

Prospective Study of Outcomes of Superior Plating for Fractures of Middle Third of Clavicle

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ABSTRACT

Introduction: Clavicle fractures were usually treated by little more than benign neglect. But now, especially for middle one third fractures, open reduction and internal fixation with plate appears to give better functional outcomes. Study evaluated the results after open reduction and superior plate osteosynthesis of fractures of middle one third of clavicle in terms of DASH score, complications and patient satisfaction.

Method and materials: We designed a prospective study between Jan 2014 and Sept 2015 which includes 30 acute fractures of middle one third of clavicle treated with open reduction and internal fixation with plate on superior surface of clavicle. Study population included 10 female and 20 male patients who were followed for 6 months and DASH score was calculated at 12 and 24 weeks.

Results: The average age of patients was 35.17 years with SD 9.79 years (range 19-52 years). The average duration of hospital stay was 7.03 days with SD of 1.35 days (range 5-10 days). Post-operatively 2 had hardware prominence, one had deep infection and one had scar hypertrophy. The average DASH score at 12 and 24 weeks was 15.29 and 8.23 respectively.

Conclusion: Open reduction and internal fixation with plate on the superior aspect of clavicle gives good functional outcomes by reducing the rate of non-union and malunion and restoring the anatomy.

Keywords: Clavicle, Middle third, Superior plating, DASH

INTRODUCTION

Fractures of the clavicle account for upto 5% of all adult fractures.^{1,3} The middle third of clavicle is the thinnest and weakest segment of the bone. Therefore, middle third is the most common site, accounting for upto 81% of all clavicle fractures.^{2,6}

The mode of injury for clavicle injuries in young adults and children is most commonly a high energy trauma like a road traffic accident, sports injury and fall from height. The incidence of the injury has a bimodal age distribution with two peaks, one under 40 years of age and other above 70 years of age.^{1,3-5}

Clavicle fractures were earlier considered to be very forgiving and treated conservatively in most of cases despite high rate of nonunion (15%).⁷ After mid clavicular fracture, distal third fracture occur more frequently (15-20%). The mechanism of injury is common to both the fracture types but fracture of distal third involve more elderly population and is due to simple falls. Earlier clavicle malunion was believed to carry only radiological significance with no functional implications whatsoever.^{1,2,8,9} But now, the malunion of the clavicle has been clearly shown by multiple authors to be a distinct clinical entity with characteristic signs and symptoms that can be significantly improved by corrective osteotomy.^{10,11} It was also shown by

studies that treatment of nonunion of these fractures produce results which are inferior when compared to results of primary operative intervention.¹²

After the dawn of era of AO principles which stressed upon rigid fixation and early mobilization, several techniques of fixation have evolved which include plates, Kirschner wires, Steinman pins, external fixators, Rockwood pins and titanium elastic nails.

Although there is no dearth of studies concentrating on the results of operative treatment, valid and scientific evidence showing primary operative intervention to be superior compared to closed treatment for dislocated fractures, still lacks.¹²

The purpose of this study was to observe the results of osteosynthesis with plate fixation in 30 patients.

MATERIAL AND METHODS

A prospective study was done from Jan 2014 to Sept 2015 at Department of Orthopaedics, Moti Lal Nehru Medical College, Allahabad and Department of Orthopaedics, King George Medical University, Lucknow. We studied 30 cases of fracture of middle third of clavicle which were selected based on inclusion and exclusion criteria and were included in our study after written consent from patient and ethical committee approval of our institutes.

Inclusion criteria: (1) An unilateral middle third fracture of the clavicle. (2) Age between eighteen and sixty years.

Exclusion Criteria: (1) A pathological fracture, (2) An open fracture, (3) A fracture seen more than 4 weeks after the injury, (4) An associated neurovascular injury, (5) An associated head injury (a Glasgow Coma Scale score of <12), (6) An upper extremity fracture distal to the shoulder, (7) Pre-existing shoulder pathology, (8) Unfit for surgery and/or anaesthesia, (9) A lack of consent.

