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Comparative Study Of Surgical Management Versus Conservative Management Of Displaced Fractures Of The Clavicle.

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ABSTRACT

Clavicle fracture accounts for approximately 2.6% of all skeletal fractures. These fractures are often associated with shoulder girdle injuries in approximately 44% of cases. Nonoperative treatment has been a mainstay of a modality of treatment, and irrespective of the type of fracture and amount of comminution, all these fractures were treated non-operatively. Different surgical methods for clavicle midshaft fractures have been described and these are locking compression plate fixation, intramedullary K-wires, Steinmann pin fixation, and intramedullary nailing with TENS. Therefore, in this study, we have compared the functional outcome of displaced clavicle fractures treated by non-surgical management with that of surgical management by TENS and by open reduction and internal fixation with clavicular locking compression plate. All patients with clavicle fractures presenting to the Hospital, are to be selected based on the inclusion and exclusion criteria. Group A patients received non-operative treatment with an arm pouch and clavicular brace (30 patients). Group B received surgical management (30 patients). All patients were evaluated by detailed history about the trauma and mode of injury, and detailed physical and radiological examination. A detailed history including name, age, sex mode of injury, and existing co-morbidities will be obtained with due consideration to the exclusion criteria. The treatment method is decided by the patient after explaining both procedures, Patients with their language consent have been obtained for the procedure. The protocol and evaluation will be followed. The patient's follow-up will be at 3 weeks, 6 weeks, 3 months, 6 months. According to this study, surgery can be recommended over conservative treatment in patients with displaced mid-shaft clavicular fractures.

Keywords: Midshaft clavicle fracture, surgical management, TENS nailing, clavicle plating, conservative management, clavicle brace with sling application, Constant and Murley Score, functional outcome.

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INTRODUCTION

Clavicle fractures account for approximately 2.6% of all fractures and 44% to 66% of fractures around the shoulder. Middle-third fractures account for 80% of all clavicle fractures, whereas fractures of the lateral and medial third of the clavicle account for 15% and 5%, respectively [1]. The clavicle is an S-shaped bone that acts as a strut between the sternum and the glenohumeral joint. The mid-clavicular region of the clavicle is a common site that accounts for most fractures occurring in this region. After conservative treatment, particularly in displaced fractures with some amount of shortening, will have some degree of disability at the shoulder girdle [2]. Operative treatment results in anatomical reduction, quick pain relief, early mobilization, and good functional outcomes [3]. Therefore there is an increasing trend to operate all displaced clavicle fractures. More and more surgeons now prefer to do surgery as the results of non-operative management are seen as inferior both functionally and clinically. However surgical methods for treating fractured clavicles are not complication-free; there can be skin infection, keloid formation, wound dehiscence, delayed union, non-union iatrogenic great vessel damage, or brachial plexus injury [4]. Different techniques, such as intramedullary K-wires fixation, Steinmann pin fixation, TENS fixation, or plate fixation, are available for surgical treatment of midshaft clavicular fractures. Various plates available are reconstruction plates, dynamic compression plates, semi-tubular plates, and locking compression plates. Of all of these, the most preferred is a pre-contoured locking compression plate (LCP). Various braces are introduced in the conservative stream to immobilize the mid-third clavicle, especially the Bohlers brace, Parham support, Velpeau wrap, Taylors support, Billington yoke, and Figure of Eight brace. Among conservative braces, the most widely used is the commercial figure of eight brace. This study aims to evaluate functional outcomes and complications in conservatively and surgically treated midshaft clavicular fractures [5].

