

Diaphyseal Humeral Fractures Treated by Plaster Cast & Dynamic Compression Plate

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ABSTRACT

Objective: To assess the results of diaphyseal humeral fractures treated by plaster cast and dynamic compression plate and comparing their results regarding hospital stay, union time and complications.

Methods: This cross-sectional study was conducted in Orthopaedic Department of Peoples University of Medical and Health Sciences, Nawabshah, during July 2015 to June 2016. A total of 50 consecutive patients of closed diaphyseal humeral shaft fractures were selected according to inclusion criteria. All the cases were admitted from outpatient department, from Trauma Center and were divided in two equal groups A and B. Group A treated with plaster cast (POP) and group B with dynamic compression plates (DCP). Follow-up was done. Results were tabulated and analyzed software.

Results: The mean age was 27.12 ± 3.2 years, with male to female ratio of 5.2:1 in POP group and 3.1:1 in DCP group. Time to achieve union in both groups was recorded. Union time ranges 10 to 24 weeks in both groups. The mean healing time in plating group was 12.3 weeks while in cast it was 14.6 weeks. Complications observed were infection 2(8%) patients in DCP VS 0(0%) patients in POP group, iatrogenic palsy of radial nerve observed in 2(8%) patients in DCP VS 0 (0%) patients in POP group, Non union was seen in 1(4%) patient in DCP VS 4 (16%) patients in POP group, delayed union was present in 1(4%) patient in DCP VS 5(20%) patients in POP group, 1(4%) patient show malunion in DCP VS 6(24%) patients in POP group, stiffness of shoulder joint was observed 3(12%) patients in DCP VS 10(40%) patients in POP group.

Conclusion: Fracture shaft of humerus is most common among young males. The rate of complications of DCP is lower than that of POP. DCP is related to low risk of delayed union as compared to POP.

Key Words: Diaphyseal Humeral Fractures, Plaster Cast, Dynamic Compression Plate.

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INTRODUCTION:

Fractures of humeral shaft are commonly encountered by orthopedic surgeons¹. Non-operative management is the best option in majority of cases & results in a high union rate with minimal complications in comparison to internal fixation and open reduction². Patients often find the non operative method uncomfortable, and Frustrating, there fore The temptation is to perform

Surgery: 1. if correct position and alignment is not possible by conser-vative measures, 2. severe multiple injuries, 3. an open fracture, 4. segmental fracture, 5. radial nerve palsy after manipulation, 6. non-union, 7. floating elbow, etc. Fixation can be done with either 1. a dynamic compression plate & screws, 2. an intra medullary interlocking nail, or 3. an external fixator^{3,4}. Excellent reduction and fixation can be achieved by plating and is not to interfere with shoulder or elbow fixation⁵. However, it requires wide dissection and radial nerve must be protected⁶. There is always a growing need to tailor the treatment options according to circumstances and resources to effectively maximize the health care delivery to the patients⁷. The purpose of current study is to

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compare the results of humeral shaft fractures treated by POP cast or plating, in order to find out simple and convenient method, and would be practicable and material available in most of our centers⁸.

The aims & objectives of the cross-sectional study are to assess the results of diaphyseal humeral fractures treated by plaster cast and dynamic compression plate and compare their results regarding hospital stay, union time and complications.

METHODS:

This study was carried out in the department of orthopaedic, People's University Hospital Nawabshah, during July 2015 to June 2016. After the approval from ethical committee 50 consecutive patients were admitted through the outpatient and casualty departments. All data was entered in a specified proforma designed for this purpose. Patients were divided in two equal groups A and B, each comprising of 25 patients. Group A for plaster cast (POP) and group B for dynamic compression plates. Detailed Clinical examination of the patient was done and recorded in proforma. Systemic review was also done to see any major or minor head injury. All patients underwent for base line investigation. The inclusion criteria comprises the patients with closed diaphyseal humeral shaft fracture, bilateral fractures, associated with minor head injuries, age between 20-50 years and fracture not more than two weeks old. Group A the patient's injured arm is immobilized in a plaster of paris U-slab, Drugs are given to alleviate pain. Group B the patients were taken for elective surgery as soon as possible after necessary blood, urine & radiographic pre-operative work-up. The patient's attendants were explained about the nature of injury & its possible complications. Patient's attendants were also explained about the need for the surgery & complications of surgery. The Dynamic compression plate (DCP) is a self compressing plate due to the special geometry of the screw hole that makes it possible to achieve axial compression without the use of a tension device, & the screws can be angled in any direction. The plate is adaptable to many different internal fixation situations & can be used as static compression plate, a neutralization plate & buttress plate. Broad DCP's were used through Antero-Lateral Approach and Posterior Approach.

