ORIGINAL RESEARCH

ADULT CLAVICULAR FRACTURES IN PORT HARCOURT: OUTCOME OF NON-OPERATIVE TREATMENT

https://doi.org/10.71921/ajrmhs.vol3no2.75

Mike Tochi Achor[1*], Tamunokuro Ezekiel Diamond[2]

[1]Department of Surgery, Faculty of Clinical Sciences, College of Medical Sciences, Rivers State University, Nigeria.

[2]Department of Surgery, Faculty of Clinical Sciences, College of Health Sciences, University of Port Harcourt, Nigeria.

***Correspondence:** Achor, MT; **Email:** miketochi.Achor@ust.edu.ng

Abstract

Background: Fractures of the clavicle are commonly encountered in musculoskeletal trauma. Non-operative treatment remained the mainstay of management of clavicular fractures until recent evidence showed improved functional outcome and fewer complications with surgery for some fracture patterns and specific injury types. In the developing world, the indications for operative treatment are less probably due to a combination of limited resources and low health insurance coverage.

Objective: The aim of this study was to evaluate the result of non-operative treatment of fractures of the clavicle.

Methods: The study was a descriptive retrospective study, spanning a period of 5 years. Records of patients whose information met the inclusion criteria were utilized in the study. Their information was obtained from hospital records and analysed using SPSS version 26.

Results: Records of 46 patients were utilized in the study. The age group 31-40 and 61-70years were mostly affected (n=11 each; 23.9%) with female to male ratio of 1.2:1. Mid-shaft clavicular fractures were predominant (n=31; 67.4%). Falls were responsible for most of the injuries (n=24; 54.3%). Most of the patients (n=30; 65.2%) were treated with figure-of-eight splint. Union was achieved in 89.1% (n=41) of the fractures with mean time to radiological union of 19.04±3.66 weeks. There was positive linear correlation between increasing age and time to radiological union (p=0.007).

Conclusion: The result showed that non-operative treatment is an effective method of managing clavicular fractures in adults.

Key words: Fracture of clavicle, Adult, Port Harcourt, non-operative treatment

Cite as*: Achor MT, Diamond TE. Adult Clavicular Fractures in Port Harcourt: Outcome of Non-Operative Treatment. AJRMHS. 2025;3(2):54-61*

INTRODUCTION

Fractures of the clavicle are commonly encountered in trauma care. It is responsible for 2.6 – 4% of all adult fractures and 35% of injuries to the shoulder girdle. [1,2,3] It may occur alone or as part of injury complex in a polytraumatized patient. The incidence is greatest in the second and third decades of life.[4] The prevalence tends to decrease every decade after the age of 20years.[4] However, the ratio of female to male increases with age [4]. The aetiology includes motor vehicle accidents, sports injuries, falls and assaults. In the elderly, falls predominate[3].Injuries to the clavicle can be divided into three distinct anatomical sites; the medial clavicle, shaft and lateral end.[1,2,3] Mid-shaft clavicular fractures are predominant, accounting for about 82% of all clavicular fractures.[3] Medial and lateral end fractures are responsible for 18 and 2% respectively.[3] Injury location and pattern are considered in formulating a treatment plan.

A number of classification systems have been used to describe clavicular fractures. Allman [5] divided fractures of the clavicle by anatomical site into 3 groups: Group 1-fractures of the middle third; Group 2-fractures distal to coracoclavicular ligament; Group 3- fractures of proximal third of the clavicle.

Neer [6] subdivided lateral third fractures into three groups; undisplaced, displaced and intra-articular. The displaced variety were further divided into 2a and 2b, depending on the presence of injury to the coraco-clavicular ligaments (CC). Type 2a injury is a fracture medial to both conoid and trapezoid elements of the CC ligaments, with shaft displacing superior relative to the lateral end. A type 2b injury is a fracture of lateral end of the clavicle, with disruption of the conoid portion of the CC ligament. Robinson [1] reported a detailed description of clavicular fractures in relation to their displacement and the degree of comminution. He then used his parameters to successfully predict the risk of non-union.[7]

