

# Treatment Of Humeral Diaphyseal Fractures In Elderly Using Functional Brace

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## Abstract

**Background:** Conservative treatment for humeral diaphyseal fractures demands great cooperation by the patient in maintaining a suspended position of arm, sleep in Fowlers semi erect position and start active exercises of the limb. Elderly patient are bereft with a number of medical and surgical problems and humeral diaphyseal fractures in them are difficult to treat.

**Material and Methods:** From March 2004 to December 2005, 44 elderly patients aged 50-75 years (Average 58.6 years) who had closed or type 1 open humeral diaphyseal fractures were treated conservatively in the orthopaedic department of Government Medical college university of Kashmir with a follow up of 12 to 18 months (average 15 months). Among 41 patients available for follow up, 28 (68.3%) were female and 13 (31.7%) were male patients. Cause of injury was domestic fall in 31 (76%), road traffic accident in 7 (17%) and direct trauma in 3 (7%) patients. 4 patients had type 1 open fracture. 22 (54%) were right and 19 (46%) were left sided fractures. There were 9-A1, 12-A2, 10-A3, 7-B1, 1-B2 and 2-B3 fractures. There were 13 distal third, 19 middle third and 9 proximal third fractures. Fractures were reduced and stabilized by coaptation splint for 2 weeks when a prefabricated humeral brace was applied with cuff and collar for additional comfort.

**Results:** Results were interpreted in terms of radiological union, clinical outcome (Severity of pain and Range of motion of shoulder and elbow) and functional outcome (system of American Shoulder and Elbow surgeons shoulder score). Radio logically ununited fractures were graded as poor results. 14 (34%) patients who showed union within first 3 months of treatment with no pain, grade 1 ROM and ASES score of greater than 45 were graded as excellent. 9 (21%) patients united between 3 to 4 months with mild pain, grade II ROM and ASES score of 35 to 45 and were graded as good. Union was delayed in 6 (14%) patients with grade III ROM, severe pain and ASES score of <35, were graded as poor result. 12 (29%) patients failed to show the signs of union and were again grade as poor results.

**Conclusion:** Elderly patients with humeral diaphyseal fractures do not cooperate with difficult rehabilitative program of conservative treatment and using functional brace is fraught with poor results. Further research is needed to come out with best modality of treatment for these fractures in this particular age group.

## INTRODUCTION

All of the current modalities have a place in treatment of humeral diaphyseal fractures, but none of the treatments is a panacea and complications may occur with each one of them (AAOS Instructional course lectures trauma Chap.8). Non operative treatment is a rational option for the treatment of isolated humeral shaft fracture with no or minimal displacement<sup>1,13</sup>. Closed treatment results in an excellent clinical outcome for most humeral fractures<sup>3</sup>. When choosing conservative methods, functional bracing should be primarily considered in the treatment of humeral diaphyseal fractures because of low complication but very high success

rates<sup>8</sup>. Antegrade Interlocking intramedullary nailing leads to less blood loss and provides rotational stability, but injury to rotator cuff with shoulder dysfunction and non union remain problematic.<sup>1,7</sup> Operative treatment using dynamic compression plate achieves better anatomical reduction but extensive dissection with more blood loss, risk of infection and iatrogenic radial nerve paralysis are the major disadvantages<sup>4,5</sup>

Most of reported series in literature have tried to evaluate and compare the results of non operative,<sup>8,10,13</sup> and operative treatment (dynamic compression plates<sup>2,6</sup> interlocking nails

5,12 ender nails 4 for humeral diaphyseal fractures. But, no papers have been published to report the results of non operative treatment in a specific age group of elderly patients. Elderly patient are bereft with a number of medical and surgical problems and the goal of treatment remains restoration of patient to his or her preoperative status in earliest possible time with low morbidity and mortality. Humeral diaphyseal fractures in elderly patients are difficult to treat. Fixation of fracture in an osteoporotic bone using compression plate is unreliable. Anesthetic problems further compound the treatment plan in this high risk age group. Conservative treatment needs a great cooperation by the patient in maintaining a suspended position of arm, sleep in Fowlers semi erect position and start active exercises of the limb. Elderly patients may not cooperate with this difficult rehabilitative program and conservative treatment in them may lead to displacement of the fracture, decreased bone density, non union and stiffness of the joints.

