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The Outcome of Precontoured Distal Humeral Locking Plate & Humeral Reconstruction Plate in the Treatment of Humeral Intercondylar Fractures

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Abstract

Background: Fractures of the elbow, specifically humeral intercondylar fractures, are common among adults worldwide, and treatment methods for these fractures vary based on various factors. Precontoured distal humeral locking plate fixation and humeral reconstruction plate fixation have gained popularity in the orthopedics community as treatment options. This study aimed to compare the functional outcomes of humeral intercondylar fracture treatments between precontoured distal humeral locking plate and humeral reconstruction plate.

Methods: A cross-sectional comparative study was conducted at the Department of Orthopedics Surgery, Sylhet MAG Osmani Medical College Hospital, Bangladesh, over a two-year period from January 2017 to December 2018. Twenty patients with intercondylar humeral fractures were selected based on inclusion and exclusion criteria and were randomly divided into two equal groups for treatment.

Result: The participants were divided into Group A (Precontoured Distal Humeral Locking fixation) and Group B (Humeral Reconstruction Plate fixation). The mean age was 40.60 years (SD 11.28) in Group A and 31.40 years (SD 13.59) in Group B. Female prevalence was slightly higher, and road traffic accidents were the most common cause of injury. There was no significant difference in operation time between the two groups, but hospital stay and mean time for bony union differed significantly. Patient complications were minimal, with 80% of Group A and 60% of Group B experiencing no complications. Excellent outcomes were observed in the majority of participants, with no significant difference between the two groups.

Conclusion: The study findings suggest that both humeral condylar precontoured locking plate and reconstruction plate are equally effective in treating humeral intercondylar fractures in adults. However, a slightly higher improvement rate and lower complication rate were observed among patients undergoing the precontoured locking plate method. These results support the use of both fixation methods for the treatment of humeral intercondylar fractures.

Keywords: Fracture; Humeral; Elbow; Precontoured; Reconstruction

Introduction

The distal end of the humerus, including trochlea, capitalism, olecranon, coronoid, and radial fossa is called the condyle of the humerus. When the fracture line extending between the medial and lateral condyle, extends to

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the supracondylar region, this results in a T-Y fracture, otherwise called an intercondylar fracture. Such fractures of the distal end of humerus fractures comprise 2% of all fractures [1]. The most common fracture pattern among them is the extra-articular fracture accounting for just under 40% of cases [1]. The majority of such injuries are generally caused by high energy impacts from road accidents or falls from great heights [2]. Intercondylar fractures of the humerus are more common among the older population, especially in cases where the bones become osteoporotic [3]. Fractures of the distal humeral T Y intercondylar remain a challenging problem despite advances in technique and implants. Joint function often is compromised because of stiffness, pain, and weakness. Rarely is a "normal" elbow the outcome after these fractures, but outcomes have been improved with advances in implant technology, surgical approaches, and rehabilitation protocols [4]. In the treatment of such cases, the surgical goals are to obtain anatomic restoration of the articular surface, and recreation of joint alignment with stable internal fixation, while securing enough leeway to allow early range of motion [5]. Since the introduction of AO techniques, open reductions, and internal fixations have become the gold standard, making conservative management almost obsolete. It is well-accepted fact that plates are to be applied on both columns in articular fractures, however, there is still no consensus regarding the orientation of plates on both columns [6]. The introduction of angular stable implants has revolutionized the operative treatment of these fractures, particularly in multi-fragmentary fractures. For distal humeral intercondylar fracture, anatomically precontoured plates with extensive distal screw choices are now available, offering greater stability, and simplicity of application [2]. Historically, the AO group has suggested perpendicular treatment with conventional reconstruction plates (CRPs), with the lateral column plate put posteriorly, and the medial column plate twisted roughly 90° and placed medial to the supracondylar ridge. A modern tendency is to employ precontoured distal humerus locking plates (PDHLPs) in a parallel arrangement, where plates are inserted on the medial, and lateral columns roughly 180° apart. Because of angular screw stability, and an anatomically precontoured form, these newer plates are appealing as an alternative to CRPs, however, evidence to advocate locking plates over non-locking plates for distal humerus fractures is limited [6]. Locking compression plates offer improved stability in areas where screw purchase may be tenuous. Locked plates have been shown to provide a marked increase in resistance to bending, torsion, and axial compression loading among distal humerus fractures as compared to standard fixation with traditional non-locking plates [9]. The locking plates provided improved resistance to screw loosening than the non-locked constructs. & failure rate was significantly lower in the distal humerus plates with locking compression plates [10]. O'Driscoll recently defined principles of fixation of distal humerus fractures using parallel locking pre-contoured plates and defined two goals that should be met: First, fixation inside the distal fragment must be maximized, and second, all fixation in distal fragments must contribute to shaft-distal fragment stability [8]. The most biomechanical stability for comminuted distal humeral fractures is provided by screwing the plates together through the bone, so generating the architectural equivalent of an arch [11]. The present study was conducted with the goal of observing the outcome of two different methods of treatment for humeral intercondylar fractures. The functional outcome of the patients was determined using the Mayo Elbow performance score (MEPS) [12]. This study aims to assess and compare the outcomes of using precontoured distal humeral locking plates and humeral reconstruction plates in the treatment of humeral intercondylar fractures in adult patients, while specifically recording and analyzing any significant factors between the two groups.

