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A comparative account of middle third clavicle fractures- perceptive in conservative and surgical treatment modalities

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Abstract

Introduction: Clavicle is the bone which links thorax to the shoulder and help in movements at shoulder joints. It is the first long bone to ossify in the body. Clavicle fractures are the most common fractures in the upper limb. Middle third clavicle fractures account for 80 percent.

Objectives: To asses rate of union in middle third clavicle fractures undergone surgical or conservative treatment

Materials and Methods: The primary database searched through PubMed, out of 240 articles, 82 articles were finally chosen for review after applying filters.

Conclusion: Plate osteosynthesis in displaced midshaft clavicle fracture has resulted in excellent functional outcomes and also good union rate.

Keywords: Clavicle, middle third, displaced fracture, conservative, surgery, plate osteosynthesis

Introduction

Clavicle fractures are common injuries in adults (2-5%)^[1]. Fracture of middle third of clavicle forms (70-80%) whereas lateral fracture contributes to (15-30%) and medial fracture 3% which are least common. Incidence peaks in 3rd decade of life^[2]. Non operative treatment is no longer valid in treating clavicular fractures with good functional outcomes^[3]. In some studies non –union rate reported in midclavicular fracture is 15% treated conservatively^[4]. Mid shaft fractures of clavicle treated conservatively with axial shortening leads to non-union, malunion^[5]. Other symptoms include neurological complications, restricted shoulder movement, protuberant callus which is cosmetically unfavourable for the patient. Patients with higher activity level and rigorous daily routine work will not accept the treatment which give prolonged recovery and restricted shoulder movements. Early fixation of the clavicle gives better shoulder functions and provides comfort to the patient. Successful surgical interventions for middle third clavicle fracture includes Plate osteosynthesis fixation and intramedullary nailing like “TENS” nailing. Open reduction and internal fixation with plating provides rigid fixation, early functional recovery which lowers the incidence of non-union and malunion. Surgical treatment of middle shaft fracture results less no of cases with non union as compared to conservative treatment^[6]. We have taken this review of middle third clavicle fracture to see the functional outcomes on the patients undergoing treatment with plate osteosynthesis and conservative.

Materials and methodology

The primary database searched through PubMed. We have included the studies which have been done on adolescents (aged over 10 years), and the studies which include adults who had been diagnosed with middle third clavicle fracture. The studies were excluded with children younger than 10 years of age as the data was limited for it. The studies were excluded which were comparing different techniques of surgical interventions alone, or different techniques of conservative interventions alone. Internal fixation using a plate- and- screw, Kirschner wires, titanium nail, and Knowles pin, and external fixation with an external fixator these modalities comes under surgical treatment. Conservative treatment include slings, strapping, figure- of- eight bandages and splints, or other physical treatments, as well as adjunctive

therapies, such as therapeutic ultrasound.

Classification of clavicle fractures

There are numerous classification schemes been proposed for the clavicle fracture. The tradition in proposing these classification is based on the position of the fracture. Advantage of grouping the fracture pattern according to the position helps in corresponding to most of the surgeons in regard to fracture treatment, outcomes, and fracture pattern.

Allman's Classification ^[7]

Group I - Middle 3rd fracture of clavicle

Group II - Distal 3rd fracture of clavicle

Group III - Medial 3rd fracture of clavicle

Craig Classification ^[8]

Clavicle fracture was moreover detailed by CRAIG in 1900.

- Group 1- Most common clavicle fractures are middle one third which contributes to 80% in adults and children. Medial fragment displaces upwards by the action of sternocleidomastoid muscle, whereas displaced lateral fragment gets pulled downwards by the weight of the limb.
- ^[9] Group 2 - Lateral one third of the clavicle contributes to 10- 15% of clavicular fractures. And are subdivided into-
 - Type 1- minimal displacement/ non-displaced, fragments are held together closely by intact ligaments.
 - Type 2- Fractured clavicle displaces upwards in the part of medial segment.
 - Type 3- Articular surface fractures which involves acromioclavicular joints.
- Group 3- 5% of fractures are middle one third fractures. These fractures have higher rates of neurovascular injury, intrathoracic injury if it gets displaced.

Conservative Treatment

There are various conservative treatment ^[10, 11] options available, the commonest being the use of a sling or 'figure-of-eight' bandage ^[12, 13]

- In adults, the undisplaced fracture is treated with triangular sling which supports the upper limb, with active exercises of fingers, wrist and elbow (50 times, thrice a day). The sling is removed after 3 weeks and shoulder exercises is advised.

