

**Assessment Of Outcome of Anatomic Locking Plate in Extraarticular Distal Humeral Shaft Fractures**

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**Received:** 06 October 2022

**Revised:** 20 November 2022

**Accepted:** 05 December 2022

**ABSTRACT**

**Background:** To assess outcome of anatomic locking plate in extraarticular distal humeral shaft fractures.

**Material and Methods:** Eighty- eight extraarticular distal humeral shaft fractures of both genders were included and parameter such as fracture type, time tounion (weeks), University of California Los Angeles (UCLA), Mayo Elbow Performance Score (MEPS), associated injuries and complications were recorded.

**Results:** Out of 88 patients, males were 50 and females were 38. Fracture type was 12- A3 in 8, 12- B1 in 12, 12- B2 in 34, 12- B3 in 16, 12- C2 in 10 and 12- C3 in 8, time tounion was 23.7 weeks, University of California Los Angeles score was 35, Mayo Elbow Performance Score (MEPS) was 94.5, associated injuries were abdominal trauma in 2, open fracture tibia in 1, ipsilateral both bone forearm fracture in 4 and ipsilateral DRUJ injury in 1 case. Complications found were non-union with screw failure in 2, PIN injury in 1, radial nerve palsy in 2 and wound infection in 5 cases. The difference was significant (P< 0.05).

**Conclusion:** Anatomic locking plate is an effective modality in treating extraarticular distal humeral fractures.

**Keywords:** Distal humerus fractures, locking plate, metaphyseal.

**INTRODUCTION**

Distal humerus fractures represent only a small proportion of upper extremity fractures. Until now, they have remained difficult to manage.<sup>1</sup> In elderly patients, some combination of osteoporotic bone conditions, metaphyseal comminution, and poor tolerance for joint immobilization is often present, worsening the situation. During the last few decades, open reduction and internal fixation has become the treatment of choice in adults.<sup>2</sup>

Operative stabilization of these fractures is rational and is favored by many authors. Restoration of alignment and stable fixation is critical to allow early rehabilitation and a good functional outcome.<sup>3</sup> Management of these injuries takes a cue from the treatment options of both humeral shaft, as well as intercondylar fractures. The extraarticular distal humerus plate has been specifically designed to address these complex fractures.<sup>4</sup> It is anatomically pre

contoured to be placed along the central humeral diaphysis proximally and on the lateral supracondylar ridge distally. The increased locking screw density in the lateral column affords a strong fixation of the distal fragment. Intramedullary nailing, as well as plating, with 4.5 mm compression or locking techniques has the limitation of inadequate fixation.<sup>5</sup> Studies have shown that the posterolateral plate is biomechanically superior to the 3.5 mm locking compression plate (LCP) in case of distal humeral diaphyseal osteotomies.<sup>6,7</sup> The present study assessed outcome of anatomic locking plate in extraarticular distal humeral shaft fractures.

**MATERIAL & METHODS**

After considering the utility of the study and obtaining approval from ethical review committee of the institute, we selected eighty- eight extraarticular distal humeral shaft fractures of both genders. All gave their written consent.

Data such as name, age, gender etc. was recorded. All patients underwent radiological examination such as PA view, lateral view and CT scan of humerus bone. All were managed with locking plate. Parameter such as fracture type, time to union (weeks), University of California Los Angeles (UCLA), Mayo Elbow Performance Score (MEPS), associated injuries and complications were recorded. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

