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Outcome of fracture shaft of humerus fixed with dynamic compression plate in B. P. Koirala Institute of Health Sciences, Dharan, Nepal

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ABSTRACT

Introduction: Open reduction and internal fixation with dynamic compression plate (DCP) is necessary for fracture shaft of humerus (SoH) whose closed reduction is not acceptable or cannot be retained in slab or cast.

Objectives: Aim of the study was to evaluate outcome of fracture SoH fixed with DCP.

Methodology: Patients with fracture SoH fixed with DCP in BPKIHS in 2015-16 were prospectively studied for one year for perioperative issues and functional outcome using DASH score.

Results: There were 87 patients of fracture SoH fixed with DCP. Among 87 patients, 65.5% were male and 34.5% were female. The mean age was 36.4 years. The most common mode of injury was road traffic accident followed by fall from height, work place injury. The average operating time was 71 minutes with standard deviation 15.6. The mean blood loss was 205ml ± 45.60. Post-operative hospital mean stay was 4.5 days. There was post-operative radial nerve palsy in 4.6%. Only 69 patients can be followed up for one year for evaluation. Radial nerve palsy recovered fully in those with post-operative palsy. Disability of shoulder arm and hand (DASH) score was 82.50±9.6 after one year of surgery. Fracture was not united in 3(4.3%) patients out of 69 patients who reported for follow up at one year of injury and needed bone grafting and secondary intervention. This shows satisfactory functional outcome in fracture SoH fixed with DCP.

Conclusion: Dynamic compression plating for SoH fracture has satisfactory outcome.

INTRODUCTION

Fractures of the shaft of humerus (SoH) comprise approximately 3% of all fractures. The proportion of these fractures being treated conservatively reportedly varies from 33% to 95%. Intramedullary fixation of humeral shaft fractures as well as compression plating or external fixation in open fractures is described. It has been reported a near 100% union rate in shaft of humerus fractures treated with either intramedullary interlocking nails or compression plates and screws [1, 2, 3].

With the dramatic success of intramedullary fixation for fractures of the femur and tibia, there is speculation that IM-ILN might be more appropriate for humeral shaft fractures than DCP.[1] In our institute, we are mostly fixing fracture shaft of humerus with dynamic compression plate (DCP). So, we decided to know in this study the outcome of humeral shaft fracture fixed with DCP in our hospital.

METHODOLOGY

Patients with fracture SoH fixed with DCP **(fig 1)** in BPKIHS in 2015-2016 were prospectively studied for one year for perioperative issues and functional outcome

using DASH score. All the patients with SoH fractures attending OPD or emergency were first attempted for conservative management by closed reduction and U-slab application. Shaft of humerus fracture whose closed reduction was not acceptable or could not be retained in slab or cast was planned for open reduction and internal fixation (ORIF) with DCP. Ethical clearance (Acd 1226/071/072) for the study was obtained. Informed consent was taken for participation in the study with those who were planned for fixation with DCP and approved pro forma filled with necessary data. Their functional outcome was assessed using DASH score in follow up till one year.

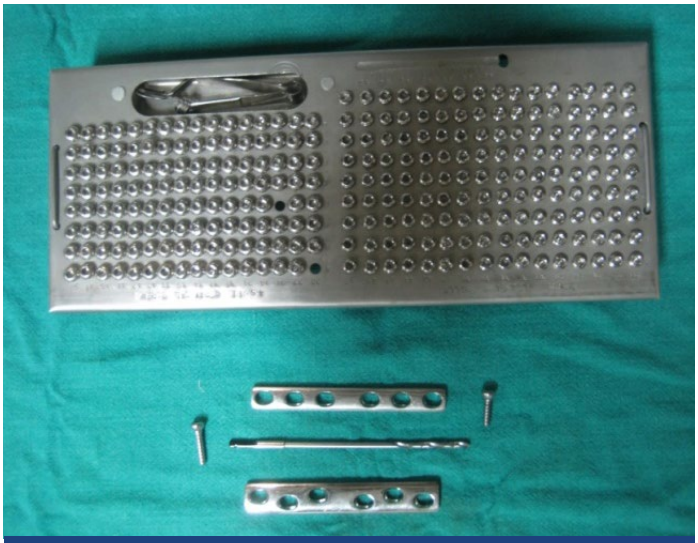

Fig 1: Dynamic compression plate & Screw

The patients with Gustilo grade II and III open fractures of shaft of humerus, periarticular fractures of the humerus, fractures with neurovascular injury, bone & joint disease interfering with rehabilitation, primary nerve palsy, patients with active infection, candidates not giving consent to be included in the study, age less than 18 years with immature skeleton and pathological fracture were excluded from the study.

Statistical Methods applied:

Proportion, measure of central tendency and dispersion of the variables like age, sex, involved limb, dominant limb, duration of injury, type of fracture, duration of operating time, amount of blood loss, rate of infection, pain at fracture site, time to achieve union, functional outcome of shoulder and elbow, complications of surgery were tested by appropriate parametric and nonparametric statistical technique (e.g.- T-test, $\chi 2$-test) depending upon the nature of the variables in both the groups. Multivariate analysis (Regression analysis) was applied to control the confounding effect of different variables (i.e. outcome variables). The results were compared with other relevant studies in the literature and consensus view presented comparing infection rate, pain, union time, nonunion rate, functional outcome of shoulder & elbow.