The treatment of fractures of the clavicle could be non-operative (conservative) or operative. Non-operative treatment involves analgesia; application of arm sling or figure-of-8 bandage (figure-of-8 splint). Operative fixation entails the use of various plates and screws as well as intramedullary nails to stabilize the fracture. Non-operative treatment is ideal for most closed clavicular fractures and have shown good results. Operative fixation on the other hand is indicated for widely displaced lateral third fractures with skin tenting, fractures with neuro-vascular injuries, non-united fractures, fractures with unacceptable mal-union as well as open fractures. More recently, cosmetic reasons and patients' preferences have influenced the choice of treatment. Non-operative treatment still remains the most predominant treatment option in the study center. Studies [8,9,10,11] have reported good outcome with non-operative treatment. Earlier comparisons of non-operative and operative treatments were in favour of the former [10,11]. In recent years, there has been a trend towards operative fixation especially for mid-shaft fractures with studies [9,12] reporting improved functional outcome and lower rates of complication. Despite this trend, non-operative treatment has remained the main stay of care in Port Harcourt, Nigeria, partly due to cost consideration as health financing is predominantly out-of-pocket. Therefore, it is necessary to evaluate the results of this treatment modality in this environment with limited resources.

The aim of this study was to determine the pattern of presentation and outcome of non-operative treatment of adult clavicular fractures at Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria.

METHODS

Study Area: The study was carried out at the Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Rivers State, Nigeria.

***Data Sources*:** The data were collected at the orthopaedic clinics, wards, theatre and accident/emergency department of RSUTH.

Research Design: This was a retrospective descriptive study.

***Study Population**:* Records of adult patients (18 years and above) who presented to the orthopaedic surgeons between 1st June 2018 to 31st May 2023 and met the inclusion criteria constituted the study population.

***Inclusion and Exclusion Criteria**:* The study included records of adult patients with fractures of the clavicle, who had been managed non-operatively by the orthopaedic surgeons at RSUTH between June 2018 to June 2023, and followed up for at least one year. The diagnosis was made based on clinical presentation and radiographic evaluation. The eligible medical records were those of patients with complete information. These data were collected manually using a proforma validated by the authors. Excluded from this study were patients with incomplete medical records and those with open fractures.

***Study Variables of Interest*:** Secondary data from patients who met the inclusion criteria were utilized for the study. Data retrieved from recruited patients' folders include: patients' bio-data, time interval between injury and presentation, possible aetiology, site of the clavicular fracture, treatment given, time of radiological union corroborated with serial x-rays and complications.

Initial radiographs at presentation were also retrieved and evaluated. A radiograph which adequately reveals the fracture site was accepted for enrolment. This served as basic diagnostic tool for the clavicular fractures, described the fracture site, pattern and revealed associated injuries.

Treatment notes, follow up notes, follow-up radiographs and physiotherapy notes were also retrieved and analyzed.

***Ethical Consideration*:** Ethical approval was obtained from ethics committee of the hospital. Consent from the patients were waived due to retrospective nature of the study. However, their personal information was kept anonymous.

***Validity/Reliability of Instrument*:** The data were scrutinized by the authors for authenticity before usage.

***Data Analysis**:* Data collated were analysed using Statistical Package for Social Sciences (SPSS) version 26 (United States). The results were presented in tables and bar charts and variables expressed as mean, proportion, and standard deviation.

RESULTS

Table 1: Demographic characteristics of patients with clavicular fracture

Variables (N = 46)	Frequency	Percentage
Age category		
≤20 years	2	4.3
21 – 30 years	7	15.2
31 – 40 years	11	23.9
41 – 50 years	5	10.9
51 – 60 years	10	21.7
61 – 70 years	11	23.9
Mean ± SD; Median (range)	*45.89±14.98years; 47.5 (19 – 69) years*	
Sex		
Male	21	45.7
Female	25	54.3
Female-to-male ratio	*1.2:1*	
Level of education attained		
None	2	4.3
Primary	3	6.5
Secondary	16	34.8
Tertiary	25	54.3

SD – Standard deviation

The medical records of 77 patients with clavicular fractures were initially retrieved. However, only 46 met the inclusion criteria and hence utilized for the study. There were 25 females (54.3%) and 21 males (45.7%). The highest number of cases were recorded in age backets 31-40 years and 61-70 years (n=11 each; 23.9%). The demographics of patients are as shown in table 1.