**RESULTS**

**Table I Patients distribution**

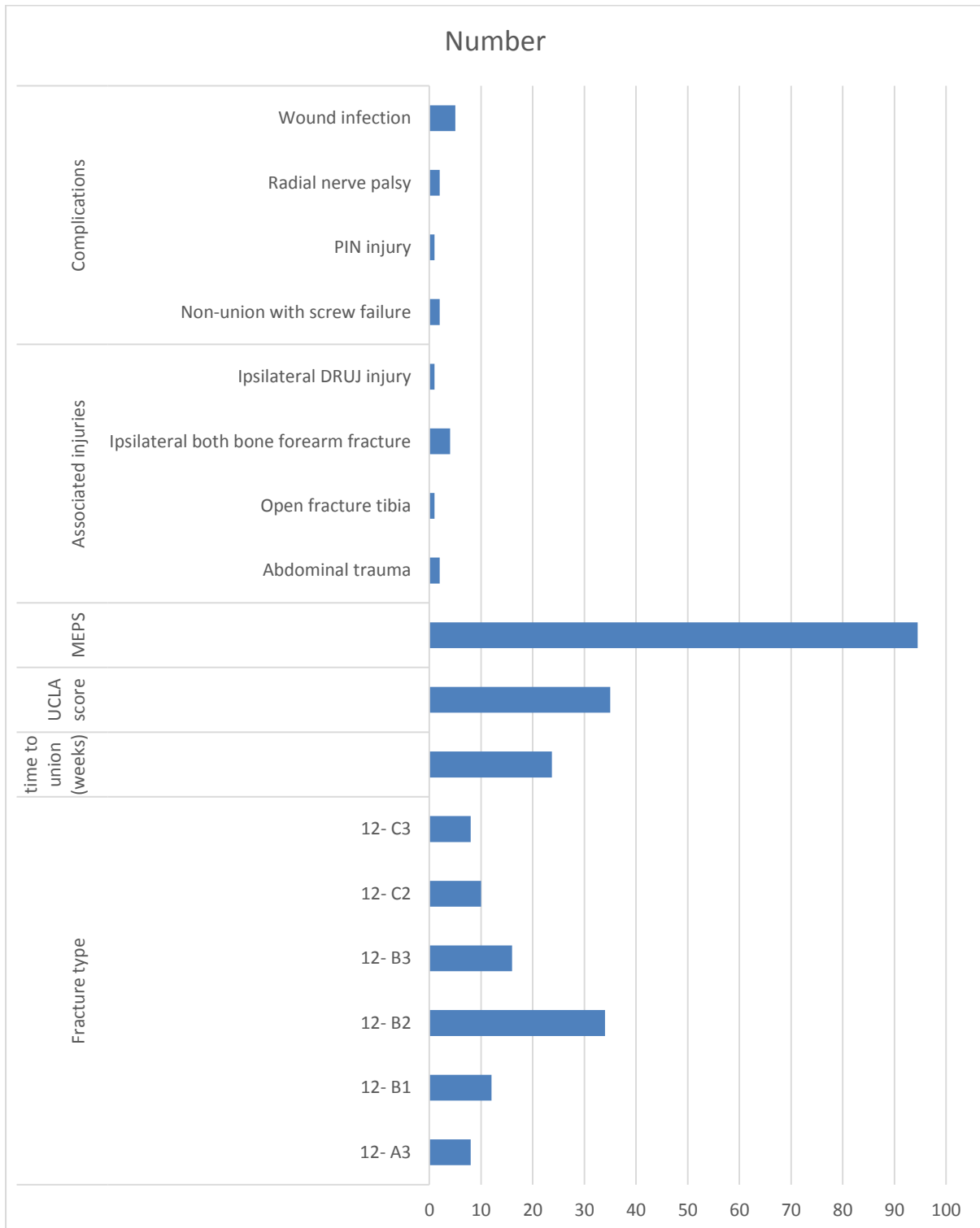
<b>Total- 88</b>		
<b>Gender</b>	<b>Male</b>	<b>Female</b>
Number	50	38

Out of 88 patients, males were 50 and females were 38 (Table I).