Operative Procedure:

Open reduction and internal fixation with Dynamic compression plate: After appropriate anesthesia, patient was positioned supine and draped with arm abducted and externally rotated on side table. Fractures in proximal and middle third were approached through an anterolateral incision. Fractures that extend into distal third of the bone were approached through posterior. Fracture ends were delivered out, medullary canal opened, reduced and fixed with a broad 4.5mm DCP and screws **(fig 2)**. In physically small individuals with narrow humerus, a narrow 4.5mm DCP was used. Wound was closed in layers. Standard dressing and post-operative protocol were followed.

Fig 2: Per operative picture showing SoH fracture stabilized with DCP

RESULTS

There were 87 patients of fracture shaft of humerus fixed with dynamic compression plate in 2015-2016 in routine operation theatre of BPKIHS. Among 87 patients, 65.5% were male and 34.5% were female. The mean age was 36.4 years with standard deviation of 15.49 ranging from 18 to 65 years.

The usual mode of injury was road traffic accident followed by fall from height, and work place injury.

Right limb was the more involved limb in both the groups. Closed reduction and U-slab was the most common initial treatment modality for shaft of humeral fracture.

Mean injury surgery interval was 20 days with standard deviation of 13.26. The mean duration of surgery was 71 minutes with standard deviation of 15.60. Per operative mean blood loss was 205ml with standard deviation of 45.6. The mean hospital stay was 4.5 days with standard deviation of 0.69. The post-operative surgical site infection rate was 4%. Immediate Post-operative

radial nerve palsy was in 4.6% of cases. The mean VAS Score of pain at arm was 1.1 with Standard deviation of 0.31 after one year of surgery. The tenderness at fracture site on attempted angulation was 1.15 (±0.37; measured in VAS Score) at one year follow up. DASH score was 82.50 ± 9.67 and radiological evidence of union was in 3.80 ± 0.41 cortices at one year follow up of DCP fixation for fracture shaft of humerus. The different variables are summarized in following tables 1 and 2.

Table 1: Demographic Variables

Variable		Mean±SD
Age (in years)		36.40±15.49
Sex	Male	15
	Female	5
Dominant limb	Right	18
	Left	2
Injured limb	Right	12
	Left	8
Mode of injury	RTA	8
	Fall from height	5
	Workplace injury	6
	Physical assault	1
Immediate treatment	U-slab	17
	Above elbow slab	1
	External fixator	2
Injury surgery interval (in days)		20.05±13.26

Table 2: Outcome variables

Variables		Mean±SD
Duration of surgery (in mins)		71±15.60
Blood loss (in ml)		205.00±45.60
Post-operative Radial Nerve Palsy	No	95.4%
	Yes	4.6%
Post-operative Surgical site infection	No	96%
	Yes	4%
Hospital stay (in days)		4.50±00.69
Pain at arm at one year follow up		1.10±0.31
Tenderness at fracture site on attempted angulation at one year follow up		1.15±0.37
Radiological evidence of union at one year follow up		3.80±0.41
DASH SCORE at one year follow up		82.50±9.67
Radial nerve palsy recovery at one year follow up		100%

DISCUSSION

Sixty-five percent were male and thirty-five percent were female who underwent dynamic compression plate fixation for fracture of shaft of humerus. In the study by Changulani M et al., 86.9% were males and 13% were females in nailing group, while in plating group 79.2% were males and 20.8% were females. The mean age was 36.4 years of our studied case files. The mean age of patients was 35 years for those who underwent DCP fixation in the study by Changulani M et al. The mean age of patients with fracture shaft of humerus was 45.3 years in the study conducted by S Raghavendra, Haresh P Bhalodiya. The demographic data in our study and that of Changulani M et al and S Raghavendra, Haresh P Bhalodiya are similar.

The usual modes of injury were road traffic accident followed by fall from height which was similar to the study by Changulani M et al.

Most of the patients were right handed. Right limb injury was more common. Mostly the immediate immobilization technique used was U-slab application. Mean injury surgery interval was similar 20.05 days. Mean injury surgery interval was less as compared to the study by Changulani M et al.

Open reduction and internal fixation with dynamic compression plate for fracture shaft of humerus took significantly less time. The mean operative time for humerus plating was 71 minutes with standard deviation of 15.60. Per operative blood loss was significantly more in open reduction and internal fixation with dynamic compression plate. The mean blood loss in humerus plating was 205 ml with standard deviation of 45.60. This is comparable with the study of Lin.

Post-operative hospital stay was 4.5 days. S Raghavendra, Haresh P Bhalodiya has also found similar results in their study regarding post-operative hospital stay.

The perioperative radial nerve injury was 4.6% which had recovered in one year follow up period. This indicates that those radial nerve palsy were due to neurapraxia.

Post-operative Surgical site infection was in 4% of cases which healed with general care of wound and antibiotics without any chronic sequalae.

S Raghavendra, Haresh P Bhalodiya has also recorded similar results regarding post operative infection.

The pain over arm gradually decreased with passage of time. There was no significant pain and tenderness at fracture site on attempted angulation at one year follow up which shows clinical evidence of union of fracture. Raghavendra S et al. has also noted faster union in plating.

DASH score gradually improved. DASH score was significantly better in plating at one year of follow up. This shows better functional outcome in plating group. Raghavendra S et al. had also found better functional outcome.

Humerus plating showed significantly better radiological evidence of union at one year follow up.

CONCLUSION

Dynamic compression plate provides compression at fracture site, so union is faster. The functional outcome is better in dynamic compression plating for fracture shaft of humerus. It is concluded that outcome after dynamic compression plating is better in our setup for fracture of shaft of humerus.

RECOMMENDATION

Fracture shaft of humerus should be fixed with plates and screw when there is indication of open reduction and internal fixation.

LIMITATION OF STUDY

The study has been done at single center.

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CONFLICT OF INTEREST None

FINANCIAL DISCLOSURE None

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