Follow up of all these patients was done. Initial four visits after every week, then alternate week upto 3rd month then monthly upto 6 month to assess any complication. The results were prepared with help of tables and graphs and data was analyzed through SPSS software version 16.0.

RESULTS:

The 50 cases of closed diaphyseal humeral shaft fracture. They were divided into two groups; Group A for plaster of paris (POP) comprising of 25 patients

Group B for dynamic compression plates (DCP) comprising of 25 patients.

In plaster of paris (POP) group 21(84 %) were male and 4(16%) female with male:female ratio of 5.2:1

In dynamic compression plates (DCP) group 19(76%) were male and 6(24%) female. Ratio male:female ratio of 3.1:1 (Table-I).

The Fracture pattern was Oblique in 29(58%) cases, Transverse in 13(26%) and Spiral in 8(16 %) (Table-I). The most common site of humeral shaft fracture was the middle third in 37 (74%) cases and lower third in 13(26%) cases (Table-I). Time to achieve union in both groups was recorded. Union time range 10 to 24 weeks in both groups. The mean healing time in plating group was 12.3 weeks while in u-cast it was 14.6 weeks. (Table No-I).

Post operative Complications: The complications seen in this study were Infection in 2(8%) patients in DCP VS 0(0%) patients in POP group, Iatrogenic palsy of radial nerve in 2(8%) patients in DCP VS 0 (0%) patients in POP group, Non union in 1(4%) patient in DCP VS 4 (16%) patients in POP group, delayed union in 1(4%) patient in DCP VS 5(20%) patients in POP group, malunion in 1(4%) patient in DCP VS 6(24%) patients in POP group, stiffness of shoulder joint in 3(12%) patients in DCP VS 10(40%) patients in POP group (Table No-II).

DISCUSSION:

Diaphyseal shaft fractures of the humerus are definitively not subjects for "gold standard therapies". Although there exists a huge amount of creativity in developing new techniques and implants for the fixation of these fractures, the variety of fracture patterns and situations make clinical studies difficult to be compared with and very often the decision of treatment is led mainly

Table-I: Clinical and Demographic Profile

Paramaters	DCP Group (n=25)		POP Group (n=25)	
	No. of Patients	Percentage	Number of Patients	Percentage
Gender				
Male	19	76%	21	84%
Female	06	24%	04	16%
Age in Years				
21-35	18	72%	16	64%
36-60	07	28%	09	36%
Radiographic Findings				
Oblique	15	60%	14	56%
Transverse	07	28%	06	24%
Spiral	03	12%	05	20%
Site of Fracture				
Middle one Third	19	76%	18	72%
Lower one Third	06	24%	07	28%
Duration of Fracture				
10 to 12 Weeks	13	52%	10	40%
13 to 16 Weeks	10	40%	08	32%
17 to 20 Weeks	02	08%	05	20%
21 to 24 Weeks	00	00%	02	08%

Table-II: Post Operative Complication

Complications	DCP Group (n=25)		POP Group (n=25)	
	No. of Patients	Percentage	No. of Patients	Percentage
Infection	2	8%	0	0 %
Iatrogenic Palsy Radial Nerve	2	8%	0	0 %
Non Union	1	4%	4	16%
Delayed union	1	4%	5	20%
Malunion	1	4%	6	24%
Stiffness of shoulder joint	3	12%	10	40%

by personal experience, which is connected with very subjective bias⁹.

This study was carried out to compare the functional out come between dynamic plates and conservative treatment of plaster of paris. The male to female ratio seen in DCP group was 3.1:1 as compared to POP group where it was 5.2:1. The higher rate of fracture in male clearly correlated

with the life style of male, especially, in our part of world. The males are more involved in outdoor activities and the young male are more enthusiastic about life & careless drivers. Female usually have sedentary life style and less involved in driving which is a common cause. However the male to female ratio given by Mirdad TM¹⁰ is 9.8:1, Reyes-Saravia GA¹¹ is 3.4:1 and Akram R¹² is 1.3:1.

The age ranged from 20 to 50 years in both groups with mean age of 27.12 ± 3.2 years. The fractures were most common in the 3rd and 4th decades in our study. The other series also show higher incidence of fractures in younger age groups. However Tsai CH showed age range from 9 to 82 year with the mean age for females was 50.8 years and for males 31.7 years¹³ and Gadegone WG¹⁴ showed mean age was 37 years.

The clinical parameters were further supported by x-ray which revealed. Oblique fracture in 29(58%) cases, Transverse fracture in 13(26%) and Spiral fracture in 8(16%).