MATERIALS AND METHODS

This Comparative Retrospective & Prospective Study was done in the Department of Orthopaedics, Sri Venkateswara Medical College Hospital and Research Centre, Ariyur, Puducherry over 6 months in 2023.All outpatients attending to ortho OPD. Based on Robinson's classification (2B1) midshaft displaced clavicle fractures were segregated into two groups, of 18 each (total 36 cases) taken for conservative management and surgical management. The cases were between 18 years to 60 years old. A figure of eight clavicle brace and arm pouch/sling was given to patients treated conservatively. After making the patient sit on a stool/couch, the patient was asked to sit erect with both hands kept at the waist and shoulder pulled backward as much as possible and a clavicle brace applied. To support the upper limb of the same side, an arm pouch/sling was also given. The clavicle brace was used for 6 weeks, and patients were reviewed and if the belt was found loosened, it was adjusted every week. Numbness and distal upper limb pulses were checked, after tightening. Patients and patient attendants were also taught how to tighten the brace when required. It was advised that the brace be used all day (including bed-time). To keep the shoulder in the correct position during sleep, patients were also recommended to put a rolled-up towel between their shoulders on the bed during the night. Radiographs were taken during the immediate post-bracing period, in the 6th week, in the 3rd month, in the 6th month, and in the 12th month.

Inclusion criteria

- Both male and female patients are between 18 to 60 years of age.
- Displaced middle third clavicle fractures (Robinson type 2B1)

Exclusion criteria

- Age < 18 years and >60years
- Fractures of the lateral and medial third of the clavicle.
- Open and comminuted fractures.
- Undisplaced fractures.
- Polytrauma patients.

Rehabilitation protocol (for conservative group)

- Day 1 to 6 weeks: - A clavicle brace was placed on the patient and the limb was immobilized with

a sling/arm pouch. With no movement permitted at the shoulder, the elbow was held at 90-degree flexion. After 4 weeks, pendulum exercises of the shoulder were started gently in the sling.

- At 6 to 8 weeks: Active to active - active-assisted movement was allowed in all planes.
- At 8 to 12 weeks: Isotonic and isometric exercises were prescribed to the shoulder girdle muscles.

Intramedullary nailing of clavicular fractures has been done for over 50 years, with a variety of devices, including Rockwoodpins, Kirschner wires, Kuntscher nails, and Rush nails. Suggested advantages of intramedullary fixation include small skin incision, less periosteal stripping, and relative stability to allow callus formation, but frequent complications such as intrathoracic migration, pin breakage, and damage to underlying structures have limited the use of this technique. A biomechanical study comparing fixation of the clavicle with 3.5-mm compression plates and 3.8- or 4.5- mm intramedullary pins also showed that plated constructs were superior in resisting displacement. More recently, titanium elastic intramedullary nails have been used, with good results reported in several studies. Plating techniques continue to evolve. Newer pre-contoured plates allow more accurate fitting while maintaining strength; however, complications have been reported with 3.5-mm reconstruction plates, which allow easy contouring but are too weak to maintain reduction. Currently, the most commonly used technique is superior placement of the plate but when the fracture configuration allows, we prefer anteroinferior plate placement because of the safe screw trajectory and less hardware irritation. Regardless of the plate placement, meticulous attention is mandatory to preserve the periosteum and avoid injury to the subclavian vessels and lungs. Lag screw fixation should be used when possible. Contour a 3.5-mm plate to fit along the superior surface of the clavicle. Usually, an eight-hole plate fits well when contoured into an S-shape as viewed on the edge. Insert the screws from superior to inferior, taking care to avoid injury to the neurovascular structures. If an oblique fracture is present, a lag screw can be placed either through the plate or directly into the bone at roughly a 90-degree angle to the fracture line before applying the plate. After achieving adequate hemostasis, the incision is closed in layers and a sterile dressing is done.

Constant and Murley scoring system

Constant and Murley scoring system is a 100-point scale consisting of four variables that are used to assess the function of the shoulder, which are 1) Pain 2) Activity level 3) Range of motion 4) Muscle strength. The subjective variables are pain and ADL (sleep, work, sports) which give a total of 35 points. The objective variables are range of motion and strength which give a total of 65 points. Finally grading of Constant Shoulder Score measured by 90-100 = Excellent, 80-89 = Good, 70-79 = Fair, 0-70 = Poor.

