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ORIGINAL RESEARCH

A comparative study of clavicle fracture management by conservative approach versus kirschner wire

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ABSTRACT

Aim: The aim of this study was to compare the outcomes of clavicle fracture management using the conservative approach and the Kirschner wire (K-wire) fixation technique. We focused on assessing parameters such as union rates, infection rates, need for revision surgery, implant effects, and functional recovery. **Material and Methods:** This prospective, cross-sectional, hospital-based study was conducted at the Department of Orthopedics, Santokba Durlabhji Hospital, Jaipur. A total of 60 patients aged above 18 years, who presented with displaced clavicle fractures without neurovascular injuries, were enrolled between June 2021 and February 2022. The patients were divided into two groups: Group A (conservative treatment) and Group B (treated with K-wire fixation). Preoperative assessment included sociodemographic data, clinical examination, and routine investigations. Both groups were followed up for clinical and radiological union at regular intervals. **Results:** The study found that the most common age group for clavicle fractures was 20-30 years, with males predominantly affected. The right side was the most commonly injured, particularly in the mid-shaft. Statistical analysis revealed no significant differences in gender or side of injury between the two groups. However, there was a significant difference in the part of the clavicle fractured, with mid-shaft fractures being more common. The K-wire group showed a significantly higher rate of union (93.3%) compared to the conservative group (73.3%). The conservative group had no cases of infection or need for revision surgery, whereas the K-wire group had superficial infections (6.7%) and required revision surgery in 6.7% of cases. The K-wire group also showed higher rates of implant irritation (20%) and migration (6.7%). **Conclusion:** This study demonstrated that surgical treatment with K-wire fixation is more effective in promoting union and preventing shortening compared to conservative management. K-wire fixation is a simple, cost-effective technique with fewer complications such as malunion or nonunion. It allows for early rehabilitation and better patient satisfaction compared to the conservative method, which often leads to poorer functional outcomes.

Keywords: Clavicle fracture, conservative treatment, K-wire fixation, union, rehabilitation

INTRODUCTION

Clavicle fracture is one of the most common injuries around the shoulder girdle, observed in clinical practice. Clavicle fractures accounts for 2.6 to 10% of all fractures and up to 44.1% of the fractures involving the upper girdle. 80% of clavicle fractures occur in the midshaft clavicle, while distal and proximal clavicle fractures have a low incidence.[1-2]

A male dominance of approximately 70% has been reported. Incidence in males is usually highest in second and third decade which decreases thereafter as per age. In females, it is usually bimodal, with peak incidence in young and elderly. Clavicle fractures have an increased incidence, regardless of sex, above age 70 years. The incidence of this type of fracture among adolescents and adults is 29 and 64 per 100,000 per year, respectively.[3]

The majority (69–82%) of fractures occur in the midshaft of the clavicle, followed by 12–26% in the lateral part and 2–6% in the medial part. This can be anatomically explained by the fact that the medial and lateral parts of the clavicle are firmly secured by strong ligaments and muscles, whereas the middle part of the clavicle lacks any strong attachments and thus is more vulnerable to trauma. The muscle attachments often cause a dislocation of the major fragments in clavicle fractures and a shortening of the clavicle, particularly in midshaft fractures.[4] Clavicle fractures were classified according to Robinson‘s classification system. This new classification was developed based on radiological review of the anatomical site and the extent of displacement, comminution and articular extension.[5]

These fractures have been traditionally treated by

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conservative means. Simple slings, collar ‗n' cuffs and figure-of-eight-bandages are commonly used to immobilise the fracture during the first weeks in non-operatively treated fractures, which often include medial fractures, most lateral fractures and midshaft fractures without displacement.[6-8] Conservative treatment in the form of sling, ―figure of 8‖ bandage with sling and arm pouch have been used for long time but poor outcomes like mal-union and non-union (15%) have been observed after conservative treatment of displaced clavicle fractures.[9]

