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Functional Outcome of Displaced Clavicle Fractures Treated with Open Reduction and Internal Fixation using Plate and Screw

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ABSTRACT

Introduction: *Clavicular fractures commonly occurred due to road traffic accident in younger people. Functional outcome of this fracture depends on mode of treatment. The study aimed to find out the functional outcome of displaced clavicle fractures treated with open reduction and internal fixation using plate and screws.* ***Methods:*** *This cross-sectional study was conducted at North Bengal Medical College and Hospital, Sirajganj, Bangladesh, from January, 2019 to December, 2021. Twenty-six (n-26) patients with the medial third of clavicle displaced fracture were treated with open reduction and internal fixation using a plate and screws. Clinical history, routine blood tests, and radiographic evaluations were performed. The outcomes were measured using the Constant-Murley shoulder outcome score.* ***Results:*** *Most patients with clavicle fracture were young, male and right sided. Common cause was road traffic accident and early union (8 to 12 weeks) occurred after surgery. Most 21 (80.77%) patients experienced excellent outcomes, and a smaller portion of 3(11.54%) cases achieved satisfactory outcomes.* ***Conclusion:*** *Surgical intervention of displaced clavicle fractures is more effective in terms of functional outcome than conservative treatment.*

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INTRODUCTION

Clavicle fracture is the break of the natural continuity of the clavicle or collarbone. Pain at the site of the fracture and decreased ability to move the affected arm are common symptoms of clavicle fracture.[1] Complications include pneumothorax, nerve or blood vessel injury, and joint stiffness.[2] A fall on a shoulder, an outstretched arm, or direct trauma often causes it. Fractures may also occur in a baby during delivery. The medial part of the clavicle is frequently involved.[1,3] Clavicle fractures typically occur in people younger than 25 and older than 70 years age.[2,3] Male are more frequently affected than female.[3] Fractured clavicles account for approximately 5% to 10% of all fractures and up to 44% of shoulder girdle injuries. Adults and children contribute 5% and 13% to fractures, respectively.[1,3] Most clavicle fractures occur in the mid-shaft of the bone,

approximately 80% to 85%, where regular compressive forces converge on the shoulder, resulting in fracture. The lateral third accounts for 20%,[4] and the medial third fractures are the rarest (5%).[5,6] It is more common in active young people who participate in activities or sports where high-speed falls (e.g., cycling, motor-cycling) or violent collisions (e.g., football, hockey). It is also caused due to road traffic accidents, falls from heights, and direct falls onto shoulders or outstretched arms. Diagnosis is usually based on symptoms and confirmed by X-rays. Fractured clavicles are traditionally treated conservatively with various closed manipulation and fixation methods. The figure of eight splints is the most commonly used. Previous studies suggested that clavicle fractures, even when significantly displaced, were essentially benign injuries (no lacerated and vascular injury) with an inherently good prognosis if treated non-operatively.[7,8]

Though conservative treatment is still effective in case of non displaced clavicle fracture but efficacy is not satisfactory in displaced fracture. There is controversy between the functional outcome of conservative and surgical (open reduction and internal fixation) treatment in displaced clavicle fracture. So, this study was aimed to find out the Functional outcome of clavicle fractures treated with open reduction and internal fixation using plates and screws.

METHODS

This cross-sectional descriptive study was conducted in the Department of Orthopaedics at North Bengal Medical College and Hospital, Sirajganj, Bangladesh, from January, 2019 to December, 2021. Twenty-six (n-26) patients with the medial third of clavicle displaced fracture were treated with open reduction and internal fixation using a plate and screws. A detailed clinical history and evaluation were made, including routine blood investigations and proper radiographic evidence with an X-ray of the chest with bilateral shoulder AP view and 45° cephalic tilt view of the involved side. Patients aged 18 to 65 years with clavicle fractures with more than 2 cm displacement were included in this study. Exclusion criteria were pathological fracture, previous or concurrent lesion of the ipsilateral shoulder, neurovascular injury association, open fractures, bilateral fractures, floating shoulder, clinical contraindication to surgery, and patient's inability to attend follow-ups. For outcome measurement, Constant-Murley shoulder out-come score was used.[9]

General information like name, age, sex, occupation, and address were noted. Then, a detailed history was elicited regarding the mode of injury. The enquiry mentioned the site of pain and swelling over the affected clavicle. Past medical illness and family history were also noted. All data were presented in a suitable table or graph according to their affinity. Statistical analysis was performed using the Statistical Package for Social Science (SPSS) program version 20.

RESULTS

Among 26 patients, most (46.15%) were aged 18-29 years, and only 7.69% were 50-60 years. Almost 70% of patients were male (Table I).

Table I: Age and gender distribution of the patients (n-26)

Variables	Frequency	Percentage
Age in year		
18-29	12	46.15
30-39	6	23.08
40-49	6	23.08
50-65	2	7.69
Total	**26**	**100**
Sex		
Male	18	69.23
Female	8	30.77
Total	**26**	**100**

Road traffic accident is the most common cause of clavicle fractures and frequently affects the right side (Table II).

Table II: Mode and side of injury of the patients (n-26)

Variables	Frequency	Percentage
Mode of injury		
Road traffic accident	14	53.85
Fall from height	4	15.38
Simple fall on the shoulder	3	11.54
Fall on an outstretched hand (indirect injury)	3	11.54
Sports Injury	2	7.69
Total	**26**	**100**
Side affected		
Right	16	61.54
Left	10	38.46
Total	**26**	**100**

Surgical intervention was done within seven days of fracture in most (23, 88.46%) cases (Table III).

Table III: Time interval between fracture and surgery

Time of surgery	Frequency	Percentage
<7days	23	88.46
>7days	3	11.54
Total	**26**	**100**

The pre-contoured plate (15, 57.69%) was used most frequently, followed by the reconstruction plate (Table IV).

