

Displaced Mid Shaft Clavicular Fracture Fixation by Plate and Screws (Functional Outcome)

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INTRODUCTION

Clavicle fracture is common orthopedic injury seen in practice it account for about 7.5 % of all fracture admission in the emergency department, young male are more commonly effected than female specially with direct trauma (Postacchini et al 2002). The mid shaft or mid third clavicle fracture is the most location of injury in approximately 80% of the total collarbone fracture (Abo el nor 2013). Traditionally most of the bone fracture can be treated conservatively without surgical intervention but fractures location, degree of comminution, displacement and associated skeletal and nearby structures injuries is play an important role in determine the best option for treatment and value of open reduction and internal fixation in these circumstances. Non-displaced fracture of mid clavicle can healed conservatively without any intervention with wide acceptance among orthopedic surgeons, but displaced fracture carry higher risk of complication than previously mentioned type specially non-union and symptomatic malunion in addition to time to resume job (Robbin et al 2012). Malunion of clavicle lead to situate the shoulder in a predictable position of scapular protraction and tilt, inferior and anterior displacement. This malposition can modify the kinematics of the muscles controlling shoulder and scapular motion as well as adversely affect the underlying neurovascular structures, the abnormal kinematics of the musculature responsible for shoulder and scapular motion resulting from malunion has well described as a cause of scapular dyskinesis (Kibler WB et al 2012). Shoulder ptosis

ABSTRACT

Background: Displaced mid shaft clavicular fracture can be manage conservatively and surgically, open reduction and internal fixation with plate and screw, as primary intervention is valid option.

Method: prospective cohort study was conducted of 18 young patients with displaced mid shaft clavicle fracture ,these patients underwent open reduction and plate and screw fixation, after 6 months follow up evaluation done for complication rates functional score by DASH & ULCA score, patients satisfactions and estimation of time need for resume job.

Results: 15/18 patients were male; those patients underwent open reduction and internal fixation by plate and screw in time up to 40 days post injury. 50% have complications mostly minor complications like prominent hard ware and scar or paresthesia, 2/18 patients have major complication, one infection and other implant failure ,most of patients 14/18 have fully satisfied with result ,61% resumed the job early within 3 weeks. The mean DASH score was 34.9 ,ULCA score 28.9, factors effecting DASH score was comorbidity, complication, range of motion, satisfaction and time to return to job, while ULCA score effected by use of regional anesthesia, complication, range of motion, satisfaction and time to return to job. There is no statistical relationship between age, gender, and complications and time to fixation to satisfaction or time to resume job.

Conclusion: open reduction and internal fixation of displaced mid shaft clavicle fracture should be offered for patient with expectation of good outcome especially with supervised rehabilitation.

Keywords: Displaced, mid shaft clavicular fracture, fixation, plate and screws, functional outcome.

following mal-united clavicle fracture occurred following fractures displacement more than 2 cm, which resulted in Orthopedic, neurological (Thoracic Outlet Syndrome), and cosmetic symptoms (Chan KY et al. 1999). Malunion fracture in the other hand made burden on patient and health system due to need for further intervention, prolong morbidity and less successful rate. To overcome these problem primary open reduction and internal fixation offered for displaced mid-shaft clavicle fracture; the option could be completed with use of plate and screw or by clavicle nail. This study aim was to assess the outcome of using plate and screw as first line in the management of displaced middle third clavicle fracture.

METHOD

Prospective cohort study conducted from January 2018 to December 2019 at Al-Hussain medical city at Karbala, for young patients with displaced mid shaft clavicle fracture. Patients include in study are young and have trauma, mid-shaft displaced fracture, acute injury, need operative management. Exclusion criteria were pediatric and geriatric age group, pathological fracture, both end clavicle fracture, patient preference of conservative management, chronic injury, nonunion and delayed union. Patient evaluation and preparation by; history, physical examination, investigation, preoperative planning by informed consent, Prepare 2 paints of blood and selection of the appropriate implant depending on fracture geometry, after 6 months follow up evaluation done for complication rates functional score by

DASH & ULCA score, patients satisfactions and estimation of time need for resume job.. Statistical analysis done by SPSS 22, frequency and percentage used for categorical data, mean and SD for continuous data. Chi-square used for assessed association between variables, ROC curve also used to show more specific and sensitive cutoff point. P-value less or equal to 0.05 is consider significant.