Surgery finds absolute indication in the presence of open fractures, high comminution and dislocation of the fragments, high risk for in–out skin wounds, a shortening superior to 20 mm, floating shoulder and neurovascular lesions. Relative indications are polytraumas, painful malunions or non-unions. Operative treatment can be achieved successfully using plates or intramedullary (IM) implants like Rush pins, Kirschner wires, or nails, but an optimal surgical technique is still not identified. Kirschner wire fixation is a traditional method of open reduction and internal fixation of clavicle fractures. Kirschner wire fixation is more common; and requires a smaller incision, and less soft tissue and periosteum dissection.

There is still doubt in minds of orthopaedic surgeons regarding the choice of management for clavicle fractures, i.e. whether to treat conservatively or to operate. Because the treatment of clavicle fractures is a debated question, treatment can vary between different departments, with regards both to which fractures are operated and operative method chosen.[9]

MATERIAL AND METHODS

The study was conducted in the Department of Orthopedics at Santokba Durlabhji Hospital, a tertiary care centre in Jaipur. It was a prospective, cross-sectional, hospital-based study involving 60 patients above 18 years of age who were referred to the emergency and OPD of SDM Hospital with clavicle fractures. The study was carried out between June 2021 and February 2022. Ethical clearance was obtained from the institutional Ethical Committee, and the nature of the study was explained to each participant before obtaining written informed consent.

Inclusion Criteria

- Age group >18 yrs
- Displaced clavicle fractures
- Without association of neurovascular injury.

Exclusion Criteria

- Old fracture >1 month
- Undisplaced fractures
- Open fractures
- Pathological fractures
- Previous surgery on the affected shoulder.
- Previous trauma and previous rehabilitation treatment on affected joint.

Method of data collection

All eligible patients fulfilling inclusion criteria were approached by investigator himself and explained about nature and purpose of study. After obtaining the informed written consent for the study, a detailed history regarding sociodemographic characteristics and illness was taken. General and orthopaedic examination was done and routine and special investigation was performed as per standard procedure.

Pre operative assessment and planning

- Detail history regarding name, age, sex was taken into consideration.
- Systemic examination of patient.
- Local examination of fracture site.
- Pre operative investigation: CBC, PT, INR, VIRAL MARKERS (HIV , HBsAg)
- Informed and written consent
- NPO for 4- 6 hr.

Operative procedure

The patient candidates for surgical treatment were subjected to the reduction in fracture and fixation with intramedullary threaded Kirschner wire (K-wire). The patients underwent general anaesthesia. The technique provided the patient in the supine position on a radiolucent surgical table with a slight overflow of the arm out from the edge of the bed and with a slight inclination of the trunk to ensure freedom of movement of the arm. A small incision (3–4 cm) was made at the level of the fracture in line with its major axis of the clavicle. After a blunt dissection of the soft tissue, the fracture site was reached. A drilling bit was used to open the intramedullary canal. The threaded Kirschner wire (from 2 to 3 mm diameter according to the size of the intramedullary canal) was advanced in the bone fragment intramedullary canal till the K-wire exits throughout the skin. The advancement of the K-wire was controlled with a C-Arm. K wire removal was done at 3 -4 months after surgery, depending on appearance of callus formation in x ray of clavicle. All patients (conservative and operative manage) were follow up in orthopaedic OPD on 15th day, 1st month, 2nd month , 3rd month and till sign of union radiologically and clinically. (Patient who managed by conservative method have same follow up period)

Statistical analysis

The data obtained from the study was subjected to statistical analysis using SPSS version 20.0, for further evaluation at significance level of p-value=0.05. The data was presented as frequency and percentages for categorical variables. For comparative analysis Chi square and one sample t-test statistical test was used.

