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Original Research Article

Outcome of absolute fixation by 3.5mm superior locking plate for displaced diaphyseal fractures of clavicle

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Abstract

The current study is a multi centre study done by both the surgeons in different tertiary care hospitals on thirty four patients, both the orthopedic surgeons followed the same operative protocols. It's a prospective observational study of outcome of diaphyseal fractures managed by absolute fixation by 3.5 mm superiorly placed anatomically contoured locking plate. In case of comminuted fractures lag screws were also used in antero superior plane of clavicle. DASH (Disability of the Arm, Shoulder and Hand) Score was used to quantify the outcome. Regular follow-ups were done and our study showed a mean outcome of DASH score of 3.3 at 2 yrs.

Keywords: Clavicle fracture, superior plating, locking plate, DASH (Disability of the Arm, Shoulder and Hand) Score

1. Introduction

Clavicle fractures occur due to a direct blow or as a result of FOOSH (Fall on outstretched hand). Fractures of Clavicle occur mostly in young adults and constitute 2.4 to 4% of fractures [1, 2]. Most patients with a clavicle fracture, particularly young adults, will give a history of a fall directly onto the shoulder. The majority will give a history of injury of a simple fall, fall from a height, fall during sporting activity, or a motor vehicle accident. In the adult population, the incidence of clavicular fracture decreases from age 20 to 50 years, increasing again for age more than 70 years. For the older age groups, lower energy injuries become more common. Fracture is more common in men than women up to approximately age 50 years, at which point the incidence between the two genders approximately equilibrates.

As viewed in the coronal plane, the clavicle is a slender bone, wider medially at its sternal articulation and noticeably thinner at its lateral third. Viewed axially, however, the three-dimensional structure becomes more apparent. The clavicle assumes a gentle s-shape, the medial end convex forward and the lateral end concave forward. This shape has been likened to the musical symbol the clavichord, thus the name. In the axial projection, the clavicle is also noted to have both medial and lateral flat expanses, linked by a thin, tubular middle. This central transitional area represents a weak link in clavicular structure. The midclavicle, therefore, is the most common site of fracture. Finally, when viewed in the sagittal plane, the extent of anterior to posterior transition is clearly identified. Possibly the most commonly used system is that of Allman [3]. He separated clavicle fractures into three groups:

- Group I: middle third fractures
- Group II: lateral third fractures
- Group III: medial third fractures

The indications of surgery are skin or soft tissue compromise, neurovascular compromise, refracture, malunion, non-union and floating shoulder. The aim of the study is to assess how the mid clavicular displaced fractures heal by absolute fixation with a 3.5mm superior locking plate. The results are assessed by DASH (Disability of the Arm, Shoulder and Hand) Score.

2. Materials and Methods

This was a prospective study of Thirty four patients referred to the Orthopaedics department of the Tertiary care hospitals from December 2016 through December 2019. This study was conducted in two different tertiary centers and was carried out by the first two authors in the same manner. All the patients in the study were adults ranging from 25 to 75 years. Informed and written consent was obtained from all the participants and the patients were also explained about the need of follow-up and the study. None of the participants rejected the study. There were 28 males and 6 females in the study and we had observed 26 of them were on the right side and 8 were on the left side. All of them were followed till last December.

Surgical procedure: All the patients were operated under General anesthesia with the endotracheal tube fixed at the opposite side of the angle of mouth. Beach chair position was used and arm let to hang free with bolster placed in the interscapular area to get extension at shoulder (Figure1). C-arm was checked before the procedure so that it would be easy to operate. Under Sterile precautions careful draping would be done and surgical incision site would be infiltrated with a mixture of Xylocaine and adrenaline after informing Anesthetist. Incision is placed along the palpable anterior surface of clavicle with meticulous dissection to preserve supraclavicular nerve, In case of comminuted fractures supraclavicular nerves are not spared to help in ease of soft tissue handling.

Minimal soft tissue stripping is done and any comminuted fractures are fixed with Lag screws to convert the construct to a stable one as shown in (Figure 2) an Antero-posterior plane to prevent interference with placement of plate on Superior surface. 3.5 mm Anatomically contoured locking plate is placed on the superior surface and locked on either sides. Care is taken while drilling the inferior surface to prevent neurovascular injury by placing a bone retractor and by appropriate length of drill bit not crossing 18mm in length beyond the Jacobs chuck after checking with the drill sleeve. Care is to be taken more on the medial side to prevent Brachial plexus and vascular injury. Superior placement of plate prevents the interference of lag screws (Figure3). Reduction and position of screws is reconfirmed with Image intensifier (Figure4).

Wound closed in layers after wash and subcuticular 3-0 ethilon suturing (Figure5). Dressing would be done and arm placed in broad arm pouch. Dressing is checked every third day & shoulder movements are encouraged in broad arm sling. Analgesics are prescribed till the pain settles.

3. Results

All the results were scored by DASH (Disability of the Arm, Shoulder and Hand) Score at 6 months and at 1yr & 2yrs. Manual labourers and professionals who require overhead abduction are allowed to work only after 3 months. All of them have to come for review at 6 weeks, 3months, 6 months, and every year. The average DASH scores were 11.8 at 6months and improved to 3.3 at 2years.

Professional where the requirement of overhead abduction was present like painters, mechanics, electricians had poor scores probably due to irritation of implants where they complained of hardware prominence on palpation. The results improved after implant removal. Patients with DASH scores where the implant prominence was a feature improved on implant removal. At 2yrs interval implants were removed if

asked by the patients, they were again reassessed at 6months and a year later. None of them infection, refracture or non-union.



Fig 1: Position of Patient



Fig 2: Comminuted fracture fragments fixed with Lag Screw



Fig 3: Superior locking plate with sleeve



Fig 4: C-arm picture showing absolute stable reduction with Lag screws & locking plate



Fig 5: Sub-cuticular suturing done

4. Discussion

Biomechanical studies have showed no s in torsional forces and resistance among superior, antero-superior and anterior plating [4]. Though some studies suggest superior plating would be more effective and less implant prominence we had to stick to only superior plating because of financial constraint of implants. Studies have shown that in situations where there is shortening of more than 2cms, or 100% displacement or bone loss the results are better with open reduction and internal fixation rather than a conservative method [5, 6]. Careful drilling and preventing neurovascular injury while plating is the most important precaution to be taken by using appropriate size drill bits and using counter support with bone levers on the undersurface of clavicle. The number of patients was small so we need a large a sample size to substantiate our findings.

5. Conclusion

Intact clavicle helps in brachiating movement which is disturbed in fractures. The maintenance of adequate length of clavicle, early rehabilitation and absence of unsightly bump are the reasons for opting towards absolute fixation rather than a conservative method of figure of 8 bandages or an arm pouch. The problem with surgical fixation is wound dehiscence and infection which can be prevented by meticulous soft tissue dissection and minimal periosteal stripping. Selection of proper anatomical contoured locking plates with no sharp edges help in preventing irritation to soft tissue. We had seen situations where the implants failed because of early aggressive weight lifting or in case of thin gauge implants.

To conclude minimal soft tissue handling, less periosteal stripping, preventing neurovascular damage, proper selection of anatomical contoured locking plate, application of AO principles and stable fixation, regular follow-up help in good to excellent outcomes

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7. References

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