RESULTS

A study of 18 patient midclavicular fracture, 15 of them are male (83%) mean age about 26.3 and 3 female (17%) as shown in chart (1) with mean age about 26 years. While chart (2) below show mechanism of injury which mostly due to road traffic accident

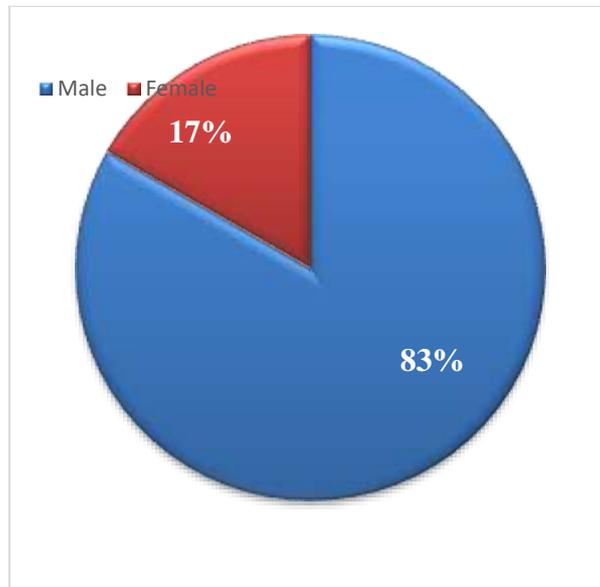


Chart1: Gender of patients

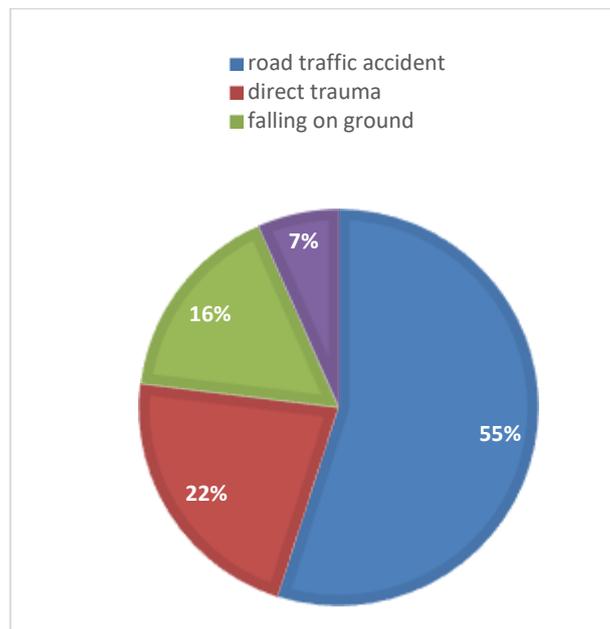


Chart 2: Mechanism of injury

All of them were used open reduction with internal fixation with plate and screws. General anesthesia was used in 14 patients while the others four surgeries did under regional anesthesia. After surgery and during follow up of the patients, 9/18 had no complications, while 7 /18 was with minor complications (prominent hardware, scar, paresthesia) and only 2/18 patients with major complications (one of them failure of fixation and other was

deep infection). Follow up of patients shoulder motion show that 10/18 regain full range of motion & the remaining 8/18 ended with some degree of limitation that are functionally negligible. Most of the patients (14/18) was fully satisfied with their result & four of total patient's number are partially satisfied to achieve their aim. Regarding return to normal activity of daily living all patients return to that level of activity, from those patient only 61% of patients carry out

their jobs as pre-injury level. As table (1) below show above data.