Range of Motion

Measuring active range of motion with the patient sitting on a chair or bed, with weight even distributed between the ischial tuberosities. No rotation of the upper body took place during the examination. In the case of active motion, the patient lifts his arm to a pain-free level. The number of degrees at which the pain starts determines the range of motion

Muscle Strength

Strength is given a maximum of 25 points in the Constant and Murley Score. The European Society for Shoulder and Elbow Surgery measures strength according to the following method:

- A spring balance is attached distal on the forearm.
- Strength is measured with the arm at 90 degrees of elevation in the plane of the scapula (30 degrees in front of the coronal plane) and elbow straight.
- The palm facing the floor (pronation).
- The patient is asked to maintain this resisted elevation for 5 seconds.
- It is repeated 3 times immediately after another.
- The average in pounds (lb) is noted.
- The measurement should be pain-free. If pain is involved the patient gets 0 points. If the patient is unable to achieve 90^0 of elevation in the scapula plane the patient gets 0 points.

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Statistical Method

Statistical analysis: Statistical analysis was done using SPSS v.19 software (SSPS Inc., Chicago, IL, USA). The t-test was used for the paired analysis of preoperative and final results. A p-value < 0.05 was considered to be significant.

RESULTS

The present study consists of 36 patients, among which 18 patients with fresh fractures of the mid-third clavicle were treated surgically, and 18 patients were treated conservatively. Patients were followed up in the 6th week, in the 3rd month, in the 6th month, and in the 12th month. Results were analyzed both clinically and radiologically.

Table 1: Mode Of Injury:

Mode of Injury	No. of Middle third clavicle	%
1. Road Traffic Accident	26	72.2
2. Fall from Height	10	27.8
Total	36	100

Out of the 36 patients that were included in the study, 26 patients (72.2%) sustained a fracture as a part of a Road traffic accident, and 10 patients sustained a fracture due to a fall from height (27.8%).

There was a statistically significant difference in Constant and Murley scores at 6 weeks, at 3 months, at 6 months, and at 12 months between the surgical group and the conservative group and scores were significantly higher in the surgical group than the conservative group.

Table 2: Comparison Of Constant And Murley Scores Between Surgical And Conservative Group

Constant and Murley score	Surgical Group		Conservative group		t value	p-value
	Mean	SD	Mean	SD		
At the time of injury	29.44	2.81	28.22	1.80	1.553	0.130
At 6 weeks	56.78	5.53	44.89	4.30	7.198	0.000
At 3 months	71.11	5.91	67.56	3.72	2.159	0.038
At 6 months	80.11	7.69	73.11	4.51	3.33	0.002
At 12 months	85.50	6.80	77.88	3.90	3.981	0.000

Table 3: Distribution Of Complications In The Conservative And Surgical Group

	Surgical Group (Total 18)		Conservative Group (Total 18)	
	Frequency	Percentage	Frequency	Percentage
No complications *Adverse events:-* Wound dehiscence	13 1	72.22 5.56	7 0	38.9 0
Keloid formation	2	11.11	0	0
Shoulder stiffness	0	0	5	27.78
Superficial Skin infection	2	11.11	0	0
Delayed union	0	0	2	11.11
Nonunion	0	0	4	22.2
Total	18	100	18	100

