

To Evaluate Functional Outcome in patients with Closed Fracture Shaft of Humerus Treated Conservatively with Coaptation Splint

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ABSTRACT

Aim: To evaluate the functional outcome in patients with closed fracture shaft of humerus treated by coaptation splint.

Methodology: This was a case series study, carried out in Orthopaedic Department, Shaikh Zayed Hospital Lahore, during period of 6 months from January 2011 to July 2011. Both male and female patients of 15-50 years of age, having isolated closed fracture shaft of humerus (up to four weeks old) were admitted through emergency and outpatient departments. The study comprised of 100 patients. **Results:** Functional outcome (pain, range of motion and radiological alignment) was assessed using Stewart and Hundley's criteria and the coaptation splinting for humeral shaft fracture was found equally better method of conservative treatment for these fractures.

Conclusion: Coaptation splinting or U-slab is an effective and easy method for conservative treatment of closed diaphyseal fractures of humerus especially in our low socio-economical setup.

Keywords: Coaptation splint, Humeral diaphyseal fractures.

INTRODUCTION

The fracture shaft of humerus is a common event, representing between 2-7% of all fractures.¹ Although most fractures of the humeral shaft are inherently unstable, closed methods without surgical intervention remains the criterion standard.^{2,3} More than 90% of union rate is expected with the non-operative treatment. Multiple closed techniques are available, including the employment of traction, as well as the use of the hanging arm cast, coaptation splint or u-slab, Velpau dressing, abduction humeral/shoulder spica cast, or functional brace^{2,5}. Guidelines for acceptable reduction include less than 3 cm of shortening, angulation of less than 20 degrees and rotation of less than 30 degrees⁴.

Most of reported series in literature have tried to evaluate and compare the results of non-operative and operative treatment⁶. Operative treatment using dynamic compression plate (DCP) achieves better anatomical reduction but extensive dissection with more blood loss, risk of infection and iatrogenic radial nerve palsy are the major disadvantages^{8,9}.

The indications for operative treatment are open fractures, segmental fractures, pathological fractures, those with associated vascular injuries, radial nerve palsy after fracture manipulation, neurological loss, fractures with unacceptable alignment and failed conservative treatment⁷.

Bohler first described the coaptation splint in 1935. Coaptation splinting represents a method of dependency traction treatment for humeral shaft fractures, involves the placement of a well molded plaster slab from the axilla, around the elbow, and over the deltoid with the elbow flexed to 90 degree. A collar-and-cuff suspension sling supports the forearm (Figure 1, 2). An international study has reported very good in 60% and good results in 20% of cases after treatment with coaptation splint according to Stewart and Hundley criteria¹⁰.

Functional outcome were measured by using Stewart and Hundley's criteria. a: patients who felt pain with heavy work or activity. b: patient who felt pain on daily routine activities such as combing hair performing personal hygienic tasks. c: Range of motion of elbow means, up to which degree one can flex or extend the elbow. A normal person can flex elbow up to 140° and can extend elbow up to 0°. Range of flexion-extension motion is 0-140°. Range motion of a normal shoulder is 170° abduction, 165° flexion and 60° extension. Range of motion was compared with normal opposite limb, measured with goniometer during the course of follow up and at final assessment. d: No anteroposterior or mediolateral angulation

was present between the fragments of bone. e: when fracture was not united after 4 months of injury, it was said to be having non-union.



Figure 1: Fracture shaft of humerus



Figure 2: Coaptation splint

METHODOLOGY

This was a case series study. Total 100 cases were included in the study having isolated, closed fracture shaft of humerus (up to four weeks old) were admitted through emergency and outpatient departments. Closed fracture shaft of humerus diagnosed on x-rays, up to four weeks old, Spiral fractures, Oblique fracture (angle $>30^{\circ}$) and Transverse fractures (angle $<30^{\circ}$) were included. Polytrauma patients, open fracture, fractures with neurovascular injury, pathological fractures, comminuted fracture, old fracture of more than four weeks were excluded.

The following necessary things for the application of the coaptation splint were taken; slightly warm water, bucket, stockinette (optional), soft cotton padding, plaster bandage, elastic bandage and adhesive tape. Then the patient is made to sit over the stool. The length of the splint was individualized for each patient. Using the uninjured contra-lateral extremity, the distance from the base of the axilla, around the inferior aspect of the elbow, over the top of the shoulder to the base of the neck was measured to determine the length of the plaster. The stockinette was then applied over the injured extremity. Then soft cotton padding of the limb was done. Then, 6 to 8 layers of 4 inch plaster bandage with appropriate length were made. Meanwhile, elastic bandage also wrapped around the humerus and the splint was molded with slight valgus stress to make banana shape to the splint. The splint used to hold in desired shaped until it was dried and became hard. The small limb of the splint, present in the axilla is slightly molded to avoid injury to the axillary skin and brachial plexus. The patients were discharged from the ward usually within 24 hours.