Table 1: Follow up data of the patients

Complications	No	9	50.0%
	Minor	7	38.9%
	Major	2	11.1%
ROM	No limitation	10	55.6%
	Partial limitation	8	44.4%
Satisfaction	Yes	14	77.2%
	partial	4	22.8%
Time to return to job	Early	11	61.1%
	Late	7	38.9%

Statistical analysis of the result to determine the relation of variables to DASH score at 6 months follow up as shown below in table 2:

Table 2: The relation between patient's characteristics and DASH score.

patient's characteristics		Mean	SD	Minimum	Maximum
Gender P=0.431 NS	Female	27.93	2.90	25.00	30.80
	Male	36.31	17.49	10.00	66.20
Morbidity P=0.045 S	No	31.55	14.16	10.00	66.20
	Smoking	51.73	18.00	31.00	63.40
Injury P=0.157 NS	Trauma	20.40	12.01	10.00	30.80
	RVA	41.13	16.93	24.00	66.20
	Blast/bullet	43.30	.	43.30	43.30
	Fall	30.73	7.48	25.00	39.20
Time to fixation P=0.974 NS	<11 days	34.43	8.71	25.00	46.70
	11-20 days	39.20	18.86	26.00	60.80
	21-30 days	33.77	25.21	10.00	66.20
	>30 days	33.60	7.92	28.00	39.20
Anesthesia P=0.070 NS	GA	31.23	13.92	10.00	63.40
	RA	47.80	19.16	25.00	66.20
Complications P=0.003 S	No	26.72	11.31	10.00	43.30
	Minor	36.90	13.10	25.00	60.80
	Major	64.80	1.98	63.40	66.20
ROM P=0.002 S	No limitation	25.29	9.79	10.00	43.30
	Partial limitation	46.94	14.78	29.00	66.20
Satisfaction P=0.004 S	Yes	29.94	12.75	10.00	60.80
	partial	53.87	13.03	25.00	66.20
Time to return to job P=0.003 S	Early	26.57	10.20	10.00	43.30
	Late	48.01	15.64	29.00	66.20

NS: Not significant, S: Significant

Significant values of different variable in relation to ULCA score functional outcome:

1. anesthesia: Regional type mean 25.50, SD= 1.91, P value was significant about 0.009
2. complication: Major complication mean was 23.50, SD =0.71, Minor complication mean was 27.71, SD =2.75, P value was so significant about 0.005
3. range of motion: Partial limitation mean 26.88, SD =3.64, P value was significant = 0.009

4. satisfaction: Partial satisfy mean 24.00, SD = 0.81, P value was so significant about 0.005
5. time to return to job & ADL: Late return mean 26.29, SD =3.40, P value was significant about 0.002

The relation between patients characteristic and their satisfaction, return to job and activity of daily living as shown in tables 3, 4 and 5.

Table 3: Age in relation with satisfaction & return to job

		Mean	SD	Minimum	Maximum
Satisfaction P=0.014 S	Yes	24.50	5.32	18.00	34.00
	partial	32.50	4.04	27.00	36.00
Time to return to job P=0.206 NS	Early	24.82	4.71	20.00	34.00
	Late	28.57	7.46	18.00	36.00

Satisfaction P value was so significant about 0.014

Table 4: Gender in relation to satisfaction & time to return to job

		Female		Male	
		Count	%	Count	%
Satisfaction P=310 NS	Yes	3	100.0%	11	73.3%
	partial	0	.0%	4	26.7%
Time to return to job P=0.130 NS	Early	3	100.0%	8	53.3%
	Late	0	.0%	7	46.7%

Table 5: Time of fixation in relation to, satisfaction, Time to return to job, Complications.

		<11 days		11-20 days		21-30 days		>30 days	
		N	%	N	%	N	%	N	%
Satisfaction P=0.568 NS	Yes	5	71.4%	3	100.0%	4	66.7%	2	100.0%
	partial	2	28.6%	0	.0%	2	33.3%	0	.0%
Time to return to job P=0.644 NS	Early	4	57.1%	2	66.7%	3	50.0%	2	100.0%
	Late	3	42.9%	1	33.3%	3	50.0%	0	.0%
Complications P=0.068 NS	No	2	28.6%	1	33.3%	4	66.7%	2	100.0%
	Minor	5	71.4%	2	66.7%	0	.0%	0	.0%
	Major	0	.0%	0	.0%	2	33.3%	0	.0%

All of this variable are statistically not significant in relation to time of fixation.

