



Treatment of Medial Clavicle Fractures: A Case Report and Review of the Literature

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Abstract

Medial clavicle fractures are not common and may be associated with injuries to the adjacent vital structures. This study consists of the case of a 15-year-old boy who had a preexisting ventriculoperitoneal shunt and a displaced medial clavicle fracture. In the study, we performed a successful surgical treatment using a distal radius locking plate. The mechanism of the injury and treatment options are discussed in relation to the literature in the field.

Key Words: Medial clavicle fracture, mechanism, locking plate fixation

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Introduction

Clavicle fractures comprise almost 2- 5% of all fractures in adults and 10-15% in children [1-2]. Approximately 2-9.3% of all clavicle fractures involve the medial part [2-3]. Although less common than fractures of other parts of the clavicle, it is important to diagnose these injuries to avoid possible serious complications [4-7].

Regardless of dislocation or physical separation of the medial clavicle, if displaced retrosternally, it may be associated with injuries to the adjacent vital structures and high mortality [3]. We present the case of a 15 year-old-boy with a medial clavicle fracture and his surgical treatment with a distal radius locking plate.

Case

A 15 year-old- boy was admitted to the emergency department of a health center following an in-vehicle traffic accident. He had left tibia and right medial clavicle fractures. After being operated on for the tibial fracture with open reduction and plate screw fixation, a figure of eight bandage was applied to the clavicle fracture and the patient was discharged. We could not access the initial radiograph of the clavicle, but we learned that it was an un-displaced medial clavicle fracture from the epicrisis.

After 3 weeks, the patient was admitted to our orthopedic outpatient clinic with severe pain, asymmetry and an obvious bulge on the skin at his right medial clavicular site. Displacement of the medial clavicle fracture and dislocation were seen on the plain radiographs (Figure 1). It was understood from the detailed history that the patient had used crutches for mobilization after the tibia fracture fixation. For detailed orientation and to facilitate a prompt surgical decision, a 3D CT-scan was obtained (Figure 2) and, as a result, it was observed that there was retrosternal displacement in the medial clavicle fracture (Robinson Type 1-b) [8] and sternoclavicular dislocation (Allman grade 3) [9]. This posed a potential problem for the vital structures and the ventriculoperitoneal shunt which was placed 3 years ago. Medial physis was intact (Figure3).

During the operation, after exposure, we released the stocked medial fragment. It was dislocated from the sternoclavicular joint (SCJ) (Figure 3). After a gentle reduction, avoiding possible injury to vital structures and damage to the shunt, we fixed the fracture with a distal radial locking plate. In order to fix several screws to the distal little part and in order to allow

strong single cortex fixation, we decided to use a distal radial locking plate (Figure 4). A neurosurgeon checked the shunt for regular flow. We reduced the SCJ, repaired the capsule and placed bony sutures at the holes drilled at the manubrium sterni and the medial clavicle with PDS® II (polydioxanone) Sutures, ETHICON Johnson & Johnson, USA).

After 1 week of sling resting, the patient started physiotherapy and range of motion (ROM) exercises. After 4 months, he was painless with full ROM (Figure 5).



Figure 1. Radiograph of the patient 3 weeks after the traffic accident. This is the first admission to our clinic. Displaced medial clavicle fracture- dislocation can be seen clearly.