RESULTS

Table 1 show that out of 60 patients, 30 were treated

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with each of the two techniques; Group A (conservative) and Group B (K wire). In both the groups, the most common age group reported with clavicle fractures was 20-30yrs of age. In both the groups, the most common gender reported with clavicle fractures was males. Chi square statistical analysis revealed an insignificant (p-value>0.05) difference between both the groups in relation with gender. In both the groups, the most common side reported with clavicle fractures was Dominant side. Chi square statistical analysis revealed an insignificant (p-value>0.05) difference between both the groups in relation to the side involved. In both the groups, the most common side reported with clavicle fractures was right side. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to the side involved. In both the groups, the most common part reported with clavicle fractures was mid shaft. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to the part involved. In both the groups, the most common mechanism of injury reported with clavicle fractures was Road traffic accidents (80%).

Table 2 shows the distribution of study subjects according to associated injury in both the study groups. In Group A, maximum 23.3% patients had no associated injury, followed by polytrauma and Group B, maximum 23.3% patients had head injuries, followed by polytrauma. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation with associated injury.

Table 3 shows In both the groups, all patients were not having any NV injury.

In Group A, maximum 93.3% patients had intact superficial injury, followed by abrasion and Group B, maximum 70% patients had intact injuries, followed by skin tenting. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation with superficial injury.

In Group A, maximum 73.3% showed union, followed by 16.7% non union, 10% patients had malunion, and Group B, maximum 93.3% showed union, followed by 3.3% had non and mal union. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to union.

In Group A, no case of infection was observed and Group B, 6.3% had superficial and 3.3% had deep infection. Chi square statistical analysis revealed a significant (p- value<0.05) difference between both the groups in relation to infection.

In Group A, no case of need of revision surgery was observed and Group B, 6.7% had need of revision surgery. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to need of revision surgery. In Group A, no case of implant effect was observed and Group B, 6.7% had implant migration and 20% had implant irritation. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to implant effect.

Table 4 shows mean time of presentation after injury in Group A and Group B being 6.87±6.54days and 7.87±6.93days. One sample t-test statistical analysis revealed an insignificant (p-value>0.05) relation between both the groups. mean pre-operative shortening in Group A and Group B being 2.62±0.45 and 2.70±0.49. One sample t-test statistical analysis revealed an insignificant (p-value>0.05) relation between both the groups.

Table 5 shows mean qDASH in Group A and Group B. In both the groups, mean values decreased with time. One sample t-test statistical analysis revealed a significant (p- value<0.05) relation between both the groups at different time intervals.

Table 6 shows mean clavicle shortening in Group A and Group B. In Group A, mean was 1.3±0.37; in Group B one patient was with clavicle shortening.

Table 1 Basic parameters

Category	Group A (Conservative) Frequency (n)	Group A (Conservative) Percentage (%)	Group B (K-wire) Frequency (n)	Group B (K-wire) Percentage (%)	Chi Square	p-value
Age Groups in years						
<20	1	3.3	1	3.3	1.118	0.909
20-30	18	60	19	63.33	-	-
31-40	10	33.33	10	33.33	-	-
41-50	1	3.3	0	0	-	-
51-60	0	0	0	0	-	-
>60	0	0	0	0	-	-
Gender						
Female	6	20.0	7	23.3	1.209	0.088
Male	24	80.0	23	76.7	-	-
Side						
D	25	83.3	26	86.7	1.113	0.180
ND	5	16.7	4	13.3	-	-

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Side						
Left	2	6.7	6	20	0.997	0.013
Right	28	93.3	24	80.0	-	-
Part						
Lateral Clavicle	7	23.3	5	16.7	2.017	0.033
Medial Clavicle	2	6.7	1	3.3	-	-
Mid Shaft	21	70.0	24	80.0	-	-
Mechanism of Injury						
FFH	6	20.0	6	20.0	-	-
RTA	24	80.0	24	80.0	-	-

Table 2: Distribution of study subjects according to associated injury in both the study groups

