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Outcome analysis of plate versus intramedullary devices for mid shaft clavicle fractures

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Abstract

Background: Management of mid shaft of clavicle fracture depends on fracture pattern. Intramedullary devices can't be used for comminuted clavicle fractures. The aim of this study was to evaluate the role of intramedullary device and plating in mid shaft of clavicle fractures and to compare the results with studies of other author as available in literature.

Methods: This was a prospective study of 30 patients with mid shaft of clavicle fracture conducted between March 2022 and march 2023 with a follow up period of 1 year and all patients were assessed by the DASH score.

Results: both groups were comparable in terms of age, sex, side predominance and mode of injury. The mean age of the patients was 47.16 years ranging from 22 to 69 years. The average time to clinical union of the fracture was 11.1 weeks ranging from 7 to 15 weeks. There was a significant statistical difference in patients who underwent plating in fracture union and radiation exposure with P value < 0.001. the time to union was shorter in patients who underwent plating and DASH score in both groups improved over the course of follow up till one year.

Conclusion: By this study we conclude that plating of mid shaft of clavicle fracture is good viable option in the management of these fractures and has advantages over intramedullary devices in terms of stable fracture fixation, less radiation exposure and earlier time to fracture union by employing biological principles of fracture fixation and gives good functional results.

Keywords: Shaft of clavicle, intramedullary device, plating, fracture, DASH score

Introduction

Clavicle is a long bone. It supports shoulder so that the arm can swing away from the trunk. Clavicle transmits the weight of the limb to the sternum. The clavicle is commonly fractured by falling on the outstretched hand (Indirect violence). Shoulder abduction results in the highest compressive and torsional loads on the clavicle, while external rotation generates high tensile loads [1]. Clavicle fractures are one of the fractures where recently there has been considerable interest in primary internal fixation of clavicle fractures, with both plating and intramedullary devices being used [2]. A bimodal age distribution with peaks at ages younger than 40 and older than 70 further distinguishes the injury's incidence [3,4]. The standard of care is closed treatment using a sling, however new research has shown that non-operative care is associated with greater incidence of delayed union, non-union, shoulder discomfort, and shoulder weakening. In a recent clinical series, nonsurgical treatment of badly misplaced midclavicular fractures resulted in unsatisfactory outcomes in 4.5% to 31% of patients [5]. For operative treatment, open reduction and internal fixation with a 3.5 mm dynamic compression plate is the standard; however, intramedullary fixation using titanium elastic nail is a less invasive alternative [6]. The orif technique's success depends on careful preoperative preparation and patient choice. Currently, a pre-contoured anatomic plate is used to reduce soft tissue irritation and the amount of time needed during surgery to shape the plate to the clavicle. This technique is not appropriate for patients who are at high risk for multiple falls, alcohol addiction, or noncompliance. Soft tissue irritation at the extremities of the plate can result from failing to carefully contour the plate to accommodate the s-shape of the clavicle [7]. Typically, several 3.5-mm screws are inserted into the proximal and distal fragments, and compression

mode application of the plates is excellent to lower the risk of delayed union or non-union [8]. By avoiding the removal of soft tissue, intramedullary clavicle fixation may have the advantage of retaining the periosteal blood supply. Migration of IM devices into the neck, thorax and spine has been documented in the immediate and late postoperative periods [9].

Materials and Methods

Between March 2022 and March 2023, 30 patients were hospitalised and treated for mid shaft clavicle fractures at Saveetha medical college and hospitals, thandalam. All 30 patients received surgical treatment with IMD or plate fixation. The indication for surgery was one or more of the following criteria: completely displaced fracture fragments, shortening of greater than 2 cm, associated neurovascular injury, open fractures and threatened skin. Patients with bilateral clavicle fractures and patients not willing for follow up were excluded. All patients were seen either at the outpatients or at the emergency department & following admission, a thorough history was taken with details regarding time since injury to presentation to the hospital and a physical examination was carried out. Patients were followed up for a 1-year period after undergoing IM or plate fixation of the clavicle fracture: follow-up was at 3, 6 and 12 months postoperatively. Plain film anteroposterior (AP) radiographs were obtained at 3, 6 and 12 months post operatively. Radiographs were assessed for the presence of union. Union was defined as radiographic evidence of re-establishment of cortex continuity. Routine blood investigations were done. The patients were taken up for surgery after obtaining informed consent & anaesthetic fitness for surgery.

