Surgical Plate Fixation Failure after Proximal Humerus Fracture is Associated with Lower Deltoid Tuberosity Index

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INTRODUCTION:

Nearly 6% of all fractures and 10% of all fractures in patients over the age of 65 are proximal humerus fractures, making it the third most common fracture type in adults. While optimal treatment is still up for debate, surgical intervention is offered in patients who have significant displacement. The deltoid tuberosity index (DTI) has been proposed as a predictive tool for reduction failure after surgical fixation of proximal humerus fractures.

METHODS:

A retrospective analysis was performed using the SlicerDicer functionality in Epic at a county and a private hospital database to search for patient records from January 2016 to December 2023 who were over the age of 18 and underwent open reduction and internal fixation (ORIF) of a proximal humerus fracture. Records excluded any patients who had history of cancer, a gunshot wound to the humerus, less than three months of follow-up, and fractures initially managed non-operatively (greater than four weeks between injury and operation). Records included patients who underwent surgical fixation with locking plate and screws and with available preoperative imaging involving the deltoid tuberosity. Plate Failures were defined as any patient that had a diagnosis of plate failure in a post-operative visit note due to nonunion, plate failure, or screw cut out. DTI was obtained according to Spross, et. al., utilizing an AP radiograph of the shoulder with internal rotation. It was calculated by dividing the outer cortical by the inner endosteal diameter at the location directly proximal to the deltoid tuberosity where the outer cortical borders become parallel. Further patient information including pre-operative risk factors and demographic data was also obtained. The DTI measurements and demographic data was then analyzed and compared between patients who experienced failure and those who did not. To analyze the DTI measurements between plate failure and plate non-failure groups, we utilized SPSS software to conduct a two tailed independent samples t-test for equality of means.

RESULTS:

There were 101 patients with proximal humerus fractures who fit our inclusion criteria. There were 16 plate failures postoperatively and 85 plate non-failures (successful operations). An independent-samples t-test was run to determine if there were differences in the DTI between the failure and non-failure group. There was a statistically significant difference in the DTI between the two cohorts, with plate failures (1.477 ± 0.144) having a smaller DTI than plate non-failures (1.603 ± 0.176), 95% CI [0.033, 0.219], p = 0.008.

DISCUSSION AND CONCLUSION:

In our patient population, failure after surgical plate fixation of proximal humerus fracture was associated with lower DTI measurements. This measurement can be used to help risk stratify patients who may be high-risk for hardware failure after surgical fixation and shift clinical decision making towards another treatment option, such as reverse total shoulder arthroplasty.

Group Statistics

	Plate Failure	N	Mean	Std. Deviation	Std. Error Mean
DTI	No	85	1.6034	.17617	.01911
	Yes	16	1.4773	.14476	.03619

Independent Samples t-test for Equality of Means with Equal Variances

	t	df	Significance Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
DTI	2.68	99	0.008	0.126	0.047	0.033	0.219