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Functional Results after Osteosynthesis of Distal Humeral Fractures with Pre-contoured LCP System

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SUMMARY

Background. Evaluate the functional results and determine the complications after treating distal humerus fractures with an anatomically pre-contoured double plate system.

Material and methods. Twenty-five patients with distal humeral fractures were treated with a pre-contoured double plate system. There were 18 males (72%), 7 females (28%), with an average age of 39.68 years (22-70years). As per the AO classification, there were 4 type A fractures (16%) and 21 type C fractures (84%). In addition to clinical examination, functional results were evaluated using the Mayo elbow performance score (MEPS).

Results. Using the Mayo elbow performance score, the results obtained were graded as excellent or good results in 22 patients (88%), fair in 2 (8%) and poor in 1 (4%) of cases. Average time interval between admission and surgery was 3.8 days (average 1-9 days). All the fractures as well as the olecranon osteotomies united by 10-16 weeks (12.56 weeks). No patient had deep infection, implant failure, non-union of fracture site or olecranon osteotomy site. Superficial wound infection, which occurred in 4 (16%) patients, resolved with oral antibiotics. Transient ulnar nerve palsy developed in 1(4%) case. However, the patient recovered with conservative treatment.

Conclusions. 1. An anatomically pre-shaped distal humerus locking plate system is useful in providing stable fixation of distal humerus fractures, thereby facilitating early postoperative rehabilitation. 2. In contrast to conventional plating, we did not observe any case of secondary fracture displacement, non-union or implant failure even in elderly patients with potentially reduced bone mass. 3. The multiple angular stable point fixation seems to be effective in the application of this system.

Key words: distal humerus, osteosynthesis, angular-stable fixation, functional results

BACKGROUND

Distal humeral fractures comprise about 2% of all fractures and remain among the most challenging fractures to manage [1]. Ever since the description of these fractures, the management of these fractures has passed through various stages, i.e. bag of bones technique, cast or splint immobilization, limited open reduction, K-wire fixation, Ilizarov type external fixation, and primary total elbow arthroplasty [2-8]. However, with respect to anatomic reduction, reconstitution of joint congruity, fixation stability and mobilization, it is generally accepted that internal fixation provides the most favourable outcome for distal humeral fractures [9,10].

The multi-fragmentary nature of these fractures with comminution of the articular surface makes accurate reduction and fixation very difficult. Conventional implants have not been able to completely address the problem of implant failure and substantial stability in small distal osteoporotic fragments [10,11]. The high failure rate in these fractures is due to insufficient area for insertion of many screws in a small sized distal fragment, resulting in poor stability at bone-plate interface [12,13]. Pre-contoured distal humeral Locking Compression Plate (LCP) provide higher stability by permitting multiple screws in small distal fragment, thereby addressing some of the limitations of conventional implants [14-17]. The present prospective study was planned to evaluate the functional results of pre-contoured LCP in distal humeral fractures.

MATERIAL AND METHODS

25 patients with distal humeral fractures were treated in our hospital with pre-contoured LCP. The inclusion criteria were as follows: age of fifteen years or more, mature skeleton, no other associated bony pathology in the ipsilateral limb, Gustilo type I open fractures and consent to undergo the procedure [18]. The exclusion criteria were: Gustilo type 2 or type 3 compound injury or a pathological fracture with infective or metabolic bone diseases. In this prospective study, a posterior approach with chevron–V shaped olecranon osteotomy was used. There were 18 males and 7 females. Their ages ranged between 22-70 years (average 39.68 years). The dominant arm was involved in 13 cases. The mechanism of injury was a fall in 14 patients and a road traffic accident in 11 cases. Associated injuries were seen in only road traffic accident cases. One patient had a shaft fracture of the contralateral humerus and a shaft fracture of the ipsilateral femur. Another patient had a chest and abdominal trauma. As per the classification system of AO/ASIF, 4 fractures were type A3, 4 were type C1, 9 were type C2 and 8 cases were type C3 [19]. Three cases had grade 1 open fractures. Initial closed reduction and splinting in a long posterior arm slab was done in all cases (Tab. 1).

