Midshaft Clavicle Fractures: A Meta-Analysis Comparing Surgical Fixation via Anteroinferior Plating versus Superior Plating

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Purpose: Midshaft clavicle fractures are common injuries. There has been a recent trend to treat acute midshaft clavicle fractures surgically. Open reduction and internal fixation with superior or anteroinferior plate application are common surgical approaches. Anteroinferior plate fixation may be desirable to superior fixation due to less prominence of the plate and fewer subsequent procedures to remove the hardware. However, few studies directly compare postsurgical functional outcomes for these two techniques. The purpose of this study was to compare the outcomes of clavicle fracture fixation using anteroinferior versus superior plate placement.

Methods: We performed a meta-analysis of studies that have reported on outcomes following superior or anteroinferior plate fixation for acute midshaft clavicle fractures (OTA 15-B). A computerized literature search in the PubMed, Scopus, and Cochrane Library databases was utilized to identify relevant articles. Only full text articles without language restrictions were evaluated. The inclusion criteria consisted of: (1) fracture of the midshaft clavicle, (2) surgery for acute fractures (within 1 month of the fracture), (3) adult patients (16 years of age and older), and (4) open reduction and internal fixation with plate application in either the anteroinferior or superior position. Studies were excluded if they did not specify plate location, evaluated patients suffering multitrauma, evaluated minimally invasive procedures, or studied operations for revision, nonunion, malunion, or infection. The primary measured outcomes were symptomatic hardware (hardware prominence or irritation) and surgery to remove symptomatic hardware. The secondary outcomes were time to union, fracture union, nonunion, malunion, DASH (Disabilities of the Arm, Shoulder and Hand) score, Constant score, and implant failure. Frequencies and proportions of cases were recorded for binary outcomes, while means and standard deviations were recorded for continuous outcomes. Other summary statistics provided were used to impute means and standard deviations under the assumption of normality when these were not reported. Continuous outcomes were compared between groups using linear mixed effects models, while binary outcomes were compared using mixed effects logistic regression models, including fixed group effects and random study effects. P values less than 0.05 were considered statistically significant. All analyses were performed using SAS v. 9.4).

Results: A total of 1428 articles were identified among the three databases, of which 897 remained after removing duplicates. From that pool, 57 relevant studies were evaluated. Articles were excluded due to an inability to specify plate location (6), a subject pool not exclusively consisting of acute fractures (4) or midshaft fractures (2), a minimally invasive surgical approach (6), use of nonstandard plates (1), poor reporting of functional outcomes (2), and a duplicate group of patients (2). This left 34 articles to be used in our meta-analysis. Of these, 8 studies belonged to the anteroinferior group (N = 390) and 27 studies to the superior group (N = 1104). No significant differences were found with respect to the functional shoulder scores (DASH and Constant) between the two groups. There was no significant