All procedures were performed under regional/general anaesthesia under antibiotic cover for both IMD & plate fixation. Patient underwent surgery in beach chair position.

Plate Fixation

A longitudinal incision was made centred just anterior to the subcutaneous border of the clavicle over the fracture site. Anatomical reduction was achieved and where necessary maintained with reduction forceps. 8-hole 3.5-mm Dynamic Compression Plate (DCP) was used to achieve good anatomical alignment of the plate with the clavicle. The plate was fixed to the clavicle using 3.5-mm cortical screws and aiming for 4 bicortical screws either side of the fracture.

IMD Fixation

A small skin incision, 1-2cm in length, is made just lateral to the sternoclavicular joint anteriorly. Blunt dissection to bone is performed to expose the entry point of the nail. Using image intensifier, the entry point is obtained using a 2.5-mm drill bit in the anterior cortex of the medial clavicle 1.5-2 cm lateral to the sternoclavicular joint. The entry point is enlarged with a small awl in a lateral direction. The fracture was then reduced and the TENS nail of size ranging from 2.0-3.5mm was advanced into the medial clavicle fragment towards the lateral end of the clavicle with the aid of T-handle chuck until it reaches a firm position. The protruding TENS nail was cut and bent and buried towards the bone to prevent skin irritation and wire migration.

The postoperative rehabilitation was the same for both groups. Each patient had their injured arm placed into a broad arm sling for the first 2 weeks after fixation. Pendular exercises were allowed for the following 4 weeks, then at 6

weeks after surgery, exercises involving raising the arm upto shoulder level were permitted. Outcomes were assessed using DASH scoring system. All complications were also recorded. The postoperative time required to regain full shoulder ROM in all planes was recorded. Statistical analysis was performed using SPSS v24 (IBM, United States of America). Statistical significance was accepted with P-values <0.05.

Results

30 patients of mid shaft clavicle fracture treated with ORIF and intramedullary device were studied between march 2022 to march 2023. There were 18 males and 12 females patients in our study with right side being more commonly affected in 20 patients. The mean age of the patients was 47.16 years ranging from 22 to 69 years. The most common mode of injury was road traffic accidents followed by slip and fall (Figure 1). The mean time since injury and presentation to the hospital was 59 mins ranging from 30 to 120 mins. The average duration of surgery was 85.1 mins and the mean blood loss was 90 ml. The average duration of hospital stays 10 days. The average time to clinical union of the fracture was 11.1 weeks ranging from 7 to 15 weeks (Table 1). The average post-operative DASH score at the end of 3 months was 24.5 ranging from 19 to 32. Patients who underwent ORIF had less exposure to radiation when compared to patients who underwent IMD procedure (Figure 2,3). Post operatively 2 patients developed surgical site infection which was treated with appropriate intravenous antibiotics and 2 patients developed malunion of clavicle which was not troublesome to the patient and they were able to do shoulder movements without any restrictions. All patients returned to their preinjury status after 15 weeks and were able to utilize their shoulder comfortably without any pain (Table 2). There were no complications such as implant failure, pneumothorax, neurovascular injury, screw back out encountered in our study. None of our patients were lost to follow up (Table 3).

Discussion

In our study we compared the results of 30 patients treated with plating and intramedullary device. Our study showed male preponderance in both the groups. Previous studies have concluded that incidence of clavicular fractures is significantly more common in males due to high energy trauma.

Anatomically aligned united mid shaft clavicle fracture is always superior over conservatively treated clavicle. This can only be accomplished through an open reduction with internal fixation or a percutaneous operation. Plating is considered gold standard operative technique for mid shaft of clavicle fracture because it restores anatomical and mechanical length and alignment even in comminuted fractures by becoming the strongest implant. This approach, however, may necessitate a wider incision and extended exposure, which may result in complications such as infections, implant failure, refracture following implant removal, neurovascular damage, non-union, dysesthesia, and keloid scarring.

Percutaneous intramedullary fixation with TENS nailing is another emerging mode of fixation. It is also minimally invasive, preserves fracture haematoma and periosteum, which promotes abundant callous growth, and improves cosmesis. According to studies, the average time of union is substantially shorter since it gives relative stability. It can be done in either an anterograde or retrograde manner. Intramedullary nail or pin fixation is minimally invasive, with smaller skin incisions, less soft tissue stripping, less blood

loss, a shorter operating time, a shorter hospital stay, a shorter time for union, and few significant problems. In a study conducted by Grassi *et al* found that adverse events such as infection, re-fracture, and non-union occurred in 35% of patients undergoing intramedullary fixation; a significantly higher complication rate than nonoperative treatment [10]. Studies conducted by Andrade-silva *et al* and Meijden *et al* found no significance difference in functional outcome in the results of plating versus nailing [11, 12].