**OBJECTIVE**

We evaluated the results of non operative treatment using coaptation splint followed by prefabricated brace in closed humeral diaphyseal fractures in elderly patients.

**METHODS**

From March 2004 to December 2005, 44 elderly patients aged 50-75 years ( Average 58.6 years) who had closed or type 1 open humeral diaphyseal fractures were treated conservatively in the Orthopedic department of Government Medical college university of Kashmir with a follow up of 12 to 18 months (average 15 months). Patients having humeral diaphyseal fractures not suitable for non operative treatment were excluded. 3 patients (2 lost and 1 had fall with fracture femur during follow up) were also excluded. Among remaining 41, 28 ( 68.3%) were female and 13 (31.7%) were male patients. Cause of injury was domestic fall in 31(76%), road traffic accident in 7(17%) and direct trauma in 3(7%) patients.4 patients had type 1 open fracture. 22(54%) were right and 19(46%) were left sided fractures. There were 9-A1, 12-A2, 10-A3, 7-B1, 1-B2 and 2-B3 fractures. There were 13 distal third,19 middle third and 9 proximal third fractures. Fractures were reduced and stabilized by coaptation splint for 2 weeks if post reduction radiographs were acceptable.

**Figure 1**

Figure 1a,b: comminuted fracture, good initial reduction maintained in the splint and finally united fracture with mild various angulation.



**Figure 2**



Prefabricated humeral brace was applied at 2 weeks with cuff and collar for additional comfort. Fig. 2

**Figure 3**

Figure 2: patient in brace doing ROM Exercises.



Flexion-extension of elbow and pendulum exercise of the shoulder was started. Active abduction of the shoulder was avoided till the fracture was clinically stable. Patients were followed weekly for 4 week, every 2 weeks up to 12 weeks and then monthly for 18 months. No patient had radial nerve paralysis prior to or after application of the brace in our series. Results were interpreted in terms of radiological union, clinical outcome ( Severity of pain and Range of motion of shoulder and elbow) and functional outcome ( system of American Shoulder and Elbow surgeons shoulder score). Radio logically ununited fractures were graded as poor results.

**RESULTS**

14 (34%) patients who showed union within 3 months of treatment with no pain, grade 1 ROM and ASES score of greater than 45 were graded as excellent. 9 (21%) patients united between 3 to 4 months with mild pain, grade II ROM and ASES score of 35 to 45 and were graded as good. Union was delayed in 6(15%) patients with grade III ROM, severe pain and ASES score of less than 35 ,were graded as poor result.12(29%) patients failed to show the signs of union and were again grade as poor results.

Among these12 patients, 7 were operated with ante grade intramedullary interlocking nail which

ultimately united. 4 were operated with dynamic compression plate and bone graft,among which one DCP got infected in whom the implant was taken out and IRF was used to achieve union.

One type 1 compound fracture having non union was treated with illizarove ring fixater which failed and the patient was re operated by open reduction with interlocking nail and bone graft.

The patient needed external support and finally united with poor results. Varus angulation exceeded 15 degrees in anteroposterior plane in 2 patients and did not exceed 20 degrees in lateral planes in any patient who united in the brace. Fig. 3 & 4

**Figure 4**

Figure 3: Varus malunion



**Figure 5**

Figure 4: Varus malunion



**DISCUSSION**

No treatment is superior to any other under all circumstances for humeral diaphyseal fracture. Closed treatment of humeral shaft fractures has been recorded since ages and multiple methods advocated with reports of variable success. Closed treatment results in an excellent outcome for most humeral fractures <sup>3</sup>. But late restoration of activity has made this method less popular <sup>4</sup>. Results of operative treatment using dynamic compression plate were comparable with non-operative treatment and the rate of operative and post-operative complications were low. However, osteosynthesis with compression plate is associated with negative features like extensive soft tissue dissection, more blood loss, iatrogenic radial nerve paralysis and infection <sup>10</sup>.

Interlocking intramedullary nail fixation has gained popularity over last several years. Interlocking nail provides secure and rigid fixation with limited exposure with the disadvantages of high incidence of shoulder dysfunction and need of high technical skill and experienced hands <sup>4</sup>.

