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Clavicular Hook Plate Removal: A Necessity or A Myth?

Uzair Rashid[1], Abdulah Wali[1], Saad Ilyas[1], Ijaz Ahmed[1], Humera Rafiq[2] and Arsala Rashid[3*]

[1]Department of Orthopedic, Ghurki Trust Teaching Hospital, Lahore, Pakistan
[2]Department of Pathology, Fatima Jinnah Medical University, Lahore, Pakistan
[3]Department of Hematology, Services Institute of Medical Sciences, Lahore, Pakistan

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Corresponding Author:
Arsala Rashid
Department of Hematology, Services Institute of Medical Sciences, Lahore, Pakistan
arsala88@hotmail.com

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ABSTRACT

Timely fixation of fractures of the clavicle or acromioclavicular joint dislocation is rising in popularity vs conservative management. This is primarily due to potential complications, such as impingement, which may result in chronic pain and limited shoulder mobility. **Objectives:** To find the cause and number of hardware removals among clavicular fractures. To assess whether clavicular plates caused any after effects when they were left in. **Methods:** A Total of 156 patients treated by hook plate for either fracture of distal clavicular fracture or treatment of acromioclavicular joint dislocation were enrolled from January 2024 to April 2024 in the Orthopedic Department of Gurki Trust Teaching Hospital. All patients were followed for 12 months postoperatively. Clinical results were gauged using different scores. **Results:** There were 107 male and 49 female. At follow up patients in group I were n=50 (64.5%), while group II had only n=15 (19.2%) patients who underwent hook plate removal. The pain VAS scale had a significant p-value of 0.0035 among both groups. The SST score was statistically significant with a p-value of 0.0026. On the last follow-up visit, the mean VAS, SST, and Constant-Murley scores had insignificant p-values, respectively, in both groups. **Conclusions:** Clavicular fracture or acromioclavicular joint dislocation fixation by using hook plates is a safe and reliable mode of treatment. Patients operated with hook plates for distal clavicular fractures are more comfortable, while those treated for acromioclavicular joint dislocation are keener for its removal.

INTRODUCTION

Clavicle fractures and dislocation of the acromioclavicular joint are relatively common shoulder girdle injuries. The incidence of clavicular fracture is not so common, with 50 fractures per 100,000/ year, with distal clavicle fracture accounting for 18% to 25% of all clavicular fractures [1]. However, sports acromioclavicular (AC) joint dislocation is a relatively common injury and constitutes about half of all the shoulder injuries [2]. Depending on the nature of the injury and the percentage of the soft tissue involved, clavicular fractures can be treated operatively or non-operatively [3]. The adverse events that are increasing in non-operative treatment include symptomatic nonunion or stiffness of the shoulders, but it remains the gold standard in non-displaced or minimally displaced fractures. The operative treatment is considered in the presence of comorbid neurovascular injury, open fractures or fractures with high risk of displacement with skin perforation, or shoulder girdle fractures with significant crushing. Due to studies showing a greater number of complications, surgeons are supporting prompt and definitive fixation for fracture configurations as compared to the conservative approach, which has previously been quite promising. This operative treatment has substantially gained in popularity in the past decade [4]. Research shows that plate fixation with bone graft is one of the reliable and best methods for clavicular fractures. The internal fixation is so firm that early mobilization can be started [5]. Other methods that can be used are K-wire, coracoclavicular (CC) screw, and tight loop [6]. Other than them, AC joint fixation with pins, clavicular plate, tension band wire, and with the modified

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Weaver-Dunn procedure, almost alone and occasionally with fixation using a washer and screw, are mostly adopted. Each alternative has merits and demerits. Similarly, a hook plate is preferred by many people, but there are also advantages and disadvantages of the same [7]. Hook plate denies this kind of rotational movement. Wider hook plates or the right size of hook plate treatment can lead to much better results. The commonest being that it may cause erosion by increasing the pressure of the hook under the body of the acromion [8, 9]. Although the hook plate design is such that it allows free movement at the AC joint, especially during elevation and rotation, it does not interfere with the biomechanics of the AC joint, but it can result in impingement and inflammation [10, 11]. Complications such as osteolysis, calcification have also been documented [12]. Limited data is available internationally on the management of the hook plate of AC joint dislocation and distal clavicle fractures. Moreover, literature shows very few studies have been done in Pakistan comparing acromioclavicular joint dislocation with distal clavicular fracture. This study will also help the attending orthopedic surgeon to redefine timelines for the removal of hook plates and explore more options, weighing the pros and cons. Lastly, the surgeons must educate patients regarding the standard protocols for its removal since they are lost to follow-up, and they feel it is unnecessary.Consequently, they might face complications thereafter [13]. The study was enlightening and eye-opening for patients as well as surgeons. Moreover, the demonstration of such sequels can help surgeons to become more amicable with such modalities of treatment, as they are considered relatively new methods, at least in our locality and regions.