In our study, the plating group and nailing group required 12.67 ± 1.5 weeks for bony union. This timeline was comparable with the study conducted by Zehir *et al* when the time required for bony union in the plating group and nailing group were 13.81 ± 2.9 weeks and 11.75 ± 2.7 weeks, respectively [13]. In the study done by Silva *et al*, there was one major complication of non-union in nailing group with no major complications seen in plating group. They found a significant difference in implant related pain between two groups. Implant related pain was seen in 40% of cases in nailing group while plating group had only 14% of implant related pain [14]. In our study 2 patients had malunion & 2 patients had infection of which all the 4 patients were managed with intramedullary devices.

In our study we had a fracture healing rate of 99% with no cases of any complications at the time of last follow up. We also reviewed studies of other authors & noted that there were good fracture healing and outcome rates reported in most of the studies which compares well with the result of our study.

We thereby conclude by stating that plating is a good option for the management of mid shaft of clavicle fractures.

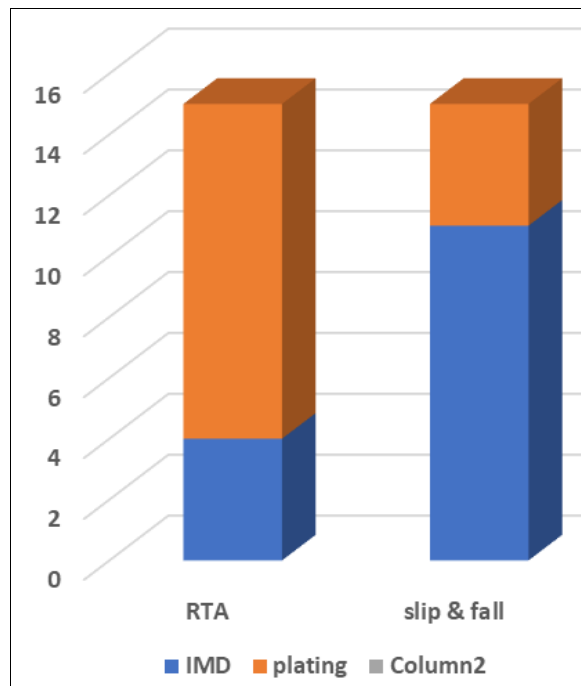


Fig 1: Mechanism of injury

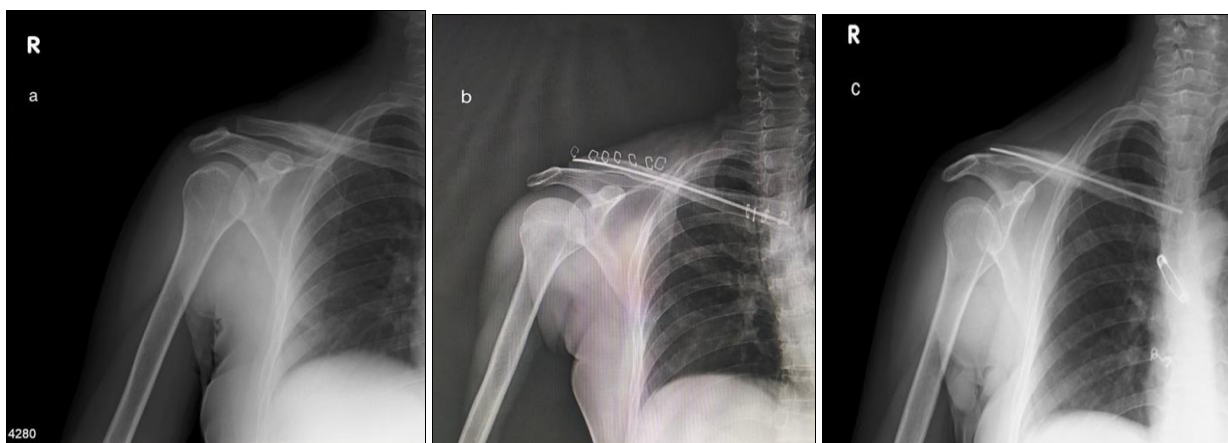


Fig 2: A- preoperative picture of shaft of clavicle fracture; b- immediate post op picture with IMD in situ; c- 3 months post op picture showing healed shaft of clavicle fracture