Table IV: Types of plate used in operation (n-26)

Types of plate	Frequency	Percentage
Pre-contoured plate	15	57.69
Reconstruction plate	7	26.93
One-third of tubular plate	2	7.69
Dynamic compression plate	2	7.69
Total	**26**	**100**

In most cases, fracture union occurred within 8 to 12 weeks after surgery (Table V).

Table V: Duration of the union of clavicle fracture

Time of union	Frequency	Percentage
8-12 week	23	88.46
>12 week	3	11.54
Total	**26**	**100**

Delayed union, pain and restriction of shoulder movement were observed common complication of clavicle fracture. No instances were recorded for deep infection, plate breakage, or signs of nerve compression (Table VI).

Table VI: Complications of the patients after operation

Complication	Frequency	Percentage
Non-union	1	3.85
Delayed union	2	7.69
Malunion	1	3.85
Superficial infection	1	3.85
Deep infection	0	0.00
Plate loosening	1	3.85
Plate breakage	0	0.00
Plate prominence	1	3.85
Hypertrophic scar	1	3.85
Sign of nerve compression	0	0.00
Pain	2	7.69
Restriction of shoulder movement	2	7.69

Most 21 (80.77%) patients experienced excellent outcomes, and a smaller portion of 3 (11.54%) cases achieved satisfactory outcomes. There was a single case with unsatisfactory results and another with failed (Table VII).

Table VII: Functional outcomes (Constant-Murley shoulder outcome score) of the patients

Functional outcomes	Frequency	Percentage
Excellent (86-100)	21	80.77
Satisfactory /Good (71-85)	3	11.54
Unsatisfactory/Moderate (56-70)	1	3.85
Failure/Poor (0-55)	1	3.85
Total	**26**	**100**

Figure 1: X ray showing pre and postoperative status of clavicle fracture (arrow marked).

DISCUSSION

Displaced fractures of the clavicle are common in young, athletic populations and frequently caused by road traffic accident. Clavicular fractures exhibit a bimodal age distribution. The first peak occurs in young, active adult men and the second in older women with osteoporosis.[10] This study primarily found that 46.16% of patients were aged 18 to 29 years. Similar findings were observed in various studies.[11-12] Gadeet al.[13] reported that 45% of patients were aged 19-29 years. This ages people are highly active.

This study also identified a male predominance (69.23%), with a male-to-female ratio of 2.25:1. This finding aligns with a previous study that found 68% of patients were male.[13] Males are frequently affected due to occupational exposure.

Most fractures result from road traffic accidents and mainly injured in the right side. Most of the patients were right handed, outstretched hand and direct blow occurs commonlyduring road traffic accident, which is responsible for clavicle fracture.[14]

Union time of clavicle fracture was between 8 to 12 weeks in maximum cases (88.46%) and only 3 cases (11.54%) took more than 12 weeks. Ramkumar et al. noted that, most fractures were united by the end of 10 weeks (86.6%) and rest (13.4%)were within 10-12 weeks.[15] Early union occurs due to rigid fixation, no infection and no comorbidities of the patients.

Among the complications, nonunion, malunion, superficial infection, plate loosening, plate prominence, and hypertrophic scar each occurred once, accounting for 3.85% of the cases individually. Delayed union, pain and restriction of shoulder movement were observed twice each, representing 7.69% of the cases. Any patients did not experience significant complications such as deep infection, plate breakage, or signs of nerve compression. Complications of clavicle fracture include radiographic and symptomatic malunion, shoulder deformity, nonunion and infections. Clavicular shortening of more than 15 mm has been associated with shoulder discomfort and dysfunction, affecting shoulder dynamics.[16-18] Symptomatic malunion can produce pain, neurovascular compromise and upper extremity weakness. For these patients, late corrective osteotomy and plate fixation with bone grafting have been shown to improve symptoms related to malunion.[19,20]

A significant improvement in functional outcome scores was also reported when comparing operatively and non-operatively treated fractures**.** It was found that, more than 80% of the study patients had excellent outcomes, and 11.54% had satisfactory outcomes. According to Constant and Murley's score, one study found that 63.3% of patients had an excellent outcome and 36.7% had good outcome.[15] A similar study reported that, 81% of cases had excellent outcome and 13% had satisfactory outcome. Gilde et al.[21] found good functional results with isolated locking plates in 32 patients, 13 of whom had more than one year's follow-up; no revision of internal fixation or other surgery was required.

This study outcomes is consistent with other similar studies.[15,21-23] Reported outcomes of surgical treatment of mid shaft clavicle fractures have become more favorable over the past two decades. In some circumstances, patient-reported satisfaction scores are superior with early surgical management. A multicenter trial reported better functional outcomes, lower malunion and nonunion rates, and a shorter overall time to union in operatively treated clavicle fractures after plate fixation.[16] Conservative management requires a longer time to achieve union at the fracture site, leading to a loss of productive workdays and increased economic and financial burdens. In cases of nonunion, operative treatment to achieve union further increases morbidity, loss of workdays, and economic burden. Sometimes, for better outcomes, patients require stretching exercises to regain motion. We prefer to follow patients through structured rehabilitation to achieve satisfactory outcomes for most patients. Avoiding contact sports for at least 4 to 5 months is essential to protect the healing clavicle.

This study is limited by its small sample size, which may not adequately represent the broader population. The short follow-up period might not capture long-term outcomes and potential late complications.

CONCLUSION

The study concluded that open reduction and internal fixation with plates and screws for displaced clavicle fractures yield excellent functional outcome. These findings support the efficacy and safety of surgical intervention (open reduction and internal fixation) for displaced clavicle fractures, highlighting its advantage over conservative treatment.

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