Associated injury	Group A (Conservative)		Group B (K-wire)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	7	23.3	2	6.7
# B.B.F.A.	2	6.7	1	3.3
# D.E.R	1	3.3	0	0
# Pelvic	1	3.3	0	0
# Proximal tibia	1	3.3	1	3.3
# Radial head	1	3.3	1	3.3
# Ribs	2	6.7	4	13.3
# Shaft tibia	2	6.7	2	6.7
# Shaft femur	1	3.3	2	6.7
# 1st M.C.	0	0	1	3.3
# Capitellum	0	0	1	3.3
# Metacarpal	0	0	1	3.3
1st MT #	2	6.7	0	0
D.E.R. #	1	3.3	0	0
Distal tibia #	1	3.3	1	3.3
Head injury	3	10	7	23.3
Polytrauma	4	13.3	6	20.0
Ribs #	1	3.3	0	0
Total	30	100.0	30	100.0
Chi square	2.228			
p-value	0.002*			

Table 3. Distribution of study subjects according to N.V. Injury, Superficial Injury, Union, Infection and Implant Effect

Category	Group A (Conservative) Frequency (n)	Group A (Conservative) Percentage (%)	Group B (K-wire) Frequency (n)	Group B (K-wire) Percentage (%)	Chi Square	p-value
N.V. Injury (Absent)	30	100.0	30	100.0	-	-
Superficial Injury						
Abrasion	2	6.7	0	0	2.081	0.049
Intact	28	93.3	21	70.0	-	-
Skin Tenting	0	0	9	30.0	-	-
Union						
Non Union	5	16.7	1	3.3	2.600	0.014
Mal Union	3	10	1	3.3	-	-
Union United	22	73.3	28	93.3	-	-
Infection						
Superficial	0	0	2	6.7	1.005	0.002
Deep	0	0	1	3.3	-	-
Revision Surgery (Yes)	0	0	2	6.7	0.665	0.022
Implant Effect						
Irritation	0	0	6	20	2.608	0.004
Migration	0	0	2	6.7	-	-

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Table 4: Mean time of presentation after injury (Days) and Mean pre Op shortening

Mean time of presentation after injury (Days)			Statistical analysis		
Descriptive analysis	Group A (Conservative)	Group B (K-wire)	t-test	df	p-value
Mean	6.8667	7.8667			
Std. Deviation	6.57442	6.93185			
Minimum	.00	.00			
Maximum	24.00	25.00	-.685	29	.499*
	Mean pre Op shortening				
Mean	2.6233	2.7033			
Std. Deviation	.45157	.49792			
Minimum	1.80	1.80			
Maximum	3.60	3.80	-.820	29	.419*

Table 5: Mean q DASH at different time intervals

Mean q DASH					Statistical analysis		
Time intervals (wks)	Group A (Conservative)		Group B (K-wire)		t-test	df	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
4wks	44.6667	3.61351	11.3333	2.84464	38.544	29	.000*
8wks	25.8000	4.93684	6.2000	3.03315	17.899	29	.001*
12wks	14.4667	5.05646	3.4667	1.81437	10.662	29	.011*
16wks	6.6667	5.26100	1.4000	1.67332	5.025	29	.000*

Table 6: Mean Clavicle shortening

Mean Clavicle shortening		
Descriptive analysis	**Group A (Conservative)**	**Group B (K-wire)**
Mean	1.3033	One patient was observed with clavicle shortening
Std. Deviation	.37184	
Minimum	.60	
Maximum	2.00	

Fig.1 A. 26 year/ female mid shaft clavicle fracture (Right) 8 months follow up (conservatively manage) Show non union

B. 32 year/male mid shaft clavicle fracture (Right) 11 months follow up (conservatively manage) Show non union

Fig.2. C. 25 year/male H/O RTA Mid shaft displaced clavicle fracture (Left) (Pre operative X-ray)