Table 2: Injury characteristics of the patients

Variables (N = 46)	Frequency	Percentage
Side of clavicle affected		
Right	20	43.5
Left	26	56.5
Cause of injury		
Fall	24	54.3
Motor vehicle crash	11	23.9
Assault	5	10.9
Sports injury	5	10.9
Site of clavicle fractured		
Lateral third	6	13.0
Middle third	31	67.4
Medial third	9	19.6
Associated injury		
Yes	6	13.0
Traumatic brain injury	*5*	*10.9*
Blunt chest injury	*1*	*2.1*
No	40	87.0

Twenty-six cases of the fractures (56%) occurred on the left. Fall (n=24; 54.3%) was the commonest cause of the injury. Forty cases (87%) were isolated injuries, while 6 (13%) had associated injuries. Majority of the cases (n=31; 67.4%) affected the middle third of the clavicle. Table 2 shows the injury characteristics of the patients.

Table 3: Time interval between injury and presentation

Time of presentation	Frequency	Percentage
Same day	8	17.4
1 – 7 days	24	52.2
1 – 2 weeks	5	10.9
2 – 3 weeks	5	10.9
>3weeks	4	8.7
Total	**46**	**100**

Majority of the patients (n=32; 69.6%) presented within one week of injury (see table 3).

Table 4: Treatment received by the patients

Treatment given	Frequency	Percentage
Arm sling	16	34.8
Figure-of-eight bandage	30	65.2
Total	**46**	**100.0**

Table 4 showed the modality of non-operative treatment received by the patients.

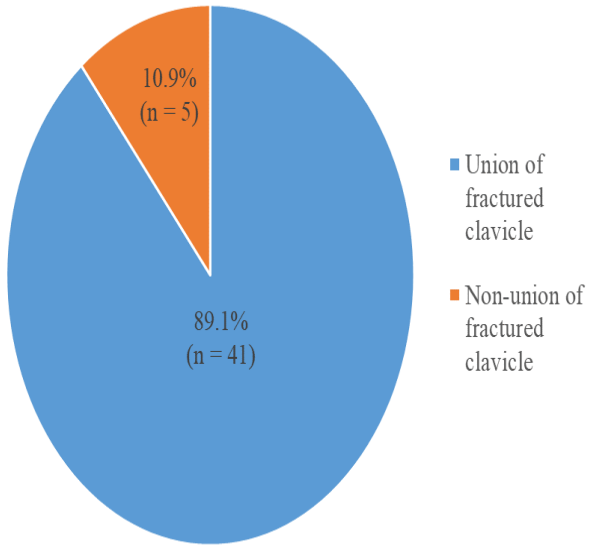

Figure 1: Pie chart showing cases of union Vs non-union amongst the patients

Forty-one patients (89.1%) achieved radiological union, while 5 (10.9%) failed to unite as shown in figure 1.

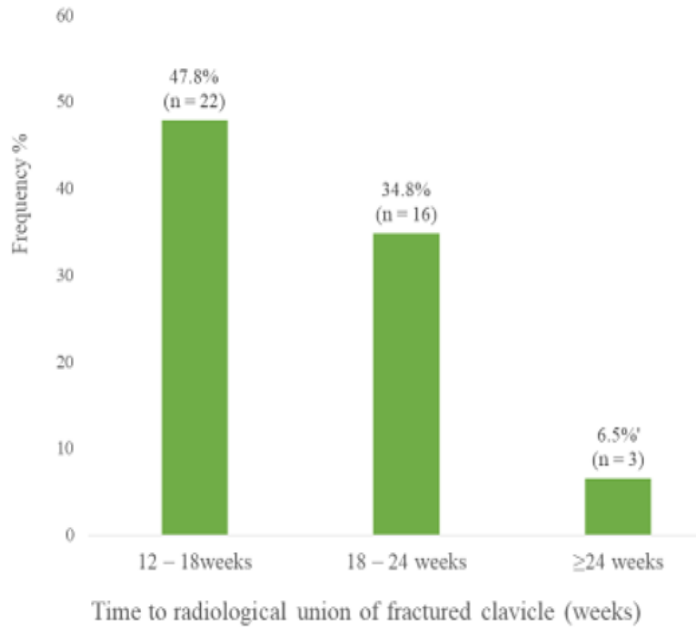

Figure 2: Bar chart showing time to radiological union of fractured clavicle (N = 41)

Mean time to radiological union ± SD = 19.04±3.66weeks, Median = 18weeks, range = 12 – 28weeks.