**Table II Assessment of parameters**

<b>Parameters</b>	<b>Variables</b>	<b>Number</b>	<b>P value</b>
Fracture type	12- A3	8	0.02
	12- B1	12	
	12- B2	34	
	12- B3	16	
	12- C2	10	
	12- C3	8	
time to union (weeks)		23.7	-
UCLA score		35	-
MEPS		94.5	
Associated injuries	Abdominal trauma	2	0.09
	Open fracture tibia	1	
	Ipsilateral both bone forearm fracture	4	
	Ipsilateral DRUJ injury	1	
Complications	Non-union with screw failure	2	0.05
	PIN injury	1	
	Radial nerve palsy	2	
	Wound infection	5	

Fracture type was 12- A3 in 8, 12- B1 in 12, 12- B2 in 34, 12- B3 in 16, 12- C2 in 10 and 12- C3 in 8, time to union was 23.7 weeks, University of California Los Angeles score was 35, Mayo Elbow Performance Score (MEPS) was 94.5, associated injuries were abdominal trauma in 2, open fracture tibia in 1, ipsilateral both bone forearm fracture in 4 and ipsilateral DRUJ injury in 1 case. Complications found were non-union with screw failure in 2, PIN injury in 1, radial nerve palsy in 2 and wound infection in 5 cases. The difference was significant ( $P < 0.05$ ) (Table II, graph I).



Graph I Assessment of parameters

**DISCUSSION**

Extraarticular fractures of distal humerus occur at an anatomical watershed between the humerus shaft and the intercondylar region.<sup>8</sup> These injuries are often displaced and have complex fracture pattern with associated comminution.<sup>9</sup> Functional bracing, though advocated, may not provide adequate stability and acceptable alignment due to the distal extent of these fractures.<sup>10,11</sup> The present study assessed outcome of anatomic locking plate in extraarticular distal humeral shaft fractures.

We found that out of 88 patients, males were 50 and females were 38. Jain et al<sup>12</sup> found that there were 21 males and 5 females with mean age of 37.3 years (range 18–72 years). Twenty-two (84.6%) cases had complex fracture patterns (AO/OTA Type 12-B and C). The mean time to fracture union was 22.4 weeks. The mean follow-up time was 11.6 months, (range 4–24 months). Four patients (15.4%) had failure of cortical screws in the proximal fracture fragment, of which two required revision fixation with bone grafting. Another non-union was seen following a surgical site infection, which healed after wound lavage and bone grafting. The MEPS (average: 96.1; range 80–100) was excellent in 81% cases (n = 21) and good in 19% cases (n = 5). UCLA score (average: 33.5; range 25–35) was good/excellent in 88.5% cases (n = 23) and fair in 11.5% cases (n = 3).

We observed that fracture type was 12- A3 in 8, 12- B1 in 12, 12- B2 in 34, 12- B3 in 16, 12- C2 in 10 and 12- C3 in 8, time to union was 23.7 weeks, University of California Los Angeles score was 35, Mayo Elbow Performance Score (MEPS) was 94.5, associated injuries were abdominal trauma in 2, open fracture tibia in 1, ipsilateral both bone forearm fracture in 4 and ipsilateral DRUJ injury in 1 case. Complications found were non-union with screw failure in 2, PIN injury in 1, radial nerve palsy in 2 and wound infection in 5 cases. Fawi et al<sup>13</sup> aimed to describe experience of using the Synthes™ 3.5-mm extra-articular distal humeral locking compression plate for treatment of extra-articular distal humeral fractures in 23 consecutive patients who underwent fixation. Of the 23 patients (12 males, 11 females; mean age 47.5 years; range 18 years to 89 years), all fractures united radiologically and clinically after the index procedure, with a mean time to fracture union of 15.7 weeks (range 9 weeks to 34 weeks) and a mean time to discharge of 17.8 weeks (range 13 weeks to 34 weeks). Oxford Elbow Score was 36.5 (range 11 to 48) at 4.6 months postoperatively; at 20 months follow-up, it was 40 (range 14 to 48) and the VAS was 8.5 (range 5 to 10). One patient had radial nerve neuropraxia pre-operatively, and one postoperatively, and both recovered uneventfully 3 months postoperatively. Neither superficial, nor deep infections were observed in this cohort.