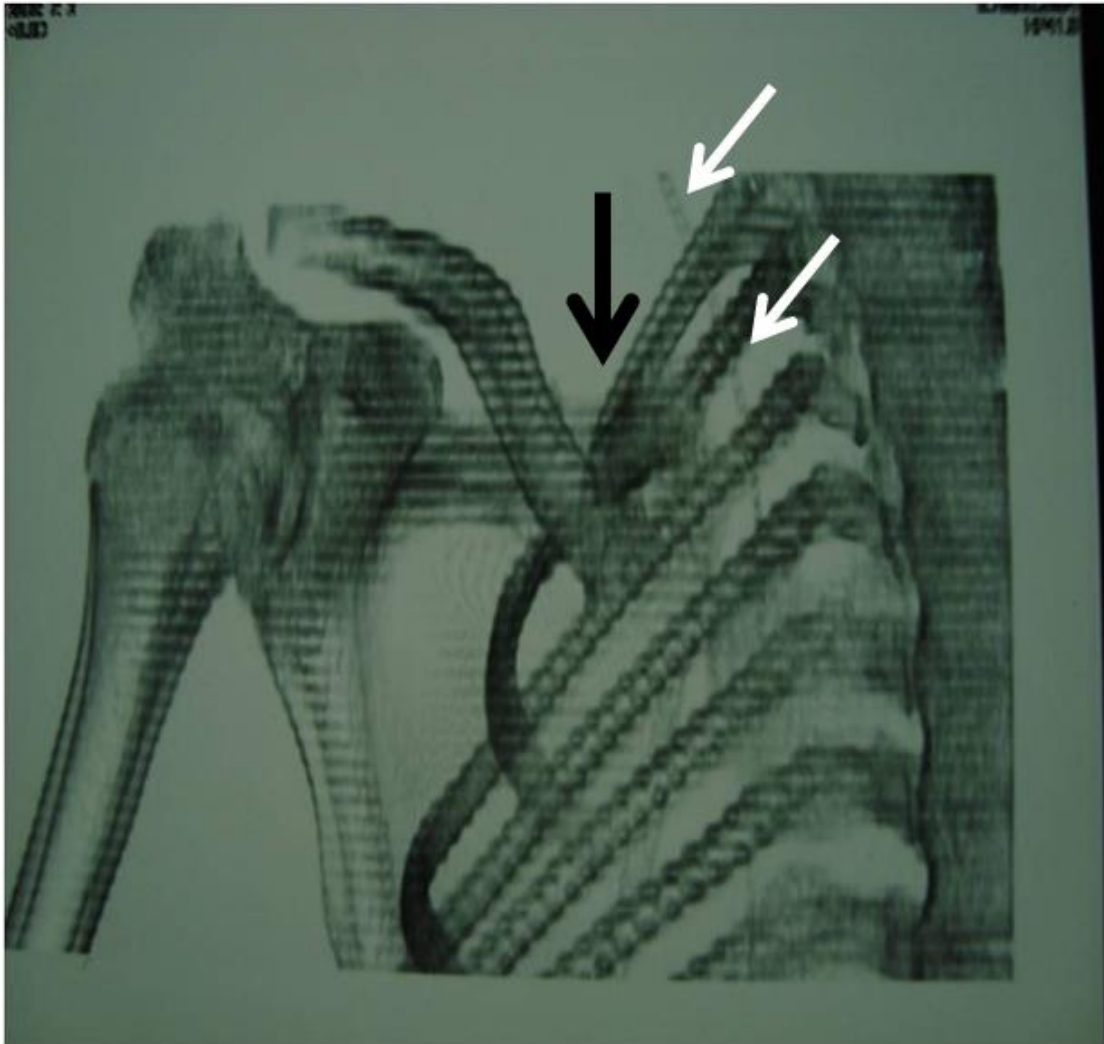


Figure 2. Computerized tomography imaging. Fracture dislocation in relation to the ventriculoperitoneal shunt. White arrow shows the VPS, Black arrow, fracture dislocation of medial clavicle.