- If the fracture fragments are displaced, the distal fragment is lifted upwards and pulled backwards and figure of 8 bandage is applied with good padding of both axilla with cotton.
- Often no subsequent therapy is suggested to the patient. Sometimes, however, a patient will require stretching exercises to regain motion.
- Periodic check-ups are important to look pressure sores in the axillary folds by figure of 8 bandage.
- The patient with a structured rehabilitation in order to have a satisfactory outcome for most patients. To protect the healing clavicle, it is important to avoid contact sports for a minimum of 4 to 5 months.
- Midshaft clavicle fracture goes on to healing with any method of immobilization. The choice of immobilization, then, should reflect patient comfort and function issues rather than anticipated healing rates.

Operative technique

Under general anaesthesia, patient positioned in supine with sand bag under the scapula. Shoulder prepared and draped, and incision made over the fractured clavicle site. The fracture site identified, and fracture reduction done and fixed with a 3.5 mm pre-contour plate. Plate was fixed over bone at superior surface, with the goal of achieving minimum of three screws in the proximal and distal fragments in most cases, with care being taken to preserve soft-tissue attachments. The delto-trapezial fascia was closed with interrupted number-1 absorbable sutures as a distinct layer, followed by skin closure ^[14].

Rehabilitation

The objectives of rehabilitation are to improve and restore the function of the shoulder for activities of daily living, vocational and sports activities. Rehabilitation of the affected extremity were done according to the stage of fracture union and time duration from day of surgery. Pendulum movements/ Codman's exercises started from 3rd post-operative day. 2 week- The sling discontinued and unrestricted range of motion exercise allowed. Patients were seen at three, six & nine months. Sports activities and heavy weighting are avoided till 12 weeks.

Results

Table 1: shows the studies done on middle third clavicle fracture and their outcomes under conservative and surgical groups

Study ID	No. participants (assessed/assigned)	Surgical fixation	Conservative treatment
Ahrens 2017 ^[41]	204/301 (67.8%)	Plate fixation: LCP (precontoured titanium plate)	Simple sling
Chen 2011	60/60 (100%)	Intramedullary fixation: TEN	Simple sling
COTS 2007	111/132 (84.1%)	Plate fixation: limited DCP/3.5 mm reconstruction plates/pre- contoured plates/other plates	Simple sling
Figueiredo 2008 ^[42]	40/50 (80%)	Plate fixation: 3.5 mm DCP plate fixation	Simple sling
Judd 2009 ^[43]	57/57 (100%)	Intramedullary fixation: modified Hagie pin	Simple sling
Koch 2008 ^[44]	68/68 (100%)	Intramedullary fixation: 2 mm pin	Figure- of- eight bandage
Melean 2015	76/76 (100%)	Plate fixation: 3.5 mm LCP/LCP reconstruction plates	Simple sling
Mirzatolooei 2011	50/60 (83.3%)	Plate fixation: 3.5 mm reconstruction plates	Simple sling
Naveen 2017	60/60 (100%)	Plate fixation: 3.5 mm DCP plate fixation	Figure- of- eight bandage
Robinson 2013a	178/200 (89%)	Plate fixation: LCP (precontoured titanium plate)	Simple sling
Smekal 2009	60/68 (88.2%)	Intramedullary fixation: TEN	Simple sling
Tamaoki 2017	98/117 (83.8%)	Plate fixation: 3.5 mm reconstruction plates	Figure- of- eight bandage
Virtanen 2012a	51/60 (85%)	Plate fixation: 3.5 mm reconstruction plates	Simple sling
Woltz 2017a	154/160 (96.2%)	Plate fixation: most operatively treated participants (80%) were treated with a precontoured clavicular plate	Simple sling

Based on the method of surgical fixation (plate or intramedullary), the included studies could be grouped into two comparisons:

1. Surgical intervention using plate fixation versus conservative intervention using a sling (Ahrens 2017; COTS 2007; Figueiredo 2008; Melean 2015; Mirzatoloei 2011; Naveen 2017; Robinson 2013a; Tamaoki 2017; Virtanen 2012a; Woltz 2017a). Follow-up data were available for 1022 participants (534 with surgical and 488 with conservative intervention).
2. Surgical intervention using intramedullary fixation versus conservative intervention using sling or figure-of-eight bandage (Chen 2011; Judd 2009; Koch 2008; Smekal 2009). Follow-up data were available for 245 participants (124 with surgical and 121 with conservative intervention).

So based on the studies reviewed surgical management has benefits in terms of function, pain and quality of life compared with conservative treatments, even it result in fewer treatment failures overall participants who have undergone or are being considered for surgical intervention the rate of non-union, malunion, mechanical failure or other complications are less in the surgical intervention.

Conclusion

Recent studies have described that conservative management leads to a higher rate of non union, late neurovascular compromise and specific deficits of shoulder function. Patients with these injuries who are managed by plate Osteosynthesis have early relief in pain and shoulder function returns to work that is comfortable to the patient. Surgical management should be preferred for the treatment of indicated middle-third clavicle fractures in active patients.

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