Prasarn et al<sup>14</sup> used the EADHP in a dual plate construct with 3.5 mm reconstruction plate and reported excellent union rate without significant complications. Yang et al<sup>15</sup> in their study 9 cases of adult extra-articular distal humeral diaphyseal fractures were surgically treated using an MLCP and lag screws. All patients were followed for a mean time of 16.6 months. The incidence of iatrogenic radial nerve palsy was 5%. There was no failure of internal fixation and no infection. After 1 year, the University of California at Los Angeles scoring system rated 12 (63.2%) patients as excellent results. The Mayo elbow performance scoring system rated 10 (84%) cases as excellent results. Completely normal alignment was presented in 16 cases.

**CONCLUSION**

Anatomic locking plate is an effective modality in treating extraarticular distal humeral fractures.

**REFERENCES**

1. Moloney GB, Pan T, Van Eck CF, Patel D, Tarkin I. Geriatric distal femur fracture: Are we underestimating the rate of local and systemic complications? *Injury* 2016;47:1732-6.
2. Hoffmann MF, Jones CB, Sietsema DL, Tornetta P 3rd, Koenig SJ. Clinical outcomes of locked plating of distal femoral fractures in a retrospective cohort. *J OrthopSurg Res* 2013;8:43.
3. Kregor PJ, Stannard JA, Zlowodzki M, Cole PA. Treatment of distal femur fractures using the less invasive stabilization system: Surgical experience and early clinical results in 103 fractures. *J Orthop Trauma* 2004;18:509-20.
4. Ahmad M, Nanda R, Bajwa AS, Candal-Couto J. Biomechanical testing of locking compression plate: When does the distance between bone and implant significantly reduce construct stability. *Injury,Int.J.Care Injured* . 2007;38:358-64.
5. Schütz M, Müller M, Regazzoni P, Höntzsch D, Krettek C, Van der Werken C, et al. Use of the less invasive stabilization system (LISS) in patients with distal femoral (AO33) fractures: A prospective multicenter study. *Arch Orthop Trauma Surg*2005;125:102-8.
6. Pehlivan O. Functional treatment of the distal third humeral shaft fractures. *Arch Orthop Trauma Surg*2002;122:390-5.
7. Moran MC. Modified lateral approach to the distal humerus for internal fixation. *Clin OrthopRelat Res* 1997;340:190-7.
8. Sharaby M, Elhawary A. A simple technique for double plating of extraarticular distal humeral shaft fractures. *Acta OrthopBelg*2012;78:708-13.
9. Scolaro JA, Voleti P, Makani A, Namdari S, Mirza A, Mehta S. Surgical fixation of extra-articular distal humerus fractures with a posterolateral plate through a triceps-reflecting technique. *J Shoulder Elbow Surg*2014;23:251-7.
10. Capo JT, Debkowska MP, Liporace F, Beutel BG, Melamed E. Outcomes of distal humerus diaphyseal injuries fixed with a single-column anatomic plate. *Int Orthop*2014;38:1037-43.
11. Gosler MW, Testroote M, Morrenhof JW, Janzing HM. Surgical versus non-surgical interventions for treating humeral shaft fractures in adults. *Cochrane Database Syst Rev*. 2012;18:1:CD008832.
12. Jain D, Goyal GS, Garg R, Mahindra P, Yamin M, Selhi HS. Outcome of anatomic locking plate in extraarticular distal humeral shaft fractures. *Indian J Orthop*2017;51:86-92.
13. Fawi H, Lewis J, Rao P, Parfitt D, Mohanty K, Ghandour A. Distal third humeri fractures treated using the Synthes™ 3.5-mm extra-articular distal humeral locking compression plate: Clinical, radiographic and patient outcome scores. *Shoulder Elbow* 2015;7:104-9.
14. Prasarn ML, Ahn J, Paul O, Morris EM, Kalandiak SP, Helfet DL, et al. Dual plating for fractures of the distal third of the humeral shaft. *J Orthop Trauma* 2011;25:57-63.
15. Yang Q, Wang F, Wang Q, Gao W, Huang J, Wu X, et al. Surgical treatment of adult extra-articular distal humeral diaphyseal fractures using an oblique metaphyseal locking compression plate via a posterior approach. *Med PrincPract*2012;21:40-5.