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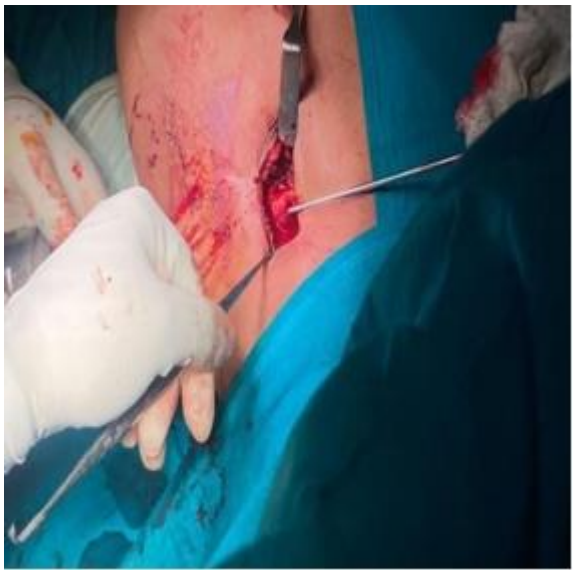

Fig. 3 Intra operative procedure image

Fig.4. Intra operative procedure image

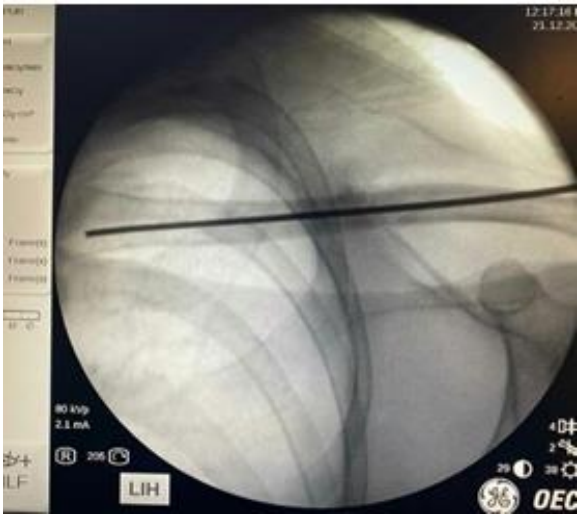

Fig.5 Intra operative procedure image

Fig.6. Intra operative procedure image

Fig.7. 4 week follow up X-ray

Fig.8. 6 month follow up X-ray (after K-wire removal) Show fracture union

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DISCUSSION

In present study, out of 60 patients, 30 were treated with each of the two techniques; Group A (conservative) and Group B (K wire). In both the groups, the most common age group reported with clavicle fractures was 20-30yrs of age. The mean age in Group A was 28.47±5.87yrs and in Group B mean age was 28.3±5.88yrs.

In accordance with our study, **Coppa V et al.[1]** found that mean age of study subjects was 38.35 years and median age was 35.64 years. **Robinson CM.[9] and Nordqvist et al.[4]** described a decreasing incidence of clavicle fractures until the age of 35 years, a more or less stable incidence until the age of 75 years and then again an increasing incidence with higher age.

The most common gender reported in our study with clavicle fractures was males (80%). In accordance with our study, **Herteleer M et al.[10]** also observed male predominance. **Coppa V et al.[1]** also found that males were more affected than females.

In present study, the most common side reported with clavicle fractures was Dominant and right side. The most common part reported with clavicle fractures was mid shaft. **Stanley D et al.[3]** mentioned that direct hit on the shoulder is the most common cause of midshaft clavicle fractures. **Robinson CM.[9]** found that middle third of the clavicle is fractured in 69% of cases, the distal third is fractured in 28% of cases, and the proximal third is fractured in 3% of cases. In contrast, in a study by **Coppa V et al.[1]** found that left side was more affected than right side.

