

To Determine the Efficacy of Locking Compression Plating in Comparison with Intramedullary Nailing for Humeral Shaft Fractures at a Tertiary Care Hospital in Karachi, Pakistan

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ABSTRACT

Objective: The purpose of our study is to compare the effectiveness, surgical outcome and complications of locking compression plating as compared with intramedullary nailing for the purposes of fixation of humeral shaft fractures in the adult population. **Methodology:** The type of study is a prospective randomized controlled trial, which was carried out for a period of three years from Jan 2012 to December 2014, at a tertiary care hospital in Karachi Pakistan. Patients coming to the hospital via the A&E department with radiographic evidence of a humeral shaft fracture were included in the study. 50 patients were selected for the study, who were randomly divided into two groups, group A (n=25) comprised of patients who underwent intramedullary nailing procedure, while group B (n=25) patient underwent compression plating for the fixation of the humeral fracture. The surgical outcome was assessed based on the operative time, intra operative blood loss, the time of hospital stay, the time required for the union of bone, functional outcome and complications. (American shoulder and elbow surgeons score) ASES and the constant score was used to assess the functional outcome of patients. **Results:** According to our study, the operative time, hospital stay and intra operative blood loss was much lower in group A (the intramedullary nail group) as compared to those in the group B (locking compression plate group). The rate of bone union, constant and ASES score did not show any significant difference. The union time for group A was lower as compared to group B. Complications such as radial nerve palsy were observed to be associated more with the locking compression plate as compared with the group of patients who underwent intramedullary nailing. **Conclusion:** According to our study the intramedullary nailing technique for the repair of humeral shaft fractures is a superior technique as compared to the locking compression plate, as it has decreased incidence of blood loss during the procedure, less time required for the procedure, less time of hospital stay and union of bone. It also has a low incidence of complications.

Keywords: Locking compression plate, humeral shaft fracture, surgical outcome, intramedullary nails.

Abbreviations: A&E: Accidents and Emergency, ASES= American shoulder and elbow surgeons score, LCP= Locking compression plating, IMN= Intramedullary nailing.

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INTRODUCTION

In trauma patients a major cause of morbidity is the fracture of the humeral shafts and its related complications.¹ These fractures accounts for 20% of all the fractures of the humerus and 3% to 5% of all the fractures of the body.²⁻⁴ The currently available options for the treatment of humeral shaft fractures include external fixation, functional bracing, internal plate fixation and intramedullary nailing.⁵

The fixation of the bone with plates, yields better rates of union but the technique itself is complicated, as it requires open surgery and stripping of the soft tissues, also the fixation provided with this technique is less secure specially in cases of osteoporotic bone.^{6,7} As observed in these studies, intramedullary nailing is the standard surgical method, whereas other studies report it to

be less functional when it comes to the shoulder joint movement and a poor rate of the union of fractured bone.⁸⁻¹¹ The subject is still open to debate to which method is more beneficial both in the short and long terms.¹² Many trials have reported both the procedures for humeral shaft fractures^{1,4,8,12-18} however they do not mention which technique is superior when both the methods are compared. According to some studies the recent locking compression plate, can offer improved stability and fixation of the bone as compared to the classic dynamic compression plate system.¹⁹⁻²¹ The main objective of our study was to compare the effectiveness, surgical outcome and complications of locking compression plating as compared with the intramedullary nailing technique for the purposes of fixation of humeral shaft fractures in the adult population.

METHODOLOGY

The type of study is a prospective randomized controlled trial, which was carried out for a period of three years from Jan 2012 to December 2014, at a tertiary care hospital in Karachi Pakistan. Patients coming to the hospital via the A&E department with Radiographic evidence of a humeral shaft fracture were included in the study. The study population comprised of 50 patients, who were randomly divided into two groups, group A (n=25) patients underwent intramedullary nailing, while group B (n=25) patient underwent compression plating for the fixation of the humeral fracture. The inclusion criteria for the study was that patients had a humeral shaft fracture that requires treatment with intramedullary nailing or plating procedures, unilateral closed humeral fractures, patients age must be eighteen years or older. The exclusion criteria was all patients younger than eighteen years of age, patients having pathological fractures, neurovascular damage, history of previous humeral shaft fracture, open fractures (grade III) and fractures that are older than 2 weeks duration. Anterograde nailing was done in all patients belonging to the intramedullary nailing group. In the group of patients who underwent locking compression plating, two techniques were used, anterolateral approach in patients with fractures of the upper and middle thirds of the humeral shaft, and posterior approach was used in patients with fractures involving the lower third segment of the humeral shaft. Surgery was performed in patients

under general anesthesia. Antibiotics were administered both pre operatively and post-operatively. All patients were advised proper exercise post-operatively by the physiotherapist. Radiographic images were obtained on a monthly basis, till complete healing of the fractured bone occurred. Patients were followed up till one year. The surgical outcome was assessed based on the operative time, intra operative blood loss, the time of hospital stay, the time required for the union of bone, functional outcome and complications. (American shoulder and elbow surgeons score) ASES and the constant score was used to assess the functional outcome of patients. Healing of the bone was assessed by serial radiographs, union of the bone was considered when a bridging callus was observed within a period of 6 months duration. Malunion and delayed union of bone were defined to be a non observable or definite union at 8 to 11 months after the injury, and malunion was defined as a rotational deformity of more than 5 degrees. Any type of neurological injury, was considered to be iatrogenic, and other complications such as iatrogenic fractures, hardware failure, compartment syndrome was noted. Fishers exact test or chi square test was used to determine the relationship between variables. Continuous data was represented as mean \pm standard deviation and were compared using t-test. A p value of less than 0.05 was considered to be statistically significant. Data was analyzed using SPSS version 20.