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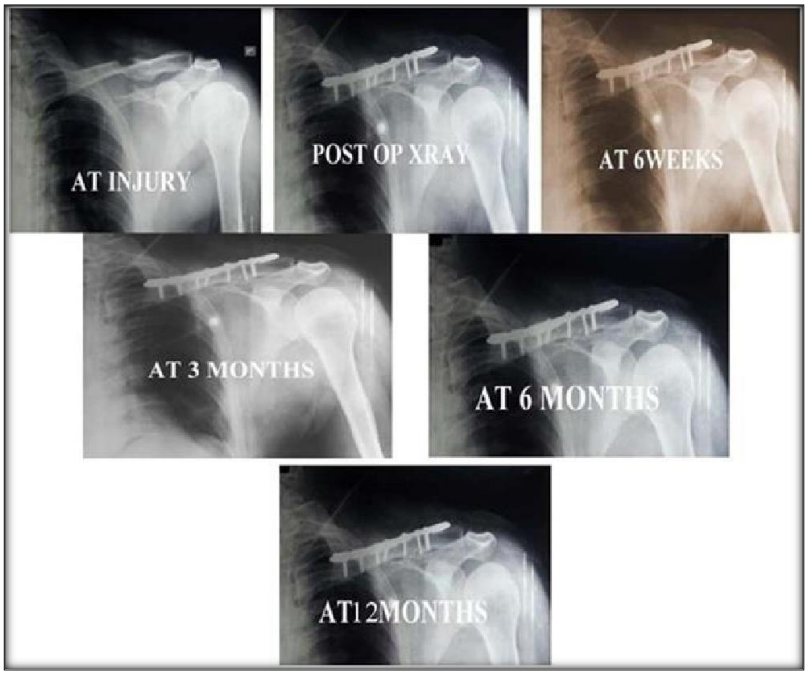
Picture 1: Conservatively treated

Picture 2: Surgically treated



DISCUSSION

The results of the present study of patients with middle-third clavicle fractures are compared with the results of standard literature. The commonly compared studies are Bostman et al study which treated 103 patients with middle third clavicle fractures, by early open reduction and internal fixation with plate and screws [6]. Previously, mal-union of the clavicle (which is typical with displaced fractures) was thought to be of radiographic interest only and required no treatment. But now clavicular mal-union is regarded as a distinct clinical entity with radiographic, orthopedic, neurologic, and cosmetic features. Nowak et al examined the late sequelae in 208 adult patients with clavicular fractures and found that ten years after the injury, ninety-six patients (46%) still had symptoms even though only fifteen (7%) had a non-union. Many recently published articles document the success of open reduction and internal fixation for nonunion of displaced clavicular fractures with low complication rates. Most of these authors used plate

fixation to treat these patients [7]. In our study, we compared two accepted treatment modalities for fracture mid-third clavicle. In my study, no patient had non-union among the surgical group and 4 patients (22.2%) had non-union among the conservative group. In Bostman et al study, no surgically treated patients went for nonunion [8]. In my study, no patient had delayed union among the surgical group and 2 patients (11.11 %) had delayed union among the conservative group. In my study, no patient had shoulder stiffness among the surgical group and 5 patients (27.78 %) had shoulder stiffness among the conservative group. In my study, one patient (5.56%) had wound dehiscence among the surgical group [9]. In my study, 2 patients (11.11 %) had keloid formation in the surgical group. In my study, two patients (11.11 %) in the surgical group had superficial skin infections. It was treated with oral antibiotics for 5 days & sterile local dressings and it was cured. The functional outcome was assessed by Constant and Murley score at the time of injury, at 6 weeks, at 3 months, 6 months, and 12 months and the score was significantly better in the surgical group than the conservative group [10]. In a randomized control study by the Canadian Orthopaedic Trauma Society, it was found that Constant score and DASH Scores are significantly better in the surgical group at 6 weeks, 12, and 24 weeks than in the conservative group [11]. The main advantage of surgical treatment of mid-third fracture clavicle with plate is that it gives immediate pain relief, early shoulder movements, less chance of non-union, and early return to work as compared to conservative treatment [12].

CONCLUSION

In this study, 36 patients with displaced mid-third fracture clavicle who presented to our hospital were randomly selected into two groups with 18 patients in each group. Every patient was followed up for 12 months. The patient's functional outcomes were assessed using the Constant and Murley scoring system and it was found that patients treated surgically had significantly better functional outcomes when compared to the conservative group. The complications we faced were four cases of nonunion, two cases of delayed union, and five cases of shoulder stiffness in the conservative group as compared to one case of wound dehiscence, two cases of superficial skin infection, and two cases of keloid formation in the surgical group which was at par with the rates in standard literature. It was observed that patients who underwent surgical treatment had better functional outcomes in terms of early ROM and they returned early to work as compared to the conservative group. According to the present study, surgery can be recommended over conservative treatment in patients with displaced mid-third clavicular fractures.

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