Surgical Technique

We performed all surgeries either in general anaesthesia or regional nerve blocks. Patients were put in supine position with a bolster in interscapular area. Curved incision was given

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How to cite this article: Ajay Kumar Verma, Narendra Singh Kushwaha, Anubhav Agrawal, Alkesh Rathod, Shah Waliullah, Vineet Kumar. Prospective study of outcomes of superior plating for fractures of middle third of clavicle. International Journal of Contemporary Medical Research 2016;3(6):1835-1838.

along superior border of clavicle. Fracture site was exposed with minimal periosteal stripping and soft tissue dissection. Supraclavicular nerves were protected wherever possible. Bone fragments were reduced and interfragmentary screws were used when needed for compression or butterfly fragment. Fixation was achieved with a precontoured LCP or a 3.5 mm recon plate was contoured to the superior surface of the clavicle. A minimum of 6 cortical purchases were ensured on both the fragments. Closure of wound was done in layers.

Post-op Protocol

Wound inspection was done on fifth post operative day and

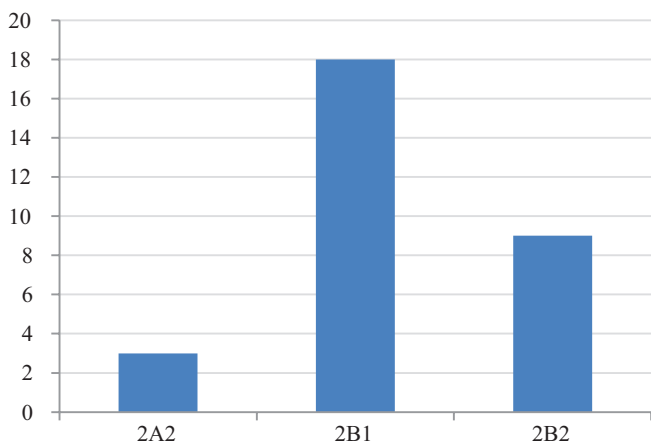


Figure-1: Distribution according to Robinson Classification

patient was discharged if the wound is healthy and patient is comfortable. Suture removal was done after two weeks and patient was allowed gentle active and active assisted exercises of the shoulder. Patient was called for follow up after six week of surgery and a X-ray was repeated. Further follow ups were scheduled at 12 weeks and 24 weeks and evaluation was done both radiologically and functionally in the form of DASH Questionnaire.

STATISTICAL ANALYSIS

Results of the study were based on descriptive statistics. Microsoft Excel 2010® version 2007 was used for calculating standard deviation and mean.

RESULTS

Our study included 10 females and 20 male patients. Thirteen fractures occurred on left side and seventeen on the right side. The mean age of patients was 35.17 years with SD 9.79 years (range 19-52 years). When classified according to Robinson classification, three fell in 2A2, eighteen in 2B1 and nine in 2B1 (Figure-1). Mechanism of injury was fall in twelve, road traffic accident in fourteen and sports injury in four cases. Epidemiological characteristics of the patients are summarised in Table-1.

The mean interval between injury and treatment is 5.1 days with SD of 3.38 days. The average hospital stay was 7.03 days with SD of 1.35 days. Speaking of complications, one patient

S.no	Age	Sex	Occupation	Dominance	Fracture side	Robinson class	Mode of injury
1	38	F	Housewife	Right	Left	2B1	Fall
2	50	M	Government employee	Right	Left	2B1	RTA
3	52	M	None	Right	Right	2A2	Fall
4	23	M	Student	Right	Left	2B1	Sports injury
5	38	M	Businessman	Right	Right	2B2	RTA
6	25	F	Student	Right	Left	2B1	RTA
7	31	M	Labour	Right	Right	2B1	Fall
8	43	F	Housewife	Right	Right	2A2	RTA
9	19	M	Student	Right	Left	2B1	Sports injury
10	29	M	Policeman	Right	Right	2B1	RTA
11	33	F	Housewife	Right	Left	2B2	Fall
12	39	M	Businessman	Right	Right	2B2	RTA
13	44	M	Government employee	Right	Left	2B1	RTA
14	27	M	Student	Left	Right	2B2	Sports injury
15	42	M	Government employee	Right	Right	2B1	Fall
16	39	M	Businessman	Right	Left	2B1	Fall
17	33	F	Housewife	Right	Right	2B1	RTA
18	31	M	Businessman	Left	Left	2B1	RTA
19	27	M	Businessman	Right	Right	2B2	RTA
20	54	F	Housewife	Right	Right	2B1	Fall
21	46	F	Housewife	Left	Left	2B2	Fall
22	23	M	Student	Right	Left	2B1	Sports injury
23	21	M	Student	Right	Right	2B2	Fall
24	29	M	Student	Right	Right	2B2	Fall
25	34	M	Government employee	Right	Right	2B1	RTA
26	31	M	Businessman	Right	Left	2B1	RTA
27	37	F	Housewife	Right	Right	2A2	RTA
28	45	F	Housewife	Left	Left	2B1	Fall
29	23	F	Student	Right	Right	2B2	Fall
30	49	M	Driver	Right	Right	2B1	RTA