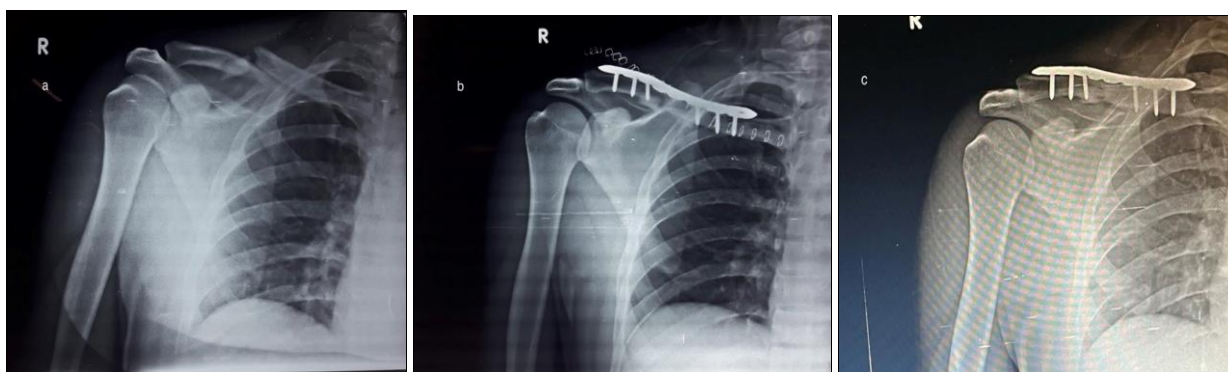


Fig 3: a- preoperative picture of shaft of clavicle fracture; b- immediate post op picture fixed with plate; c- 3 months post op picture

Table 1: Functional outcome in midshaft of clavicle fractures treated with IMD or plate fixation

	IMD fixation (n=15)	Plate fixation (n=15)
Mean time for shoulder girdle return to full range of motion compared with uninjured arm (weeks)	9 weeks	5 weeks
Postoperative pain, non-weight bearing (VAS >2)	4	3
Postoperative pain, weight bearing (VAS >2)	5	3

Table 2: Surgical outcome in midshaft of clavicle fracture treated with IMD or plate fixation

	IMD (n=15)	Plate fixation (n=15)
Malunion rate	2	0
Superficial infection	2	0
Deep infection	0	0
Reoperation rate	0	0
shortening	0	0

Table 3: Demographic distribution of mid shaft of clavicle fracture

S.no	Age	Sex	Mode of injury	Side	Procedure done	Procedure duration (mins)	Dash score (At 1 month)	Dash score (At 2 month)	Dash score (At 3 month)	No. Of radiation exposures	Fracture union (weeks)	Complications
1	52	M	RTA	R	ORIF	95	29	25	23	2	7	
2	33	M	SLIP & FALL	R	ORIF	90	29	27	23	2	8	
3	47	M	RTA	R	ORIF	105	29	25	21	3	8	
4	41	M	RTA	L	IMD	75	31	28	25	7	12	Malunion
5	55	F	RTA	R	IMD	80	34	26	24	11	14	
6	39	M	SLIP & FALL	L	ORIF	97	28	26	22	4	10	
7	48	F	RTA	R	ORIF	95	29	27	24	3	14	
8	29	M	SLIP & FALL	L	IMD	70	35	30	26	10	13	Infection
9	39	F	RTA	R	IMD	77	37	31	28	9	12	
10	56	F	RTA	L	ORIF	90	33	29	26	3	8	
11	22	M	RTA	R	IMD	80	37	32	29	6	12	
12	53	F	SLIP & FALL	R	IMD	75	37	33	31	9	14	
13	47	F	RTA	R	IMD	85	31	26	23	12	13	
14	54	M	RTA	L	ORIF	100	29	26	22	6	9	
15	62	M	RTA	R	IMD	83	33	28	25	11	10	
16	67	M	RTA	R	ORIF	97	29	27	23	5	10	
17	51	F	RTA	L	IMD	79	35	32	28	10	12	
18	63	M	SLIP & FALL	R	ORIF	100	27	25	20	7	10	
19	37	M	RTA	L	IMD	75	37	35	32	12	15	
20	43	F	RTA	R	ORIF	95	31	27	24	2	13	
21	67	M	RTA	L	ORIF	90	27	24	19	5	12	
22	59	F	SLIP & FALL	R	IMD	70	35	30	27	8	14	Malunion
23	56	F	RTA	R	ORIF	95	31	29	24	4	9	
24	45	M	SLIP & FALL	L	IMD	80	29	27	23	9	13	
25	61	F	RTA	R	ORIF	94	33	29	25	5	8	
26	31	M	RTA	L	IMD	65	33	30	28	15	13	
27	27	M	SLIP & FALL	R	ORIF	96	28	25	21	5	10	
28	66	M	RTA	R	ORIF	90	31	27	22	5	8	
29	30	M	SLIP & FALL	R	IMD	60	31	29	25	8	13	
30	35	F	RTA	R	IMD	70	31	27	24	13	14	Infection