The first step in the osteosynthesis was reduction of the condyles and reconstruction of the joint surface. Medial and lateral condyles were fixed together with a cancellous lag screw. The next step was to

Tab. 1. Demographic data

Case No	Age	Sex	Mode of trauma	Side	Associated injuries	Clinical type	Type of fracture (AO)	Time to surgery (days)
1	32	M	Fall	R	Nil	Comp-I	C2	5
2	35	M	Fall	L	Nil	Closed	C2	2
3	28	M	RTA	L	Nil	Comp-I	C2	2
4	70	M	Fall	R	Nil	Closed	C3	3
5	30	F	Fall	L	Nil	Closed	C3	6
6	50	M	RTA	L	Head Injury	Closed	C3	8
7	35	M	RTA	L	Nil	Closed	A3	2
8	44	M	RTA	R	Head Injury	Closed	C2	6
9	30	M	Fall	R	Nil	Closed	A3	1
10	37	M	RTA	R	Nil	Closed	A3	2
11	22	F	RTA	L	L#SOF/R#SOH	Closed	A3	6
12	36	M	RTA	R	Abd. trauma	Closed	C2	9
13	59	F	Fall	L	Nil	Closed	C3	5
14	43	M	RTA	L	L#SOF	Closed	C2	3
15	38	M	Fall	R	Nil	Closed	C3	1
16	45	F	Fall	R	Nil	Closed	C2	4
17	30	M	Fall	L	Nil	Closed	C1	6
18	29	M	RTA	R	Chest trauma	Closed	C2	3
19	42	F	Fall	L	Nil	Comp-I	C3	2
20	27	M	RTA	R	Nil	Closed	C1	3
21	43	M	Fall	R	Nil	Closed	C1	1
22	51	M	Fall	L	Nil	Closed	C3	5
23	37	F	Fall	R	Nil	Closed	C1	3
24	63	M	Fall	L	Nil	Closed	C3	2
25	38	F	RTA	R	Nil	Closed	C2	5

anatomically reattach the condyles to the humeral shaft. Stable fixation was achieved by using two orthogonal and anatomically pre-contoured locking compression plates, one on either side. At the end of the procedure, the olecranon was reduced and then fixed with two longitudinal 2.0 mm K-wires and an 18-gauge tension band wire. Usually by the 2nd postoperative day, active or active-assisted exercises were started. The Mayo elbow score was used to rate elbow function and for determining the satisfaction level of patients (MEPS) [20]. The arms were assessed clinically with respect to pain relief, instability, range of motion and functional improvement. Radiological assessment was done by anteroposterior and lateral views.

RESULTS

In this study patients were followed up for up to one year. The average time to union was 12.56 weeks (range: 10-16 weeks). 11(44%) patients had >100° while 14(56%) patients had 50-100° ROM at elbow. Good to excellent results were found in 22(88%), fair in 2(8%) and poor in 1(4%) of cases as per Mayo Elbow Performance scoring system (Fig. 1). No patient had deep infection, implant failure, non-union of fracture site or olecranon osteotomy site. Only minor complications occurred in this study. Four patients had superficial wound infection, 1 patient had transient ulnar nerve palsy, 2 had screw back-out (intercondylar cancellous screw) and 2 had metal prominence (olecranon K-wires). Superficial wound infection, which occurred in 4 patients, resolved with oral antibiotics. Loosening of the cancellous intercondylar screw was noticed in 2 patients; however, the fracture in these patients united uneventfully. Transient ulnar nerve palsy developed in 1 of our patients. This patient had an extra articular fracture and recovered with conservative treatment only.