Table-1: Epidemiological data of the cases in study



Figure-2: Preoperative and postoperative xrays and clinical photographs showing range of movement.

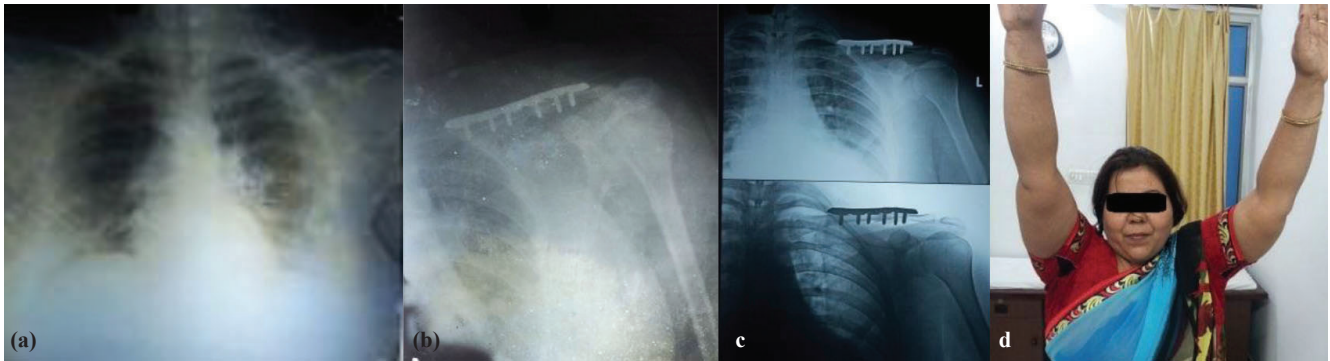


Figure-3: (A) Preoperative radiograph. (B) 6 weeks postoperative radiograph. (C) 12 weeks post operative radiograph showing union. (D) Functional outcome at 6 weeks.

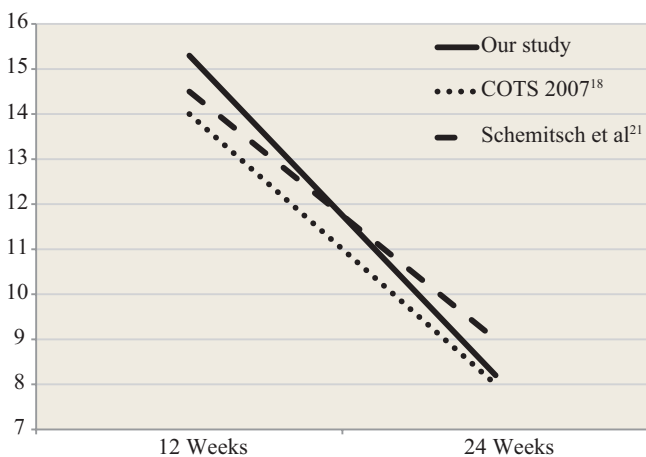


Figure-4: Comparison of DASH scores of our study with two other studies.

had scar hypertrophy, two patients had hardware irritation and one patient had delayed deep infection which was managed by implant removal at 5 months. Mean DASH score after 12 weeks was 15.29 with SD of 1.72 and after 24 weeks it was 8.23 with SD of 1.17. All of the patients were satisfied with the procedure (Figure-2 and 3). Implant loosening, non-union, malunion and implant failure was not reported in any case.