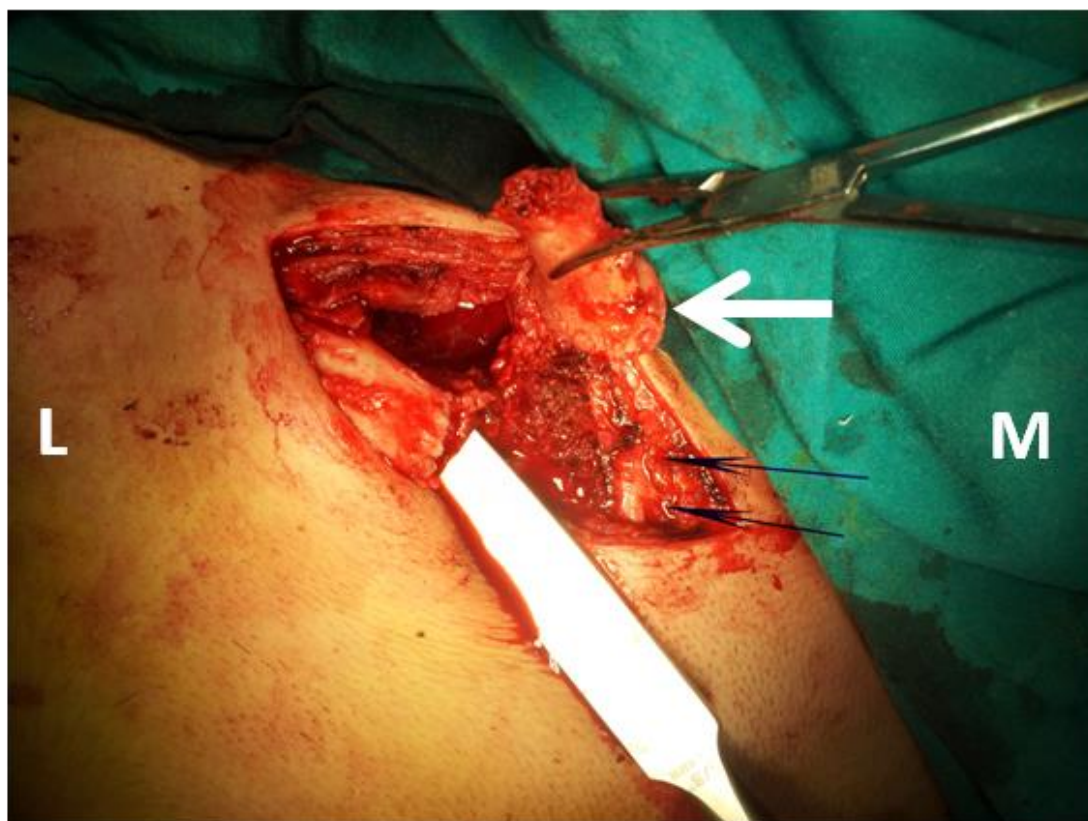


Figure 3. Intra-operative appearance of the fracture dislocation. Distal physis can be seen intact marked by white arrow. VPS marked with black arrows.