DISCUSSION

Intercondylar fractures of the distal humerus are difficult to treat because of the nature of injury and the fact that most surgeons do not have a great deal of experience with them [21,22]. Most intra-articular fractures of the distal humerus are often displaced, and therefore the successful treatment demands an anatomic reduction, stable fixation and the ability to allow early elbow motion [23,24]. As the elbow joint tolerates immobilization poorly, the functional outcome after surgical treatment is unavoidably worsened by prolonged immobilization. Despite being uncommon, distal humerus fractures pose the greatest challenge in terms of surgical fixation and absolute anatomical reduction. Surgical expertise is of paramount importance. Good functional outcomes are expected with intelligent surgical approach and early rehabilitation. Articular surface restoration and reconstruction of elbow joint is mandatory to restore maximum joint function. This can be safely achieved by stabilization of fracture fragments with plate osteosynthesis based on restoration of joint congruity.

Although various approaches have been used for reduction and fixation of distal humeral fractures, the posterior approach through an olecranon osteotomy is the most widely used [25-28]. This approach provides excellent visualisation, particularly of the distal articular fragments and the plate fixation [28, 29]. In this study, a posterior approach with chevron-V shaped olecranon osteotomy was done in all cases. Non-union of olecranon osteotomies has been reported, independent of patient age, in up to 30% of patients. However, in our study, we did not report any cases of non-union of olecranon osteotomy. The use of cheveron-V osteotomy has decreased the incidence of non-union. Two patients had metal prominence due to olecranon K-wires. All fractures as well as the chevron-V osteotomy united by 10-16 weeks (average 12.56 weeks).

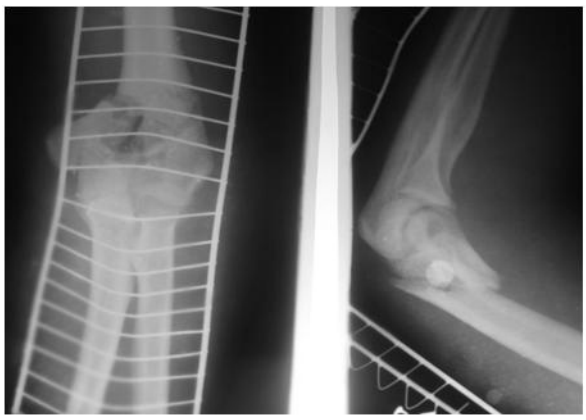

Fig. 1a. Preoperative AP and lateral radiograph (Case 3)

Fig 1b. AP and lateral radiograph at 6 months' follow-up

Incidence of ulnar nerve injury has been reported in 5-15% of patients [30-32]. In this study, 1(4%) patient had ulnar nerve palsy which recovered with conservative treatment.

In all our patients we started active and active assisted range of motion exercises from 2nd postoperative day. 11 (44%) patients had >100° while 14 (56%) patients had 50-100° ROM at the elbow.

The aim of treatment of intercondylar fractures of the distal humerus is a painless elbow which is fully mobile and stable. The operative treatment in expert hands has yielded 75-85% excellent to good results. In the present series, we treated 25 adult patients with distal humeral fractures both articular as well as extra-articular, age ranging from 22-70 years. We obtained 88% of excellent to good results, 8% of fair and 4% of poor results. Similar results have been recently reported with the use of precontoured LCP by other authors [32,33].

The complications encountered in the operative treatment of distal humeral fractures as reported by various authors are: superficial wound infection, deep wound infection, nerve injuries, delayed union, non-union of fractures and osteotomy, heterotopic ossification, stiffness, pain and implant failure. In our study, 4 patients had superficial wound infection, 1 patient had transient ulnar nerve palsy, 2 had screw back-out (intercondylar cancellous screw), 2 had metal prominence (olecranon K-wires), and 3 patients had occasional mild post-operative pain. There was no non-union or delayed union of fracture and osteotomy site.

CONCLUSIONS

1. An anatomically pre-shaped distal humerus locking plate system is useful in providing stable fixation of distal humerus fractures, thereby facilitating early postoperative rehabilitation.
2. In contrast to conventional plating, we did not observe any case of secondary fracture displacement, non-union or implant failure even in elderly patients with potentially reduced bone mass.
3. The multiple angular stable point fixation seems to be effective in the application of this system.

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