Methods

This cross-sectional comparative study was conducted at the Department of Orthopedic Surgery, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh, over a period of 2 years, from January 2017 to December 2018. A total of 20 adult patients with intercondylar fractures of the humerus were selected for the study based on the following inclusion criteria: age between 18-60 years, time between injury to admission less than 3 weeks, closed intercondylar humeral fracture, and patient consent. Patients with neurovascular injury, pathological fractures other than osteoporotic fractures, other types of fractures, inability to answer the criteria question, and those affected by other chronic diseases were excluded from the study. The selected patients were divided into two equal groups (Group A and Group B) using random assortment. Group A received treatment with a humeral condylar precontoured locking plate, while Group B was treated with a reconstruction plate. Both qualitative and quantitative data were collected using a structured questionnaire designed for the study. The outcome of the treatment was measured using the Mayo Elbow Performance Score (MEPS), which categorizes scores as excellent (90-100), good (75-89), fair (60-74), or poor (0-59) [12]. Informed written consent was obtained from all participants, and ethical approval was obtained from the ethical review committee of the study hospital. Data analysis was performed using manual formulas and SPSS software. Quantitative data were expressed as mean and standard deviation, while qualitative data were presented as frequency distribution and percentage. The Chi-square (X2) test was used to compare categorical data between groups, and the 't' test was used to compare quantitative data. Statistical significance was set at $p<0.05$.

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Table 1: Distribution of participants by presenting characteristics on admission (N=20)

Variables	Group-A (n=10)	Group-B (n=10)
	n (%)	n (%)
Age		
18-32 years	1 (10%)	5 (50%)
33-47 years	6 (60%)	4 (40%)
48-62 years	3 (30%)	1 (10%)
Mean in years	40.60(SD 11.28)	31.40(SD 13.59)
Gender		
Male	3 (30%)	6 (60%)
Female	7 (70%)	4 (40%)
Cause of Injury		
RTA	5 (50%)	8 (80%)
Fall from height	5 (50%)	2 (20%)
Side of Involvement		
Right Hand	4 (40%)	6 (60%)
Left hand	6 (60%)	4 (40%)

Results

The age of the patients ranged from 18 to 60 years with a mean age of 40.60(SD 11.28) in group-A; while it was 31.40(SD 13.59) years in Group-B. Slight female prevalence was observed (55% vs 45%) in the total study population, but the gender difference between the patients of group-A, and Group B did not show any statistically significant difference. In Group-A, the cause of injury was a road traffic accident (RTA) for 50%, and fall from height for another 50%, while in Group-B, RTA was the cause of injury for 80% of cases, and fall from height was the case for remaining 20%. Among group-A participants, the injury was on the right hand for 40%, and in Group B, the right-hand injury was observed in 60% of cases.

Table 2: Distribution of participants by operative, and post-operative characteristics (N=20)

Variables	Group-A (n=10)	Group-B (n=10)	P
	n (%)	n (%)	
Duration of Operation			
45-60 minutes	7 (70%)	7 (70%)	p>0.05
61-75 minutes	2 (20%)	1 (10%)	
76-90 minutes	1 (10%)	2 (20%)	
Mean	**59.00(SD 11.26)**	**61.00 (SD 12.02)**	P>0.05
Duration of Hospital stay			
8-10 days	5 (50%)	4 (40%)	p<0.01
11-13 days	3 (30%)	3 (30%)	
14-16 days	2 (20%)	3 (30%)	
Mean	**11.20 (SD 2.098)**	**11.70 (SD 2.11)**	P>0.05
Time of Bony union			
8 – 16 weeks	9 (90%)	7 (70%)	P>0.05
17 -25 weeks	1 (10%)	3 (30%)	
Mean	**14.40 (SD 5.06)**	**18.40 (SD 3.86)**	P<0.05

Operation time of the patients ranged from 45 to 90 minutes with the mean of 59.00(SD 11.26) minutes in group-A; while it was 61.00 (SD 12.02) minutes in Group-B. The majority of the participants from both groups had an operation duration of 45-60 minutes. Operation time between the two treatment groups did not differ significantly (p>0.05. The total length of hospital stay was 8-16 days, with the mean of Group-A being 11.20 (SD 2.098) days; while it was 11.70 (SD 2.11) days in Group B. In group–A, length of hospital stay was 8-10 days in 5 (50%) patients, 11-13 days in 3 (30%) patients, and 14-16 days in 2(20%); whereas in group B, length of postoperative hospital stay was 8-10 days in 4(40%) patients, 11-13 days in 3(30%) patients, and 14-16 days in 3(30%) patients. The length of the postoperative hospital stays between the two treatment groups differed significantly. The mean time of union was 14.40 (SD 5.06) weeks in group-A, and 18.40 (SD 3.86) weeks in Group-B. The mean time of union was significantly shorter in group A compared to Group B. In group–A, time of union was 8 -16 weeks in 9 (90%) patients, and 17-25 weeks in 19(10%) patients; whereas in group B, time of union was 8-16 weeks in 7(70%) patients. The time of union between the two treatment groups did not differ significantly (p>0.05).

