

## Surgical Fixation of Nonunion of Clavicle Fractures Is Associated with Higher Rates of Short-Term Complications Compared to Primary Fixation

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**Purpose:** When selecting patients for primary surgical fixation of midshaft clavicle fractures (OTA / AO 15.2) physicians must weigh the risks of surgery against the risk of nonunion following nonoperative management. Relatively little is known about the perioperative complication rates of primary surgical fixation and even less is known of those rates after surgical fixation for nonunion. The purpose of the current study was to establish the perioperative complication rates of surgical fixation for nonunion of midshaft clavicle fractures and contrast them to a comparative cohort of acute clavicle fractures.

**Methods:** The American College of Surgeons National Surgical Quality Improvement Program (ASC NSQIP) database was queried in order to identify patients who had undergone open reduction and internal fixation of midshaft clavicle fractures between 2007 and 2013. Patients were stratified by operative indication: acute fracture or nonunion. Patient characteristics and 30-day complication rates were compared between the two groups using univariate and multivariate analyses.

**Results:** A total of 1215 patients who underwent surgical management of a midshaft clavicle fracture were included in our analysis. Of these, 1006 (82.8%) were acute fractures and 209 (17.2%) were nonunions. Patients undergoing surgical fixation for nonunion had a higher rate of total complications compared to those with an acute fracture (5.3% vs 2.3%;  $P = 0.035$ ). After correcting for age, sex, body mass index, smoking status, diabetes, and other comorbidities, patients with a nonunion were over twice as likely to experience any complication (odds ratio [OR] 2.29; 95% CI, 1.05 to 5.00;  $P = 0.037$ ) and over three times as likely to experience a wound complication (OR 3.22; 95% CI, 1.02 to 10.20;  $P = 0.046$ ) compared to acute fractures.

| Multivariate Analysis of Postoperative Complications by Operative Indication*                            |                     |         |
|--|---------------------|---------|
|  | Odds Ratio (95% CI) | P Value |
| <b>Total complications</b>   |                     |         |
| Acute Fracture   | Ref.                |         |
| Nonunion   | 2.29 (1.05-5.00)    | 0.037   |
| <b>Wound complication</b>  |                     |         |
| Acute Fracture   | Ref.                |         |
| Nonunion   | 3.22 (1.02-10.20)   | 0.046   |
| <b>Reoperation</b>   |                     |         |
| Acute Fracture   | Ref.                |         |
| Nonunion   | 0.84 (0.21-3.25)    | 0.797   |
| *Variables with $P < .20$ on univariate analyses were included in each respective multivariate analysis. |                     |         |

**Conclusion:** Patients undergoing surgical fixation for a midshaft clavicle nonunion are at an increased risk of 30-day total complications and wound complications compared to pa-

tients undergoing primary surgical fixation. This provides additional evidence supporting primary surgical fixation in patients with a high likelihood of nonunion, as it may obviate the risk of surgical complications.

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.