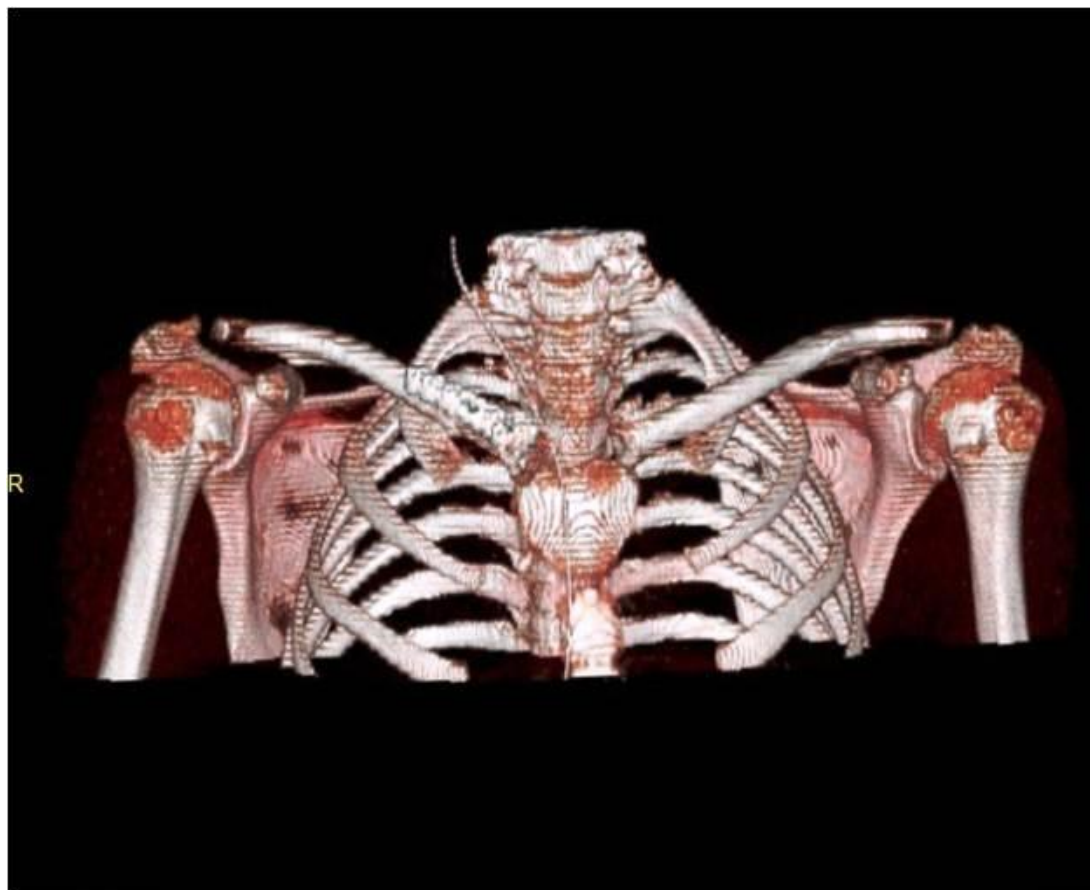


Figure 4. Reconstructed CT image after the operation. Fixation with a distal radial locking plate. Proximity of the surgical site to the shunt can be seen.



Figure 5. Clinical follow up, four months post operation.

Discussion

Medial clavicle fractures are mostly related to vehicular accidents (84%) [3]. During evaluation of a vehicular accident victim, some injuries may be overlooked due to more obvious and urgent situations. Besides an open fracture, an intracranial or an intra-abdominal injury, a clavicle fracture or sternoclavicular dislocation might be missed. In this study, a medial clavicle fracture was observed and treated with a clavicle bandage, but it was neglected due to a more obvious tibial fracture and could not be evaluated in detail. Even non-displaced, medial clavicle fractures or dislocations must be managed carefully because complications may be serious in case of displacement [5].

Beastal et al.[10] also reported a case of late displacement of a medial clavicle fracture following conservative treatment. In cases where it is decided to apply conservative treatment to patients, they should be monitored closely and, in case of displacement, they should be reevaluated for surgical treatment.

Medial clavicle fractures commonly occur with polytrauma [3]. In polytrauma cases, surgical treatment of the medial clavicle fracture may be considered in order to allow rapid rehabilitation of other injuries without a similar complication. Patients with multiple injuries may use devices like canes or walkers, etc. to assist ambulation. Huge amounts of load transfer may be generated by assisted walking devices. Anglin et al.[11], in a biomechanical study, reported that during cane-assisted walking the glenohumeral contact force can reach up to 3 times bodyweight. Even at stable shoulder site fractures, with the use of assisted walking devices there can be displacement and unstable fractures due to high load transfer. In this case, it is probable that with the possible load effect of the crutch, an initially non-displaced medial clavicle fracture-dislocation had been displaced.