RESULTS

The age range of patients in the study was 40.01 ± 10.6 years in group A and 39.8 ± 10.3 years in group B, The male to female distribution was 15 (60%) males and 10 (40%) females in group A and 17 (68%) males and 8 (32%) females in group B. The classification of fractures was done according to the AO system, in which 50% belonged to the 30B, and 30% belonged to the 18C group. Most of the patients presented after a road traffic accident (70% for group A, and 76% for group B), the rest of the patients presentation was because of blunt trauma. No significant difference was noted in the patient demographics, type of fractures that occurred, and the mechanism of injury. Refer to Table 1. the operative time, hospital stay and intra operative blood loss was much lower in group A (the intramedullary nail group) as compared to those in the group B (locking compression plate

group) $P < 0.05$. The functional outcome of both the groups was satisfactory, as the patients were able to return to their vocation in the six month period post-operatively (except the patients who developed non union, $n=1$ in the intramedullary nailing group, and $n=2$ in the locking compression plating group) Refer to Table 2. The constant score and the ASES score also did not show statistically significant difference when compared in the two groups, the constant scores being (90.21 ± 1.20) in the IMN group, and 90.30 ± 1.33 in the LCP group; $p=0.682$) and the ASES scores being (90.42 ± 1.01) for the IMN group and 90.38 ± 1.12 for the LCP group respectively). The average time taken for union of bone was 6.6 weeks in the group A, and 10.2 weeks in group B, which was significant $p < 0.001$. Union rate and incidence of union was similar among the two groups. The patients in the locking compression plating group among them $n=2$ (8%) suffered from radial nerve palsy, and they recovered after 3 months of the procedure due to rehabilitative techniques of bracing.

Table 1: Demographics and patient data

Variable	IMN Group	LCP Group
Age, Mean \pm SD	40.01 \pm 10.6	39.8 \pm 10.3
Male	15 (60%)	17 (68%)
Female	10 (40%)	8 (32%)
Fracture Classification		
A	9	8
B	12	14
C	4	3
Cause of injury		
Road traffic accident	18	19
Crushed by heavy object	4	5
Fall to the ground	2	1
Belt twisting injury	1	0

Table 2: Comparison of intra operative blood loss, operative times, and hospital stays

Group	Number	Intra operative blood loss, ml	Operative Time, min	Hospital Stay, days
IMN	25	59.01 \pm 9.43	60.01 \pm 7.12	6.52 \pm 1.15
LCP	25	150.25 \pm 11.55	92.93 \pm 5.21	10.02 \pm 1.18
P		<0.001	<0.001	<0.001

DISCUSSION

There have been many studies which have reported on dynamic compression plating and intramedullary nailing for the fixation of fractures occurring in the shaft of the humerus^{1,4,8,12-18,22} but no study has compared the efficacy of both the procedures against each other. We studied, compared and contrasted the various aspects of the two procedures, including the outcomes and associated complication such as blood loss, operative time, the time of hospital stay, the time required for the union of bone and functional outcome etc. We observed that the characteristics of intra operative loss of blood, hospital stay duration, time required for the procedure, and average time required for the union of bone was significantly lower for the group of patients belonging to the intramedullary nailing technique as compared to the other group. Incidence of complications, rate of union, the constant and ASES scores showed no statistically significant difference. The lower values shows for intramedullary nailing technique proves it to be a superior technique. According to some studies shoulder movements and delayed union has been observed and is a concern with the intramedullary nailing technique,²³⁻²⁵ which may be caused as a result of entrapment due to migration of nail more proximally as intended, damage to the rotator cuff muscles, capsulitis or other causes.^{8,24,26} But in our study we did not found any significant difference in the functional outcome, contrasting the previous studies^{1,14,26} a reason could be the good intra operative technique and prompt rehabilitative process. According to some studies the rate of non union for plate fixation has been from 2% to 10% respectively, in our study the rates have been 8% ($n= 2$) of the 25 patients in the locking compression plating group.²⁷⁻²⁹ While some studies suggest non union rates for intramedullary nailing to be in the range of 0% to 8%, including the study by Hems and Bhullar, which suggested that antegrade nailing affects healing as it causes disruption of the fracture and the soft tissues involved.^{14,27,30,31} But in our study only $n=1$ (4%) of patients showed non union of the bone in the intramedullary nailing group. We did not find any statistically significant difference when union and non union rates were compared, as is also evident by other studies.^{8,17,32} According to some studies, the radial nerve palsy is a common complication of humeral shaft fractures being 6% to 15%.³³⁻³⁵ In our study the patients in

the locking compression plating group among them n=2 (8%) suffered from radial nerve palsy, and they recovered after 3 months of the procedure due to rehabilitative techniques of bracing. The group of intramedullary nailing did not have any radial nerve palsy reported.

CONCLUSION

According to our study the intramedullary nailing technique for the repair of humeral shaft fractures is a superior technique as compared to the locking compression plate, as it has decreased incidence of blood loss during the procedure, less time required for the procedure, less time of hospital stay and union of bone. It also has a low incidence of complications.

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