Comparing Single Column vs Dual Column Fixation in the Surgical Management of Extra-articular Distal Humerus Fractures

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INTRODUCTION

- There has been a trend in operative fixation of extra-articular distal humerus fractures (EADHFs)
 - rigid fixation
 - predictable alignment & union
 - early rehab
 - optimal shoulder & elbow function
 - avoids pitfalls of non-op management
 - nonunion, deformity, pain,
 - skin problems from brace
- Multiple surgical issues:
 - small distal fragment
 - variable meta-diaphyseal extension
 - medial comminution
- Current literature has significant variability
 - fracture type inclusion criteria
 - surgical approach
 - fixation constructs:
 - single vs dual column
 - single vs dual plate

HYPOTHESIS

- Using an algorithmic approach to EADHFs:
 - Lateral paratricipital (LPT) approach could be employed in all EADHFs with single column fixation
 - Dual plate fixation would only be necessary in complex fracture patterns

METHODOLOGY

- AO/OTA 12(A/B/C) & 13-A2/A3 fractures treated operatively at a single institution between January 1, 2010 and December 31, 2018
- Exclusion criteria:
 - AO/OTA 11-A/B/C
 - AO/OTA 12 fractures requiring fixation into the humeral head and/or anterior approach
 - AO/OTA 13-A1 (med/lat epicondyle)
 - pathologic fractures
 - pre-existing neurological conditions
 - ipsilateral upper extremity injuries that would impact neurological status of the extremity
 - inability to determine pre-operative neurological status

METHODOLOGY

- Patients were stratified into two groups:

	GROUP A	GROUP B
	Retrospective multi-surgeon (Jan 2010 - Dec 2018)	Prospective single surgeon (May 2015-Dec 2018)
Demographics	27 patients; avg age 37.1 +/- 14.9; F:M = 10:18	20 patients; avg age 29.4 +/- 12.3; F:M = 7:13
Surgical approach	Surgeon discretion: olecranon osteotomy, triceps split, paratricipital (med + lat; lat only)	Lateral paratricipital only
Lat IM septum release	No	Yes
Fixation strategy: column	Surgeon discretion: Single or dual column	Single column only
Fixation strategy: plate	Surgeon discretion: Single or dual plate	Dual plate ONLY if medial column unable to be anatomically reduced

- Outcome measures: surgical approach employed, fixation strategy used, union, implant failure

Figure 1: Group B single column single plate fixation for AO/OTA 13-A3 fracture

Medial column reduced anatomically despite lateral comminution

Figure 2: Group B single column dual plate fixation for AO/OTA 12-C3 fracture

Medial column could not be reduced anatomically due to comminution

RESULTS

- Group A utilized multiple different approaches more dual plate fixation:

Table 1: Approaches and Number of Plates by Group

Group	Approach	Total	Single Plate	Dual Plate
A	Olecranon osteotomy	4	0	4
	Triceps split	7	0	4
	Med + Lat paratricipital	7	1	6
	Lat paratricipital	9	6	3
	TOTAL	27	9	18
B	Lat paratricipital	20	14	6

RESULTS

- Dual plate fixation was generally used in more complex fracture patterns in both groups: 12-B3/C3, 13-A3 (Table 2, green highlight)
- Group A dual plate fixation were mostly dual column:
 - posterior/PL + medial
- Group B dual plate fixation were all single column: PL + lateral
- Group B was able to utilize single column fixation for all fracture types
 - single column, single plate fixation was used more often in fracture types where group B utilized dual column, dual plate fixation
 - 12-B1, 13-A2 (Table 2, yellow highlight)

Table 2: Approaches and Plate Fixation Strategies by Group

AO/OTA Classification	Group A				Group B	
	Patients	LPT only	Medial exposure	Fixation strategy	Patients	Fixation strategy
12-A1	1	1/1		Single column, Dual plate		
12-A2						
12-A3	1	1/1		Single column, Dual plate	2	Single column, Single plate
12-B1	1	1/1		Dual column, Dual plate	3	Single column, Single plate
12-B2					2	Single column, Single plate
12-B3	8	2/8	6/8	4/6 Dual column, Dual plate	4	1/4 Single column, Dual plate
12-C1	1	1/1		Single column, Single plate		
12-C2						
12-C3	2	0/2	2/2	1/2 Dual column, Dual plate	3	2/3 Single column, Dual plate
13-A2	6	3/6	3/6	3/6 Dual column, Dual plate	1	Single column, Single plate
13-A3	7	0/8	8/8	7/8 Dual column, Dual plate	5	3/5 Single column, Dual plate

- Group A and Group B single plate fixation were single column:
 - posterior / posterolateral (PL)

- There were no nonunions or malunions in either group
- There were no implant failures in either group

CONCLUSIONS

- For distal AO/OTA 12 and 13-A2/3 fractures:
- There is a lack of consensus regarding surgical approach & fixation

- Employing a standardized strategy can help optimize outcomes

- Single column, single plate fixation can be employed in EADHFs as a neutralization construct with excellent union and no implant failures

- Single column, dual plate fixation can be used in comminuted EADHFs as a bridging construct where dual column, dual plate fixation has been traditionally advocated

- Future research potential with single column, dual plate fixation