Table 3: Distribution of participants by presenting complications (N=20)

Complications	Group-A (n=10)	Group-B (n=10)	P
	n (%)	n (%)	
Infection,	1 (10%)	2 (20%)	p>0.05
Stiffness	1 (10%)	2 (20%)	p>0.05
No complication	8 (80%)	6 (60%)	p>0.05

No complication was observed for 80% of Group-A, and 60% of Group-B participants, but this difference was not statistically significant. Infection was seen in only 1(10%) of the patients from group A, and 2(20%) patients in group B. 1(10%) of the patients from Group-A had Stiffness whereas 2(20%) for the study group B.

Table 4: Distribution of Patients by Outcome levels according to MEPS in group-A & Group-B (N=20)

Outcome	Group-A (n=10)	Group-B (n=10)	P
	n (%)	n (%)	
Excellent	8 (80%)	6 (60%)	p>0.05
Good	1 (10%)	3 (30%)	
Fair	1 (10%)	1 (10%)	

The outcome of the subjects was graded according to MEPS (Mayo Elbow Performance Score). There was no significant difference between the outcomes of Group A and Group B. In Group-A, the excellent result was observed in 80%, good in 10%, and fair in 10%. Similarly, in Group B, the excellent result was observed in 60%, good in 30%, and fair in 10%. None of the participants had poor outcomes.

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Discussion

The present study was undertaken to observe the results of treatment after open reduction, and internal fixation of T-Y intercondylar fracture of the distal humerus in adults with PDHLP Humeral Condylar Precontoured Locking plate (HCPLP) & reconstruction plate. HCPLPs offer potential advantages over conventional reconstruction plates in the treatment of these injuries. The insertion of distal humeral locking (DHL) plate into the humeral fragment provides fixed angle support in multiple planes, which should maintain the reduction while allowing the early mobilization of the elbow [8]. The results of the current study demonstrate that age of the patients with T-Y intercondylar fracture of distal humerus ranged from 18 to 60 years with the mean age of 40.60(SD 11.28) in group-A; while it was 31.40(SD 13.59) years in group-B. Here distribution of male, and female patients of group A, and group B did not show any statistically significant difference but slight female prevalence was observed. This was quite different from the findings of other studies where male dominance is the common finding [2,13,14]. Road traffic accidents were a common cause of injury among the participants, observed in 50% of group-A, and 80% of group-B participants. This was however disproportionate to the findings of Prateek et al. [2] where fractures from falls had a higher prevalence. This might be due to the lack of proper road safety features in our country. The distribution of patients according to the side of Involvement revealed that the right side was involved in 4(40%) patients, and the left side was 6 (60%) patients in Group-A. It was 6(60%), and 4 (40%) patients respectively in group B. Side of involvement did not differ significantly between the two treatment groups. In this study, operation time ranged from 45 to 90 minutes with a mean of 59.00(SD 11.26) minutes in group-A; while it was 61.00 (SD 12.02) minutes respectively in Group B. Operation time between the two treatment groups did not differ significantly ($p>0.05$). In the present study Length of hospital stay ranged from 8 to 16 days with a mean of 11.20 (SD 2.098) days in group-A; while it was 11.70 (SD 2.11) days respectively in Group B. In group–A, length of hospital stay was 8-10 days in 5 (50%) patients, 11-13 days in 3 (30%) patients, and 14-16 days in 2(20%); whereas in group B, length of hospital stay was 8-10 days in 4(40%) patients, 11-13 days in 3(30%) patients, and 14-16 days in 3(30%) patients. Length of postoperative hospital stay between the two treatment groups had a highly significant difference. The mean time of union was 14.40 (SD 5.06) weeks in group-A, and 18.40 (SD 3.86) weeks in Group-B. The mean time of union was significantly shorter in group A compared to Group B ($P<0.05$). The distribution of complications between the patients of group A, and group B had no significant difference, and 80% of group-A and 60% of group B had no observable complications. The outcome of the subjects was graded according to Mayo Elbow Performance Score.[12] There was no significant difference between the outcomes of Group A and Group B ($p>0.05$) at the end of the final follow-up period of 6 months. In Group A the score showed excellent results in 8(80%) patients, good in 1(10%) patients, and fair in 1(10%) patients. In contrast, 6(60%) of the patients were grouped as excellent, 3(30%) as good, and 1(10%) as fair in group B. Almost similar to the findings observed by the various researchers of different countries.[4],[15]-[17] These findings were better compared to the study findings of Prateek et al. [2]

Limitations of the study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

The present study findings suggest that the humeral condylar precontoured locking plate and reconstruction plate are both equally effective in the treatment of humeral intercondylar fractures in adults. However, a slightly higher ratio of improvement was observed among patients undergoing the precontoured locking plate method, as well as lower complications.

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Conflict of interest: None declared

Ethical Approval: The study was approved by the Institutional Ethics Committee

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