Majority of the patients (n=22; 47.8% achieved radiological union within 12-18 weeks as shown in figure 2.

Table 5: Comparison of mean time to radiological union of fractured clavicle according to the age and sex of patients

		Time to radiological union of fractured clavicle (weeks)	
Variables	**N = 41**	**Mean ± SD**	**Statistical test**
Age category			**ANOVA (p-value)**
≤20 years	2	16.00±0.00	
21 – 30 years	7	16.29±2.21	
31 – 40 years	10	18.55±2.83	3.821 (0.007)*
41 – 50 years	5	17.60±2.30	
51 – 60 years	8	20.00±5.07	
61 – 70 years	9	22.33±2.35	
Sex			**t (p-value)**
Male	18	18.11±3.56	-1.452 (0.155)
Female	23	19.76±3.65	

*Statistically significant ($p<0.05$) SD: Standard deviation

Table 5 showed that increasing age was associated with longer time to radiological union (p=0.007).

Table 6: Comparison of mean time to radiological union of fractured clavicle with the time interval between injury and presentation

		Time to radiological union of fractured clavicle (weeks)	
Time interval between injury and presentation	**N = 41**	**Mean ± SD**	**ANOVA (p-value)**
Same day	8	18.06±2.08	
1 – 7 days	23	19.22±4.27	
1 – 2 weeks	5	19.60±4.51	0.218 (0.883)
2 – 3 weeks	2	19.00±1.41	
>3weeks	3	19.33±2.31	

SD – Standard deviation

There was no statistically significant difference between time to radiological union and time of presentation (p= 0.883) as shown in table 6.

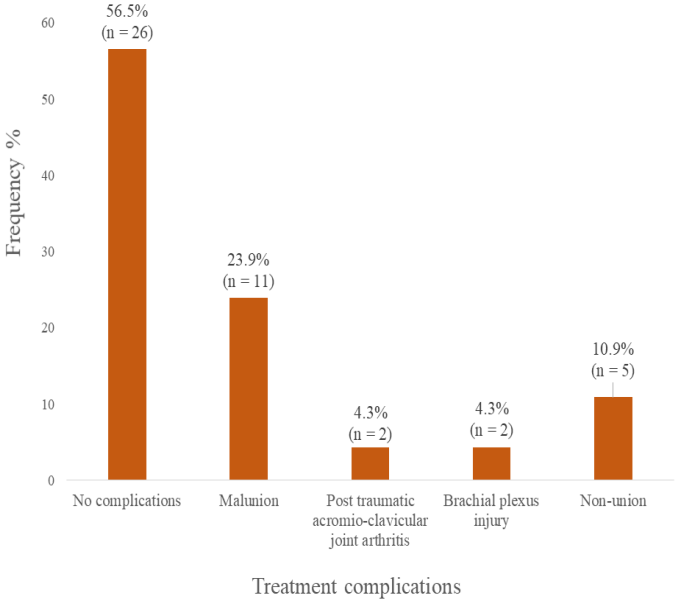

Figure 3: Bar chart showing complications observed in the course of treatment

The commonest complication observed was mal-union (n=11;23.9%), while the least were post-traumatic acromio-clavicular joint osteoarthritis and brachial plexus injury (n=2 cases each; 4.3%) as shown in figure 3.

Treatment complications according to the age and sex distribution of patients

Variables	Treatment complications					Total
	None N = 26 n (%)	Malunion N = 11 n (%)	PTAC joint arthritis N = 2 n (%)	Brachial plexus injury N = 2 n (%)	Non-union N = 5 n (%)	N = 46 n (%)
Age category						
≤20 years	1 (3.8)	1 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.3)
21 – 30 years	4 (15.4)	3 (27.3)	0 (0.0)	0 (0.0)	0 (0.0)	7 (15.2)
31 – 40 years	6 (23.1)	2 (18.2)	0 (0.0)	2 (100.0)	1 (20.0)	11 (23.9)
41 – 50 years	3 (11.5)	1 (9.1)	1 (50.0)	0 (0.0)	0 (0.0)	5 (10.9)
51 – 60 years	6 (23.1)	1 (9.1)	1 (50.0)	2 (40.0)	0 (0.0)	10 (21.7)
61 – 70 years	6 (23.1)	3 (27.3)	0 (0.0)	2 (40.0)	0 (0.0)	11 (23.9)
	Fisher's exact test = 15.554; p-value = 0.846					
Sex						
Male	11 (42.3)	5 (45.5)	2 (100.0)	0 (0.0)	3 (60.0)	21 (45.7)
Female	15 (57.7)	6 (54.5)	0 (0.0)	2 (100.0)	2 (40.0)	25 (54.3)
	Fisher's exact test = 3.942; p-value = 0.475					