We also found that patients had associated head injuries, followed by polytrauma. Similar to our study, **Lisa AT et al.[11]** reported that 65% had a closed head injury, 75% had a significant associated pulmonary injury. They mentioned that patients often have associated pulmonary and cranial injuries. Ipsilateral upper extremity and shoulder girdle injuries are common, whereas concomitant neurologic and vascular injuries are infrequent.

We also found that in Group A, maximum 93.3% patients had intact superficial injury, followed by abrasion and Group B, maximum 70% patients had intact injuries, followed by skin tenting. In Group A, maximum 73.3% showed union, followed by 16.7% non union, 10% patients had malunion, and Group B, maximum 93.3% showed union, followed by 3.3% had non and mal union. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to union. **Martetschläger F et al.[12]** also found non-union and malunion as common complications of clavicle fractures. Similar to our study, **Coppa V et al.[1]** found one (3.33%) non-union in the non-operative-treated group and none in the surgical-treated group. It is suggested by several Authors[7] that patients with non-union risk factors aforementioned, in particular high comminution, should be surgically treated by open reduction and internal fixation (ORIF).

In our study Group A, no case of infection was observed and Group B, 6.3% had superficial and 3.3% had deep infection. Chi square statistical analysis revealed a significant (p-value<0.05) difference between both the groups in relation to infection. It showed that patients treated with K-wire had higher incidence of infection than conventional group. Similar to our study, **Coppa V et al.[1]** found that Superficial infection at the site of the surgical approach for the fracture reduction was seen in 1 patient (3.57%) with hypertrophic scar formation.

In our study, Group A, no case of need of revision surgery was observed and Group B, 6.7% had need of revision surgery. Thus treatment with k-wire require revision surgery. Similar to our study, **Narsaria N et al.[13]** revealed that the patients undergoing plating the implant removal need another surgery done under general anaesthesia, with a large-sized incision, while the intramedullary devices can be removed as outpatients with or without local anaesthesia.

Among complications of surgical treatment, the most common one associated with nailing is the medial migration with skin irritation.[14]We observed that in Group A, no case of implant effect was observed and Group B, 6.7% had implant migration and 20% had implant irritation. In contrast to our study, **Coppa V et al.[1]** had no patients reported such complication. This could be explained by the usage of a threaded Kirschner wire that has its medial extremity threaded that can provide higher stability of the construct, especially to telescopic forces. This finding is supported by results provided by **Frigg et al.[15]** that showed a reduction in medial migration when using an end cap for intramedullary fixation implant.

We found that mean time of presentation after injury in Group A and Group B being 6.87±6.54days and 7.87±6.93days. Our study showed that mean pre-operative shortening in Group A and Group B being 2.62±0.45 and 2.70±0.49. **Rasmussen et al.[16],** however, advocate conservative treatment of midshaft clavicle fractures with a shortening of 20 mm or more

We noted mean qDASH in both the groups decreased with time. One sample t-test statistical analysis revealed a significant (p-value<0.05) relation between both the groups at different time intervals.

Similar to our study, **Oroko et al.[17]** found 3 of 41 patients with shortening of 15 mm or more who had low Constant disability scores, but this could be attributed to other factors. **Smekal et al.[18]** evaluated ESIN (Elastic Stable Intramedullary Nail) versus non-operative with randomized, controlled, clinical trial. These Authors showed a significant positive correlation between DASH score at endpoint and definite shortening, and between patient satisfaction and definite shortening. Furthermore, patients suffering from sequelae after 2 years had an average shortening of 6.1% (65.2%).

CONCLUSION

Our study revealed that surgical treatment demonstrated a greater efficacy in reducing initial

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shortening of the fractured bone; this is in opposition to conservative treatment that results very often in malunion, nonunion, shortening, anatomic alterations and loss of functionality. Among various surgical methods, K-wire fixation is an easy, simple, cheap technique of internal fixation with less soft tissue, periosteum damage and comparatively good functional outcome, early rehabilitation with better patient satisfaction.

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