Conclusion

We hereby conclude by stating that plating for mid shaft clavicle fractures has a good functional outcome as similar to intramedullary device but has the potential advantages of quicker fracture healing, less radiation exposure with low incidence of complications such as infection, non-union and malunion.

Conflict of interest

None declared

References

- Nordqvist A, Petersson CJ. The incidence of fractures of the clavicle. Clin Orthop Relat Res. 1994;300:127–132.
- Kim W, McKee MD. Management of acute clavicle fractures. Orthop Clin North Am. 2008;39:491-505, vii.
- Postacchini F, Gumina S, De Santis P, *et al.* Epidemiology of clavicle fractures. J Shoulder Elbow Surg. 2002;11:454-456.
- Robinson CM. Fractures of the clavicle in the adult: epidemiology and classification. J Bone Joint Surg Br. 1998;80:476–484.
- Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle third fractures of the clavicle gives poor results. J Bone Joint Surg Br. 1997;79:537–539.
- Mueller M, Rangger C, Striepens N, *et al.* Minimally invasive intramedullary nailing of midshaft clavicular fractures using titanium elastic nails. J Trauma. 2008;64:1528–1534.
- Smekal V, Oberladstatter J, Struve P, *et al.* Shaft fractures of the clavicle: current concepts. Arch Orthop Trauma Surg. 2009;129:807-815.

8. Robinson CM, Court-Brown CM, McQueen MM, *et al.* Estimating the risk of non-union following nonoperative treatment of a clavicular fracture. *J Bone Joint Surg Am.* 2004;86:1359-1365.
9. Kettler M, Schieker M, Braunstein V, *et al.* Flexible intramedullary nailing for stabilization of displaced midshaft clavicle fractures: technique and results in 87 patients. *Acta Orthop.* 2007;78:424–429.
10. Grassi FA, Tajana MS, D'Angelo F. Management of mid-clavicular fractures: Comparison between nonoperative treatment and open intramedullary fixation in 80 patients. *J Trauma.* 2001;50(6):1096-100.
11. Andrade-Silva FB, Kojima KE, Joeris A, Santos Silva J, Mattar R Jr. Single, superiorly placed reconstruction plate compared with flexible intramedullary nailing for midshaft clavicular fractures: a prospective, randomized controlled trial. *J Bone Joint Surg Am.* 2015;97(8):620-626. Doi:10.2106/JBJS.N.00497
12. van der Meijden OA, Houwert RM, Hulsmans M, Wijdicks FJ, Dijkgraaf MG, Meylaerts SA, *et al.* Operative treatment of dislocated midshaft clavicular fractures: Plate or intramedullary nail fixation? A randomized controlled trial. *J Bone Joint Surg Am.* 2015;97(8):613-9. doi: 10.2106/JBJS.N.00449
13. ZehirS,ZehirR,SahinE,CalbiyikM.Comparisonofnovelintramedullarynailingwithmini-invasiveplatinginsurgicalfixation of displaced midshaft clavicle fractures. *Arch Orthop Trauma Surg.* 2015;135(3):339-44. doi: 10.1007/s00402-014-2142-1
14. Storti TM, Camilo MS, Silva RFA, Faria RSS, Simionatto CL, Paniago AF. Clinical evaluation of the treatment of clavicle fractures: intramedullary nail × Plate. *Acta Ortop Bras.* 2021 Jan-Feb;29(1):34-38. Doi:10.1590/1413-785220212901231439. PMID: 33795967; PMCID: PMC7976870.

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