The patients were followed up weekly with fresh radiographs for the first two weeks, then at 4th, 8th, 12th and finally at the 16th weeks. Functional outcome (pain, range of motion and radiological alignment) was evaluated using the Stewart and Hundley's criteria and was labeled as good and bad as mentioned in table 3. If there was a painful movement at the fracture site along with no visible callus on the x-ray, the case was considered as non-union and treated accordingly.

Data were analyzed by using computer programme SPSS 15 to find out frequencies and percentages of the components of the final outcome variable i.e. Good and Bad. Confounding variables like age, gender.

Criterion standard of closed methods without surgical intervention

Result	Pain	Limitation of elbow or shoulder mobility	Angulations
Very Good	No pain	Full range of motion of both elbow and shoulder	Good radiographic alignment
Good	Occasional pain	<20° of limitation of elbow or shoulder	< 10°
Fair	Activity related pain	20°- 40° of limitation of elbow or shoulder	> 10°
Poor	Constant pain	>40° of limitation of elbow or shoulder	Radiological nonunion

RESULTS

This study included 100 cases of humeral shaft fractures in patients between 15-50 years of age. In this study, there were 72 male patients and 28 female patients who had closed fracture shaft of the humerus (Table 1). The overall results were very good in 60(60%) patients, good in 27(27%), fair in 11(11%) and poor in 2(2%) patients (Table 2). The poor results were in the patients in whom we could not achieve union. The mode of the injury was road traffic accidents in 35 (35%) patients, accidental falls in 48(48%), falls from height in 4(4%), sport accidents in 3(3%) and with history of fight or assault in 10(10%) patients. The pattern of fracture was oblique or spiral in 87 patients with a butterfly fragment in 15 of those patients. Only 13 patients had a transverse fracture. The average duration of immobilization was 6-8 weeks and average time taken for union was 8 weeks.

Varus-valgus and postero-anterior angulations were measured with goniometer in patients who obtained healing. Most patients had good radiographic alignment or angulation of less than 10 degree. Four patients had varus angulation more than 10 but less than 15. Four had valgus angulation; they were regarded as fair as there was no significant functional disability. Five had varus angulation of more than 15 degrees. Two patients (2%) developed non-union with movement at the fracture site and constant pain; one of them had atrophic and one had hypertrophic non-union.

Regarding movement at the elbow and the shoulder joints, there was almost full range of motion at the elbow in all the cases; but at shoulder joint, abduction was restricted less than 20° in 22 patients and five had about 30 degrees of restriction. Satisfactory functional results could be obtained in these with physiotherapy without any need for additional treatment.

Shortening of about 1.5cm developed in three patients. All patients had short oblique fractures of the humeral shaft; full length could be obtained in all the remaining cases.

Table 1: Sex distribution with fracture shaft of humerus

Sex	=n	%age
Male	72	72
Female	28	28

Table 2: Outcome in patients with Humeral shaft fracture

Results	=n	%age
Very good	60	60.0
Good	27	27.0
Fair	11	11.0
Poor	2	2.0

Table 3: Final outcome

Results	=n	%age
Good	87	87
Bad	13	13

DISCUSSION

Closed treatment of humeral shaft fractures has been recorded since ages. Since humerus does not bear the body weight like bones of the lower extremity, it is under traction forces rather than compressing forces. Non-operative methods include traction by hanging casts, coaptation splints, functional brace, shoulder spica casts, Velcro bracing, abduction humeral bracing and skeletal traction.

Our results are comparable with an international study conducted by Osman et al¹¹. In New Delhi, a study held by VK Sharma et al¹² compared the two methods of conservative treatment of humeral shaft fractures; they showed much more varus angulation as compared to the angulation seen in our study. In our study the results are much more satisfactory because during the application of the coaptation splint, we applied a valgus pressure over the splint in the lower middle part making it banana-shaped splint alongwith frequent regular follow up.

CONCLUSION

Coaptation splinting is an effective, easy and definitive conservative method of treatment for most humeral shaft fractures. Upto 98% union rates have been achieved with this method of treatment; hence preventing non-union which is more common in functional bracing when applied immediately in acute settings.

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