after surgery, an X-ray showed slight loosening of a distal screw 2.7 mm in diameter, with shortening of the acromioclavicular space and no loss of fixation of the osteosynthesis material, thus confirming complete osseointegration (Figure 3). Satisfactory functional recovery was also evident (Quick DASH scale score: 6) (Figure 4).



Figure 3. Complete osseointegration.

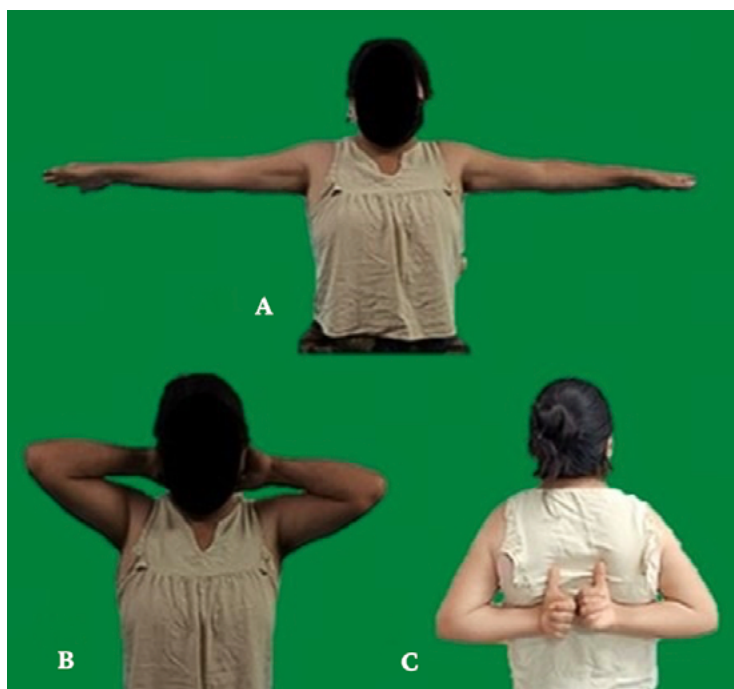


Figure 4. Functional outcome. A) abduction; B) external rotation; C) internal rotation.

Discussion

The Robinson classification is a system for categorizing clavicular fractures based on anatomical location: fifth medial or type 1, diaphyseal or type 2, and fifth lateral or type 3. These types of fracture are divided into subcategories depending on displacement/angulation (A: undisplaced and B: displaced) and joint involvement/fragmentation (1: extra-articular and 2: intra-articular) (Figure 5).^{1,3,4}

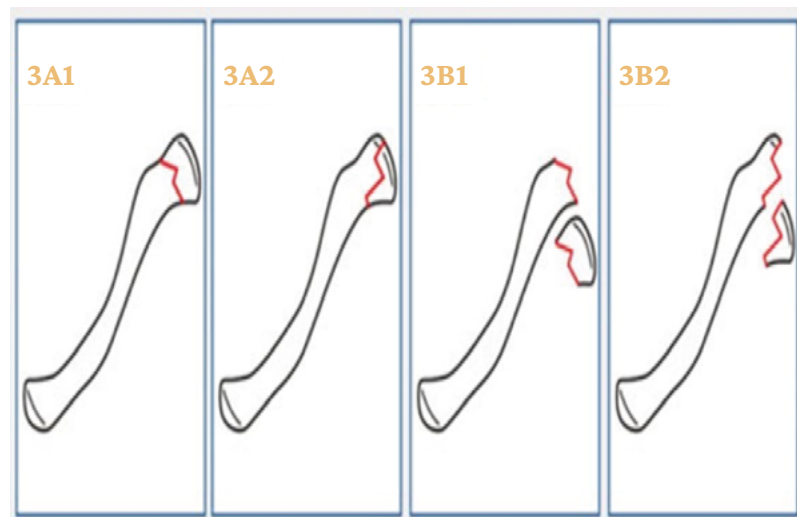


Figure 5. Distal clavicle fracture type 3A and 3B according to the Robinson classification.

Thus, type 3A and 3B fractures occur in an anatomical position lateral to a vertical line ascending from the center of the coracoid process base, a location usually demarcated by the conoid tubercle.³ The patient referred to in the present case had a 3B2 fracture, that is, a displaced fracture of the lateral fifth clavicle with joint involvement.