Sarmiento in 1977 <sup>2</sup> first treated a series of 49 patients having humeral diaphyseal fractures with functional brace and stated that, firm compression of the soft tissues surrounding the fractured bone is applied by the rigid walls of the brace which maintains adequate alignment of the fragments with sufficient stability to permit uninterrupted osteogenesis. He reported union in all the patients except one having metastatic bone disease.

Naver in 1986 <sup>11</sup> stated that functional brace cannot be used when massive soft tissue injury or bone loss has occurred, an acceptable fracture alignment cannot be maintained if the patient unreliable or uncooperative.

JB Zagorski in 1988 <sup>2</sup> treated 170 patients with prefabricated humeral brace and stated that all but three of the patients had excellent or a good functional result with full range of motion of the extremity.

Sarmiento in 2000 <sup>12</sup> reported a series of 620 patients having humeral diaphyseal fractures treated with prefabricated brace. 6% of open and 2% of closed fractures had non union. 87% patients had angulation less than 16% in anteroposterior view and 81% patients healed with less than 16% angulation in lateral view. At the time brace removal, 98% of the patients had limitation of shoulder motion of 25 degrees or less.

Nahum Rosenberg in 2006 <sup>10</sup> concluded that, although the fracture union is achieved usually following functional bracing of humeral shaft fractures, the shoulder function in the injured limb may remain impaired.

In our series, only 44% of patients showed excellent to good results. Compared with other series which reported union in more than 90% of fractures <sup>2,6,8</sup> we had low success rate with humeral brace. Non union was a major complication in 29% patients which is again high as reported by others (0-2.5%). Our observation is in accordance with Nahum Rosenberg <sup>10</sup> that adjacent joint function remains impaired following treatment of humeral diaphyseal brace with brace. We support the statement of Naver et.al. <sup>11</sup> that an acceptable fracture alignment can not be maintained if the patient unreliable or uncooperative.

We feel that compared to series of A.Sarmiento <sup>1</sup> (age=14-75years, Average 38 M:F=28:21), J.B. Zagorski <sup>2</sup> (age=14-90 years, Average-36 years, M:F=98:72) and George W. Balfour (age=11-78 years, only 9 (21%) above 50 years, M:F=28:14), our study included a subgroup of elderly patients (above 50 years, Average age-58.6 years) with females predominating (M:F=13:28).

Functional bracing requires that the patient be able to stand or sit erect which is practically difficult in elderly patients who invariably have poor general health, senility and weak upper limbs. The primary objective of the humeral bracing is

to start early active motion of the adjacent joints and to activate the muscles surrounding the site of fracture. Elderly patients have less muscle mass, poor bone stock, low fracture healing potential and more chances of stiffness of the adjacent joints. All these preexisting problems are accelerated if active exercises of the limb are not initiated at an earliest possible time. It is also difficult for this age group to remain under the constant supervision of a physiotherapist. Poor results were seen more commonly in female than male patients in our series. Among the 13 male patients 4(31%) were graded as poor and among the 28 female patients 14(50%) were poor results. Our study supports the fact that advanced age and postmenopausal osteoporosis has a negative effect on fracture healing.

It is of paramount importance to recognize this specific subgroup of patients presenting with humeral diaphyseal fractures and devise a treatment protocol so as to restore their health to pre injury state in shortest possible time. A treatment modality which will ensure rigid fixation and permit pain free range of motion exercise is desired. We observed that this group of patients cooperated better for range of motion exercise after rigid fixation of the fracture than when their limbs were in humeral brace. Our experience shows that elderly patients do not cooperate with difficult rehabilitative program of conservative treatment for humeral diaphyseal fractures. Conservative treatment using functional brace for humeral diaphyseal fractures in elderly patients is fraught with poor results and further research is needed to come out with best modality of treatment for these fractures in this particular age group.

### CONCLUSION

Elderly patients with humeral diaphyseal fractures do not cooperate with difficult rehabilitative program of conservative treatment and using functional brace is fraught with poor results. Further research is needed to come out with best modality of

treatment for these fractures in this particular age group.

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