Fracture union was considered to have occurred when fracture site was painless and there was absence of mobility between the fragments and radiographic evidence of continuous bridging callus. In adults, the time usually required for consolidation of a fractured long bone, in favourable conditions is about 12 weeks¹⁵. The mean healing time in plating group was 12.3 weeks while in u-cast it was 14.6 weeks.

Comparison with other studies showed that in study of Salick¹⁶ the mean time to achieve union was 15 weeks in operative group while 14 weeks in conservative group. The study of siebert¹⁷ reported 62 humeral shaft fractures treated by plate. The mean time for bony union was 16.2 weeks and study of Sharma¹⁸ reported 25 cases treated with POP and average time for fracture union was 17 weeks.

In our study majority of postoperative complications were found higher in POP group as compared to DCP group. Infection is virtually confined to open fractures in which the wound is contaminated by organisms carried in from outside the body. Exceptionally, a closed fracture may become infected when it is converted into open fracture by operative intervention. Wound infection occasionally remains superficial and the bone escapes but more often the infection extends to the bone and gives rise to osteomyelitis¹⁹.

In the present study we had 1(DCP=8% VS POP=0%) case of infection. Staph Aureus was isolated on culture which was sensitive to 1st generation cephalosporins, amoxycillin and clavulonic acid and fucidic acid. Although treatment was started but the wound needed several thorough debridements before the infection settled. However frequency of wound infection given by Bell et al²⁰ in a series of 33 patients treated with dynamic compression plate,

there was 1(3%) case of infection.

There was two case of radial nerve injury (DCP=8% VS POP=0%). The radial nerve injury was associated with oblique in the middle third of humerus. When it was opened for plating the radial nerve was lacerated between two bony fragments. In the respective DCP groups rates have been reported of iatrogenic radial nerve palsy were 2.6 to 14.3%²¹ and 2 to 5%^{22,23}.

In our study, both groups were comparable in terms of functional outcomes and rates of union. The complication rate was higher in the POP group (mostly pertaining to shoulder pain).

In our study non-union was seen in (DCP=4% VS POP=16%) case, which were managed by freshening of the bone ends and with bone grafting in DCP group. The incidence of nonunion reported in the literature is between 08%^{22,24}.

There is no absolute time beyond which a fracture is in a state of delayed union but as a general rule union is seen to be delayed if the fragments are still freely mobile 12 or 16 weeks after injury¹⁵. In the present study there were 6(30% of total) cases of delayed union out of which one was in the plating group and 5 were in POP group. The percentage of delayed union in plating and POP group was 5% and 25% respectively. The higher incidence of delayed union was a significant disadvantage in the plating group.

Salick reported in his study of 87 humeral shaft fractures treated by plating and POP respectively. In the plating group they observed delayed union in 2 patients while 5 cases in POP group. The overall incidence of delayed union was 18% in patients conservatively managed. The faulty application and over traction was related to a higher risk of delayed union in conservatively managed patients while infection in DCP group¹⁶.

In this study malunion was not a significant problem in DCP group. There were six patients in POP group with varus angulation less than 10 degrees while one patient had varus angulation more than 10 degrees. All due to positioning at the time of application of POP and non co-operative and careless attitude of patients due to illiteracy. The patients did not followed the advice properly.

The results of this study are comparable with the study of Sharma¹⁸ reported 25 patients treated by POP, only 16 patients had varus angulation more than 15 degree.

In the present study there were 3 cases (12%) in DCP group with stiffness of shoulder joint while 10 cases (40%) in conservatively managed cases with cast. The cases were followed up for 24 weeks. In both of these groups the patients coming back with shoulder stiffness were elderly. They did not follow the advice and avoid the exercises of shoulder joint due to fear of pain. Most of patients visited infrequently in out-patient department and at 16 to 24 weeks presented with stiffness of shoulder joint.

Babin²⁵ treated 74 humeral shaft fractures with plaster of paris cast technique. Stiffness of the shoulder represent was the most important part of 9(12%) bad results. He concluded that POP is a simple and safe treatment in most humeral shaft fracture in co-operative patients.

Longer the duration of hospital stay, greater the burden on the patient financially and psychologically²⁶. Ideal treatment should therefore minimize the duration of hospital stay hospital stay²⁷ increased in DCP group due to preparation of operative procedure. The hospital stay in this study ranged from 1 to 20 days in both groups with mean length of hospitalization as 8.46 days in DCP and 5 days in POP group. It is comparable to other studies given by different authors like 5 days¹² and 7.5 days (range, 5-14 days)²⁸.

CONCLUSIONS:

The management with dynamic compression plate (DCP) is comparatively better method of treating fracture shaft of humerus having advantages of results more predictable with no rate of complications like delayed union as compared to POP. The technique can be learnt easily.

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