According to Kihström,³ who conducted a study with data on 2 422 clavicle fractures obtained from the Swedish Fracture Register, type 3B2 fractures account for 1.69% of all clavicular fractures and 0.41% of clavicular fractures reported in women. In this type of fracture, the medial fragment is detached from the coracoclavicular ligaments and displaced upward, while the lateral fragment, which is usually small, keeps its inferior position due to the intact insertion of the conoid and trapezoid ligaments.³

Roughly 30% to 45% of all clavicle nonunion fractures occur distally.⁴ The treatment of distal clavicle fractures may be conservative or surgical,³ but the outcome depends on several factors such as fracture displacement and involvement of the coracoclavicular ligaments, which may cause unstable fractures. In this sense, most undisplaced or minimally displaced fractures can be treated conservatively, while surgical treatment is recommended for unstable fractures, considering that conservative treatment usually has a poor outcome and a high risk of nonunion,³⁻¹¹ which is problematic for the surgeon.^{4,10,12} Our patient met the criteria for instability, so surgery was indicated.

Several surgical techniques have been described for the treatment of distal clavicle fractures, including anatomic locking plate fixation, hook plate fixation, coracoclavicular fixation (using suture anchor, suture button device, or screw), tension band wiring, K-wire fixation, K-wire transacromial fixation, and arthroscopically assisted techniques.^{4,9} A commonly used technique for these injuries is hook plate fixation; however, this technique is associated with complications such as acromial erosion and fracture, impingement, subacromial osteolysis, rotator cuff damage, joint stiffness, and the need for reoperation to remove the implant.^{3,4,6,8-10,11,13-16}

Anatomic locking plate in combination with coracoclavicular fixation is recommended as the first treatment for unstable distal clavicle fractures with disruption of the coracoclavicular complex when there is sufficient bone stock.^{8,10,13-15,17} The anatomic locking plate provides a strong fixation of the fracture site and allows early movement of the affected arm.^{4,6,8-10,14-17} It has also been reported that, compared to the hook plate, the use of the anatomic locking plate reduces the risk of complications such as osteoarthritis

of the acromioclavicular joint, rotator cuff injury, subacromial space impingement, and osteolysis, as it allows the fixation of the fracture site without invading the acromioclavicular joint.¹⁰ Similarly, it has been reported that this technique allows achieving bone union without major complications (e.g., nonunion, implant failure, and deep infection) and yields good to excellent functional outcomes.⁴

Anatomic locking plate fixation in unstable type 3B2 fractures is challenging and if not augmented with coracoclavicular fixation could result in failure of fixation.¹⁵ Moreover, performing both fixations allows for early rehabilitation without complications.^{3,8,10,13-15} Our patient (3B2 fracture) was treated following the aforementioned principles, both bone stability with an anatomic locking plate and ligament stability with coracoclavicular cerclage, together with early rehabilitation, obtaining adequate functional and radiographic outcomes in accordance with the scientific evidence.^{3,8,10,13-15} It should be noted that we used nonabsorbable suture for coracoclavicular cerclage due to the lack of economic resources to consider other options such as button suture, screws, and arthroscopically assisted techniques.

When using nonabsorbable suture in coracoclavicular cerclage, it is important to keep in mind that the subcoracoid passage of the Satinsky clamps must be done closely to the inferior aspect of the coracoid process and considering that the brachial plexus runs underneath it.¹⁸

Various studies have analyzed the outcomes of anatomic locking plate fixation with and without augmentation with coracoclavicular fixation for the treatment of unstable distal clavicle fractures,^{3,4,10,16,17} demonstrating that this is the technique of choice for specific fractures with large distal fragments for screw insertion. However, because the use of precontoured locking plates with or without coracoclavicular fixation is not ideal for all distal clavicle fracture patterns, surgeons should consider multiple treatment options.⁴ Singh *et al.*⁹ evaluated the outcomes and complications of distal clavicle fractures and found that, of 37 patients treated with a precontoured clavicular plate, 97.3% (n=36) achieved stable union and only 16.2% (n=6) experienced hardware irritation requiring removal, thus confirming its effectiveness.

Conclusions

In the present case, the use of anatomic locking plate fixation and coracoclavicular cerclage proved to be a safe and effective option for the treatment of unstable distal clavicle fractures with joint involvement.

Ethical considerations

For the preparation of this case report, informed consent was obtained from the patient, in which she authorized the use of her clinical and imaging data.

Conflicts of interest

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