DISCUSSION

Fractures of clavicle are common and are being universally treated conservatively without any differentiation based on fracture configuration or displacement. Conservative treatment is so in vogue that Kreisinger in 1927 found descriptions of over two hundred devices used to treat fractures of the clavicle.¹³ Taylor et al were the first to treat a two month old fracture of

the clavicle with open reduction and encirclage wire in 1905.¹⁴ Recommendations for open reduction and internal fixation of completely displaced fractures of the middle third of clavicle first came from Hill et al in 1997 who reported a non-union in 15% of cases treated conservatively⁷ which was in contrast to previous studies which showed a non-union rate of 0.13-0.71% only.^{2,8} His results were supported by Robinson et al who reported 21% non-union in fractures treated conservatively in 2004.¹⁵

Anterosuperior plating can reasonably be considered the most popular operative method for fixation of the clavicle.¹⁶⁻¹⁸ Its advantages include a general familiarity with this approach in most surgeons' hands, the ability to extend it simply to both the medial and lateral ends of the clavicle, and the benefit of clear radiographic views of the clavicle postoperatively. These advantages come with a higher risk of injury to underlying vital structures but this can be avoided with meritorious drilling avoiding any overshooting of the drill.

In our study 66.7% patients were male and 33.3% female with a mean age of 35.17 years. In study by Canadian Orthopaedic Trauma Society¹⁸, 61% were male and 39% female with mean age of 33.5 years. We found Road traffic accidents to be the most common cause (14 cases, 46.7%) followed by fall. COTS also reported motor vehicle accidents to be the most common cause.

Robinson class 2B1 fractures were most common (18 cases, 60%) followed by 2B2 fractures (9 cases, 30%).

In our study, union rate was 100% and none of the cases had symptomatic malunion. Previous studies also shown a non-union rate of 0%-3.23%.¹⁸⁻²⁰

The DASH score at 12 weeks and 24 weeks follow up in our study was 15.29 ± 1.72 and 8.23 ± 1.17 respectively. The score

s. no	Age	Sex	Injury treatment interval	Hospital stay	DASH score at 3 months	DASH score at 6 months
1	38	F	5	7	13.2	7.2
2	50	M	2	9	14.5	6.8
3	52	M	8	7	14.6	7.6
4	23	M	2	5	15.1	7.7
5	38	M	1	7	18.7	9.4
6	25	F	3	9	16.7	10.2
7	31	M	5	8	14.5	9.4
8	43	F	4	7	13.8	8.6
9	19	M	6	5	13.2	6.8
10	29	M	4	10	17.3	7.8
11	33	F	2	7	13.4	7.2
12	39	M	5	5	14.7	8.1
13	44	M	3	6	15.2	9.7
14	27	M	4	8	15.6	9.4
15	42	M	2	5	16.3	7.4
16	39	M	5	7	13.7	7.9
17	33	F	3	9	14.1	8.2
18	31	M	12	6	13.9	9.6
19	27	M	6	8	15.4	10.3
20	54	F	9	5	16.9	8.9
21	46	F	16	7	15.7	6.7
22	23	M	11	7	14.9	6.9
23	21	M	5	7	17.2	7.6
24	29	M	4	8	16.3	9.4
25	34	M	2	6	19.6	10.5
26	31	M	1	9	14.7	8.5
27	37	F	7	7	14.5	7.8
28	45	F	5	7	13.6	6.8
29	23	F	6	6	13.2	7.4
30	49	M	4	7	18.4	7.2

Table-2: Functional Outcome of the cases in study

was comparable to that found in previous studies^{18,21} (Figure-4). We, based on our study, came to know that open reduction and internal fixation of fractures of middle third of clavicle gives good functional outcomes and patient satisfaction while decimating the rate of non-union. However small sample size and short duration of follow up were the main limitations of our study and will need studies with larger sample and longer follow up to further prove our results.

CONCLUSION

It is common practice to treat all the fractures of clavicle conservatively but internal fixation with plate after anatomical reduction gives excellent results in terms of early union, low rate of non-union, good functional status and a happier patient.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 27-04-2016; **Published online:** 31-05-2016