PTAC = Post traumatic acromio-clavicular joint arthritis

Table 7 showed that the observed treatment complications were unrelated to age (p= 0.846) and sex (p= 0.475).

DISCUSSION

Fractures of the clavicle are predominantly managed non-operatively, partly due to its excellent ability to heal and partly due to the fact that malunion in the clavicle is of little functional significance. This study focuses on the result of conservative treatment with emphasis on radiological union as the main outcome measure.

In this study, the highest number of cases were recorded in the age backets 31-40 years and 61-70 years (23.9% each). This reflects a bimodal peak and may be related to high incidence of trauma in the young (in case of the former) and senile osteoporosis (in case of the latter). It may also be related to high preponderance cases of falls in this study as earlier reported by a study.[3] The slightly higher preponderance of females in this study differs from that of other investigators [3,8,13].

Majority of the patients presented within the first week of trauma. This may be related to high preponderance of patients with tertiary level of education (54.3%) and hence better health seeking behaviour. Amongst the aetiological factors, fall (54.3%) and motor vehicle crash (23.9%) dominated. These may be related to good representation of the young and the elderly in the population studied.

Majority (56.5%) of the injuries affected the left clavicle. This is similar to the finding of another study [3]. This study did not investigate if there is any relationship between side of injury and handedness of the patients. The commonest site of the injury was middle third of the clavicle (67.4%). This is similar to the findings of other investigators [3,13]. Middle third fractures typically present with greater level of anatomical stability and heal better with non-operative treatment than lateral third fractures.

Majority of the patients were treated with figure-of-eight splint. This is similar to the finding of Nordqvist *et al* [8]. In addition to providing good external stability, these splints give the patient the freedom to use both hands while on treatment compared to slings. Itching under the splint, tightness, skin discoloration and ulcerations are some limiting factors.

Radiological union was achieved in 89.1% of the patients. Nordqvist *et al*, in a retrospective review of 225 mid-clavicular fractures managed non-operatively achieved union in 218 patients (96.8%). Radiological union here

refers to the presence of bridging callus at the periosteal and endosteal ends of the fracture gap, without obvious visible fracture lines. The time to radiological union reported in the literature vary from one study to the other. [14,15,16] This may be related to patient or injury factors such as age and nutritional status (in case of the former) or the degree of soft tissue damage (in case of the latter) as well as the treatment modality. In our study, time to radiological union range from 12-28 weeks (mean 19.04±3.66 weeks), while that of Lazarides *et al* [17] range from 6 -20weeks. Whereas our study incorporated the three classes of clavicular fractures described by Allman, Lazarides and colleagues focused-on fractures of mid clavicle alone. This may be responsible for the difference in healing time. A study in Saudi Arabia[18] that compared operative and conservative management reported a mean healing time of 15.73±0.70 weeks in the operative group and 27.47±0.74 weeks in those managed non-operatively. We also observed that increasing age was associated with prolonged time to radiological union (p=0.007). However, time to radiological union was unrelated to gender and time of presentation.

Malunion was the commonest complication (23.9%) observed in our study followed by non-union (10.9%). We also observed that the complications were unrelated to age or gender. Nordqvist and colleagues reported malunion in 53 patients (23.5%) out of 225, and non-union in 7 (3.1%) patients. They went further to rate their results clinically as good, fair or poor depending on degree of pain after treatment.

The study limitation was small to moderate sample size due to missing information in some patients' records.

CONCLUSION

This study revealed that non-operative treatment remains effective method of managing clavicular fractures in adults with respect to union rate. However, we recommend a prospective comparative study with operative fixation that factored other outcome measures, such as the degree of shortening, range of shoulder movements, time of return to work and above all evaluation of patients' satisfaction post treatment.

***Funding*:** No funding sources.

Conflict of Interest: None declared.

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