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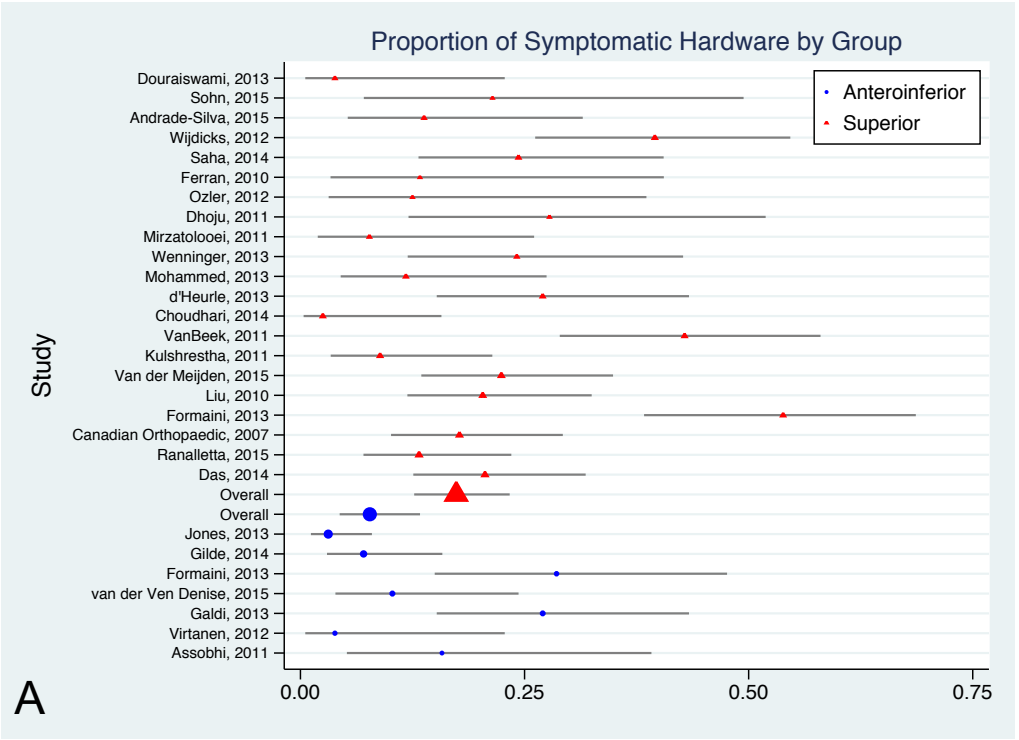
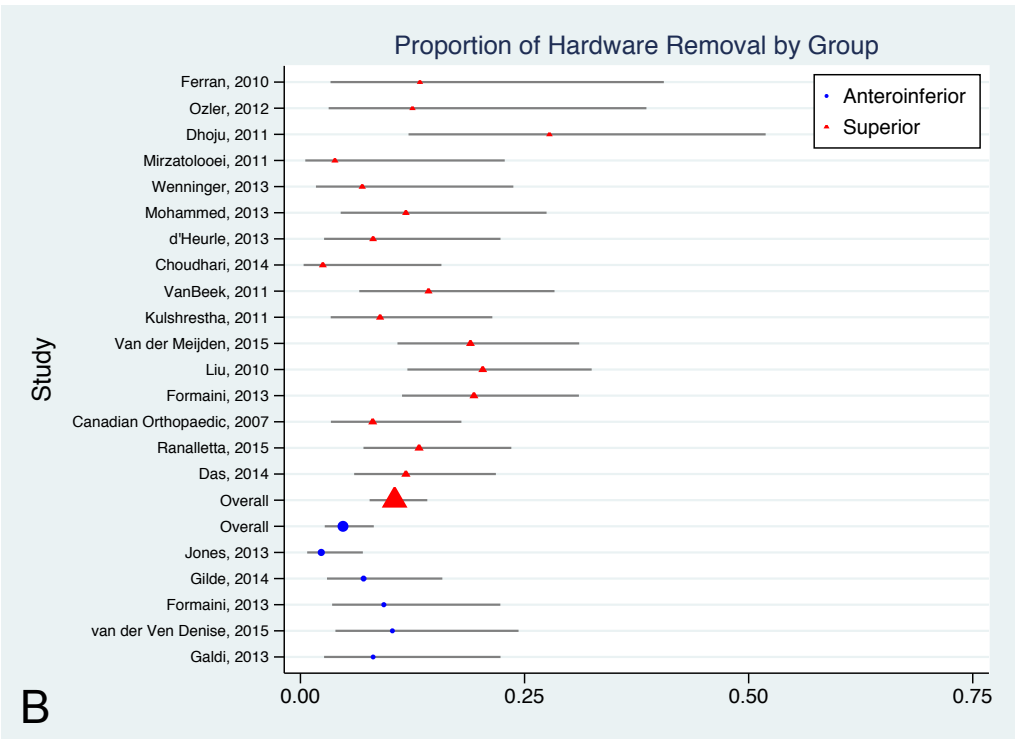
difference between each group for the probability of having a union (P = 0.41), a malunion (P = 0.28), a nonunion (0.29), and implant failure (0.39). The superior plating group had a much higher probability of suffering from symptomatic hardware (0.17) as compared to the anteroinferior group (0.08) (Fig. 1A, P = 0.005). Additionally, the superior group had a significantly higher rate of surgery for hardware removal (0.11 vs 0.05) (Fig. 1B, P = 0.008).

Conclusion: The findings of this study demonstrate that plating along the superior and anteroinferior aspects of the clavicle lead to similar operative outcomes such as union, nonunion, and malunion, as well as similar functional outcomes scores. Plates applied to the superior aspect of the clavicle are associated with higher rates of symptomatic hardware and more frequent hardware removal.





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