DISCUSSION

The optimum treatment of displaced mid-clavicle shaft fracture is still a matter of controversy, because there is no clear data about which type of management is the best. This shown with meta-analysis study done by (Xin-Hua et al 2015) with collection of large data for approximately 50 years duration. As he concluded, that surgical intervention generally was better than conservative management, but they did not recommend the use of operative fixation for all patients with displaced fractures of mid shaft clavicle as routine primary line of management. (Canadian Orthopedic Trauma Society 2007) stated that increased nonunion rates and poor functional outcomes were associated with conservative management of mid-shaft clavicle fractures. This was different from traditional belief that normal function without any deficit would obtain after healing of non-operatively treated mid-shaft clavicle fracture. Böhme et al 2013 and peter et. al 2011) recommended operative stabilization for displaced clavicle fractures, with advantages of early pain loss, better shoulder function, less deformity and weakness, with higher range of motion. Those patients had earlier return to their job, consume less medications, and shorter physical therapy was needed. The increased cost of financial surgical charge balanced by the enhancement of income with less work absence. Most of the patients in this study were males (83.3 %). That was explained by the fact that lifestyle of male make him more vulnerable for trauma. Generally, males are nearly 3 times more vulnerable to suffer a clavicle fracture than females (Robinson 1998).

Other factors that could contribute to male predominance in this study were the male wish for rapid return to pre-injury level of function, & that male patients did not care much about the presence of operation scar. According to (Daniel et al 2015). Better functional outcome and shoulder scores observed with lower threshold of primary surgery within 6 weeks of injury. He defined delayed surgery as fixation done after 6 weeks from injury. According to this definition, all cases in the current study fits into his definition of early fixation. (Robbin et al 2012) in Meta-Analysis of Randomized Clinical Trials reported complications rate of 29%. A specific set of complications (delayed union, nonunion, symptomatic malunion, hardware removal, re-fracture, neurologic symptoms, and infection. Scar and symptomatic hardware that is irritant to patient and obligate removal not recognized as complications. Two patients developed major complications. The first patient developed early hardware failure, within 3 weeks of surgery. Revision surgery indicated, the cause of failure was improper selection of implant (4.5 mm) plate for fixation, and revision surgery done with 3.5 mm anatomical clavicle locking plate, with good result. The second patient developed early postoperative infection happened in another patient that treated with irrigation, antibiotics, and preservation of implant. Healing occurred eventually with no signs of activation of infection. Minor complications observed in 38.9% of patient's, most commonly prominent hardware, which occurred mainly in thin people. (Asadollahi et al 2016) described a complications rate of 10%, after plate

fixation. He found that 23% of patients had underwent implant removal due to symptomatic hardware, but they did not consider them as complications. The same study revealed that 35% of complications were potentially avoidable because they related to poor surgical technique. The reoperation rate, if hardware removal is considered was 14% and the complications rates in general was and 43%, as reported by (Bostman et al 1997), the other reported complications included hardware failure, hypertrophic scarring and infection. (Leroux et al 2014) of 1350 patients with a mid-shaft clavicle fracture treated surgically show that nearly 25% of patients required reoperation due to prominent hardware, mostly in females. Postoperative complications in (Singh et al 2012) study were observed in 42.9% of patients, these included: metal implant prominence/pressure symptoms, infection, peri-prosthetic fracture and pain, removal of metal implant was done for all patient with complication. Seventy seven percent (77%) of these study patients were satisfied with the outcome of surgery. The rest of patients were not fully satisfied, this approximate to (Tutuhaturunewa et al 2017), that described 80 % patient satisfaction in the operative group. (Smith et al 2000) found 83% satisfaction rate in his sample with operative intervention but lower than (Hudak et al. 1996), who reported higher satisfaction rate postoperatively (94% in 232) patients. Two scoring systems for assessment of functional outcome were used, both of DASH & ULCA scoring systems, to cover both patient completed, and clinician completed types; respectively. Those scores well recognized for validity and reliability in determining the outcome of shoulder function (Amstutz et al. 1981). (Nutton et al 1997) define well to excellent result of ULCA scores if it is more than 27, in our study the mean of this score was 28.9. This excellent result was reported by (Singh et al 2012) where the mean of ULCA score was 32 for operative management of displaced mid shaft clavicle fracture.

CONCLUSION

Open reduction and internal fixation of displaced mid shaft clavicle fracture should be offered for patient with expectation of good outcome especially with supervised rehabilitation.

ETHICAL CLEARANCE

The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq.

CONFLICT OF INTEREST

None.

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