This study aimed to find the cause and number of hardware removals among clavicular fractures. To assess whether clavicular plates caused any after effects when they were left in.

METHODS

A prospective cohort study on 156 patients (by consecutive sampling technique) treated by hook plate for either fracture of the distal clavicle or treatment of acromioclavicular joint dislocation in the Orthopedic Department of Ghurki Trust Teaching Hospital, Lahore. The patients were enrolled from January 2024 to April 2024 after taking formal consent and approval from the Institutional Review Board Committee (Ref No. 2024/01/R-46). Patients who had multiple fractures or complications during surgery were excluded. The sample size was calculated by using the following formula, keeping the incidence of acromioclavicular joint injury as 11 % of all shoulder injuries [14] with an error margin of 5%: $n=^{Nx}/((N-1)E^2+x)$. The total number of patients was divided into 2 groups with an equal number of 78 patients in each. Group I had hook plate fixation for AC joint dislocation, whereas those who got it for distal clavicle fracture were referred to as group II. Statistical analysis was undertaken using SPSS Statistics version 24.0. Quantitative variables, including age of patients, scores from pain visual analogue, simple shoulder test, and Constant-Murley, were presented as mean ± standard deviation. Qualitative variables, including gender, no of patients who underwent removal of the hook plate and its causes, were presented in the form of frequency and percentages using chi chi-square test. After finding out the normality of data using the Shapiro-Wilk test, the t-test was applied to determine the p-value, with a value less than 0.05 considered statistically significant. Results were drawn using the simple shoulder test, pain visual analogue scale (VAS) and Constant-Murley scores. The follow-up time of the patients was 12 months after the operation for the study, while the mean follow-up time was 8 months and 19 days.

RESULTS

Hook plate treatment was applied to a total number of 156 adult patients enrolled in the study (78 third-Neer type II-fractures of the distal clavicle and 78 type III acromioclavicular dislocations). Out of the 156 patients, 107 were male and 49 were female, giving the male-female ratio of 2.1:1.9(Figure 1).

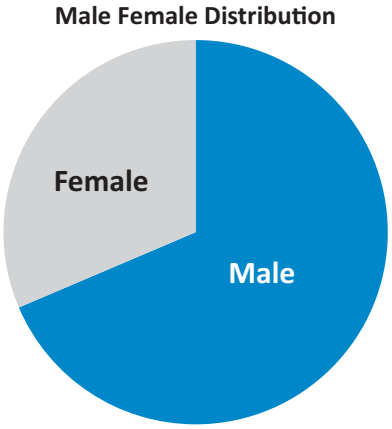

Figure 1: Male and Female Distribution

The mean age of the patients was 40.4 ± 3.45 years. About 67% of the injuries were right-sided, and 33% injuries were on the left side. Union of fractures was seen in 153 (98.56%) of the total patients. The patients were divided into groups, with group I having hook plate fixation for AC joint dislocation, whereas those who got it for distal clavicle fracture were referred to as group II. Among those in group I, patients who got the hook plate removed were n=50 (64.1%). Whereas in group II, who were treated for third-Neer type II-fractures of the distal clavicle, only n=15 (19.2%) wanted the removal of the hook plate, while 80.8 % had no objection to retaining it. About 85% of the women in

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group I got plate removal vs 60% of the women in group II.

Table 1: Variables Showing Plate Removal in Group I and Group II

Variables	Group I	Group II
Mean Removal Time (Months)	4.5	7.6
Percentage of Women	85 %	60%
Plate Removal	64.1%	19.2%
3 Months	30.4%	15.1 %
6 Months	22.4%	2.6%
1 Year	11.2%	1.5%

The main causes for removal of the plate were the following: 15(30%) patients had restricted movement of the joint, and 28 (55 %) had pain because of impingement. Mechanical failure was observed in one of the patients (2.5%), and the plate was levered off the bone or eroded the acromion. About 06 patients (12.5%) wanted to get the plates removed due to hypertrophic scar tissue (Table 2).