Although radiographs can show asymmetry of the fracture site, computerized tomography (CT) is the best choice of imaging for optimal evaluation. We also used CT to classify the fracture type and to identify the injury to adjacent vital structures [14-16]. In this case, with the help of the 3D CT we observed the relationship between the fracture fragments and the vital structures and also the Ventriculoperitoneal Shunt (VPS). Thus, we performed the operation with a neurosurgeon due to the proximity of fragments to the shunt. Ventriculoperitoneal shunt fractures are a serious cause of shunt dysfunction and occur most frequently in the neck [12]. This may occur due to external mechanical compression [13]. With the penetration of the sharp edges of a medial clavicle fracture fragment into a shunt, serious complications can emerge. In the case of displaced medial clavicle fractures, both during the fracture time or surgery, a VPS may be damaged and the orthopedic surgeon should be aware of this threat.

While the clavicle is the first bone to ossify, on the other hand the medial physis is the last physis to fuse in the body. It fuses at age 22-25. Like other injuries adjacent to any open physis in the body, injuries to the medial clavicle or sternoclavicular joint before age 25, firstly tend to harm this weakest part [14]. Although our patient was an adolescent and injuries around the SCJ firstly tend to occur at physis, in this case there was a 1/3 medial third

fracture of the clavicle and the medial physis was intact. This was probably due to the direct crushing effect of the seat belt upon its points of contact with the clavicle during the accident. There is a high incidence of clavicle fractures, due to three-point seatbelt loading. Distribution of the fracture locations due to seat belt injuries is similar to the general clavicle fracture distribution. Wraight et al.[15] reported that one medial fracture(5%) out of 20 clavicle fractures resulted from traffic accidents.

Medial clavicle fractures can be treated conservatively or surgically according to the displacement of the fracture and injury to the adjacent structures[16]. Conservative treatment is commonly associated with complications such as cosmesis, ankylosis, deformity and chronic pain [16]. In children, abnormal remodeling of the clavicle after conservative treatment may cause serious complications [17]. Although in children and adolescents there is high healing potential [18], for rapid functional recovery, it is recommended that the medial end clavicle should be treated immediately [19]. Although surgical indications for medial clavicle fractures had been determined as open fractures, severe displacement, neurovascular involvement and threat to skin integrity, recognition of poor results with conservative treatment led some surgeons to begin to treat these injuries surgically [20]. However, there is not a commonly accepted surgical fixation method. Pins, wires, small fragment reconstruction plates, dynamic compression and hook plates and plates manufactured specially for this anatomical site are all used [10, 20-21]. Plate screw fixation seems to be safer than pin or wire fixation [22]. Koch et al.[23] used figure-eight Ethibond sutures for a similar fracture stabilization for a boy at the age of 14 years. Medial clavicle fracture nonunion due to implant migration was reported in a patient treated with a small fragment reconstruction plate [10]. Kim et al. [24] reported successful surgical treatment of a displaced medial clavicle fracture using a small T-shaped plate and multiple tension band sutures. Oe et al. [25] reporting the results of ten operatively treated medial clavicle fractures, recommended the use of locking plates, such as the T-locking plate or the pilon reconstruction plate, and highlighted the importance of at least three screw purchasing of the medial bone for rigid fixation.

It is also important not to pass the counter cortex, due to very close vital structures at plate screw fixation of medial clavicle fractures. Plate fixation of single cortex can be achieved by locking plates when necessary [26].

We operated on the patient with a distal radial locking plate, which gave us the chance of three screws fixing to the medial bone and single cortex fixation when necessary. With this stable fixation, sternoclavicular joint fixation can only be performed with long-lasting absorbable sutures.

Conclusion

At the medial site of clavicle injuries, it is important to evaluate the patient not only with a radiograph but also with CT imaging, because only CT scanning can promptly show the relationship of the fracture to vital structures and to an existing dislocation.

Moreover, taking a good medical history of the patient can assist the treatment plan and priority, for instance knowledge of the VPS in relation to the fracture in this patient.

Finally, although there is not a commonly agreed implant for medial clavicle fractures, it seems effective to treat them with locking plates because they give the chance of rigid and safe fixation for rapid recovery. Surgeons commonly use locking plates manufactured for other anatomical sites for medial clavicle fractures. A specific locking plate design for medial clavicle site is needed to address fitting problems.

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