Table 2: Distribution of Causes of Hook Plate Removal in Group I

Causes	n (%)
Restricted Movement of the Joint	15 (30%)
Pain Due to Impingement	28 (55%)
Mechanical Failure	1 (2.5%)
Hypertrophic Scar Tissue	06 (12.5%)
Total	50 (100%)

The reasons for the removal of the plate in group II were pain due to plate impingement. In 8 patients (33.33 %), and 5 of them (46%) had pain because of impingement. No plate was removed due to a 'mechanical failure in this group. Only 2 (13.33%) had to get the plates removed due to an increase in scar tissue (Table 3).

Table 3: Distribution of Causes of Hook Plate Removal in Group II

Causes	n (%)
Restricted Movement of A Joint	5 (33.33%)
Pain Due to Impingement	8 (46%)
Mechanical Failure	0 (0%)
Hypertrophic Scar Tissue	2 (13.33%)
Total	15 (100%)

However, on the last follow-up visit, the mean Visual Analogue Score between the two groups was (1.75 ± 1.99 vs. 1.89 ± 1.57), the simple shoulder test had (18.05 ± 1.16 vs. 15.72 ± 1.33), and the Constant-Murley scores were (89.50 ± 5.39 vs. 95.20 ± 5.57). The p-value was found to be insignificant (p=0.423, 0.340, and 0.118) respectively in both groups (Table 4).

Table 4: Last Follow-Up Visit Between Groups

Follow-Up List	Group 1 (Mean ± SD)	Group 1 (Mean ± SD)	p-value
Visual Analogue Score	1.75 ± 1.99	1.89 ± 1.57	0.423
Simple Shoulder Test	18.05 ± 1.16	15.72 ± 1.33	0.340
Constant-Murley Scores	89.50 ± 5.39	95.20 ± 5.57	0.118

DISCUSSION

Our study had a male-to-female ratio of 2:1, probably because male is often more vulnerable to fractures of the distal clavicle and acromioclavicular joint dislocation due to road traffic accidents and sports injuries. A similar finding was seen in a study by Maliwankul *et al.* who stated the prominent causes of upper shoulder girdle as traffic accidents and sports injury [15]. The analysis using the VAS, SST and constant Murley scores demonstrated that favourable results were found when the hook plate was used for AC joint disruption or distal clavicular fractures. Martetschläger *et al.* reported similar results [16]. Our study showed union of fractures in 98.56% of patients. Kashii *et al.* reported a good union rate with the hook plate for clavicular fracture [17]. Thangaraju *et al.* and Reska *et al.* also reported a good union rate of 95% and almost no complications with dislocated distal clavicular fractures (Neer type II) who had interventional surgery with a hook plate [18, 19]. Our study showed that 64.5% patients in group I were keen for removal of the hook plate as compared to group II, in which only 19.2% were interested in removal. Similar results were observed by Oh *et al.* who stated that patients treated for AC joint dislocation wanted the hardware to be removed [20]. Our study showed that mean VAS, simple shoulder and Constant-Murley scores were insignificant in both groups; however, the VAS and SST had slightly raised values in group I as compared to group II, whereas Constant-Murley scores were higher in group II. This implies that group I had complications like pain and restricted movements due to the hook plate, which eventually led to its removal. On the other hand, patients in group II had better Constant Murley scores, showing better shoulder function despite the hook plate. Similar results Louwerens *et al.* and Hendrickx *et al.* showed same results [21, 22]. Thus, patients from group I who underwent plate fixation for AC joint dislocation were more adversely affected as compared to Group II, leading to its higher rate of removal in that group.

CONCLUSIONS

Clavicular fracture or acromioclavicular joint dislocation fixation by using hook plates is a safe and reliable mode of treatment. The added advantage of it has a very low secondary surgery for implant removal or revision. Patients operated on with hook plates for distal clavicular fractures are more comfortable with them. On the other hand, those treated with a hook plate for acromioclavicular joint dislocation are more prone to removal due to various medical reasons. In our suggestion, hook plates can be removed if they cause effects like impingement. Their use in the older age group should be carefully done as per the given tendency of the plate to lever off the bone. In other words, it is important to enlighten patients about the

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importance of implant removal and educate them about its removal.

Authors Contribution

Conceptualization: UR
Methodology: UR, HR
Formal analysis: IA
Writing review and editing: AW, SI, IA, AR

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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