

## **Patient Reported Pain Following Successful Nonunion Surgery: Can We Completely Eliminate It?**

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**Purpose:** Many patients undergo surgical revision for fracture nonunion in order to regain their pre-injury functional status and to relieve themselves of continued pain. However, there is little evidence that reveals if patients are truly relieved of painful symptoms in the long-term. The purpose of this study was to investigate which types of patients experience continual long-term pain following surgical revision for fracture nonunion.

**Methods:** Three hundred and twenty-eight patients surgically treated for fracture nonunion were prospectively followed at one institution. Demographics, radiographic evaluations, VAS pain scores, and Short Musculoskeletal Functional Assessment (SMFA) scores were collected at routine intervals. Only patients who had a minimum of one-year follow-up and complete healing were included this analysis. The average follow-up interval was 25 months. Patients were assigned to either a high-pain or low pain cohort. The high-pain cohort was defined as any patient who had a long-term pain score of 4 or higher. Based on the VAS pain scale, a score of 4 can interfere with tasks, so this cut-off was deemed reasonable. Univariate analysis was performed using Student's t-test for normally distributed continuous variables and Mann Whitney U test for non-normally distributed continuous variables. Pearson's chi-squared analysis was used for categorical variables.

**Results:** Two hundred and forty-five patients were included in this analysis, with 149 patients in the low-pain cohort and 96 patients in the high-pain cohort. Thirty-two (35.6%) patients in the high-pain cohort experienced a net increase of pain, compared to only 8 (5.7%) patients in the low-pain cohort ( $p < .0005$ ). The mean long-term pain score for the low-pain cohort was 0.83 and was 5.77 for the high-pain cohort. Within the high-pain cohort, 32 (33.3%) patients experienced continuous pain and 64 (66.7%) experienced intermittent pain, while in the low-pain group 88 (59.1%) experienced no pain, 5 (3.4%) experienced continuous pain, and 56 (37.6%) experienced intermittent pain. There were no significant differences between the groups in terms of Charlson Comorbidity Index (CCI), age at injury, age at nonunion surgery, time to nonunion surgery, gender, life activity status, education level, presence of additional injuries, or energy of initial injury. The mean baseline (preoperative) pain score was  $4.80 \pm 2.60$  for the low-pain group and  $5.91 \pm 2.41$  for the high-pain group ( $p = .001$ ), yet the baseline quality of pain was not significantly different between the groups ( $p = .229$ ). There was small correlation between baseline pain and long-term pain ( $r = .214$ ), suggesting that there are other factors that contribute to long-term pain. Lower extremity nonunion ( $p = .018$ ), current smoker ( $p = .004$ ), lower income level ( $p = .007$ ), and worker's compensation case ( $p = .004$ ) were found to be significantly more prevalent in the high-pain cohort.

**Conclusions:** Patients with lower extremity nonunions, higher baseline pain scores, history of smoking, lower income and worker's compensation case are at a higher risk of reporting significant and potentially debilitating long-term pain following nonunion surgery. While

patients may expect complete relieve of pain, orthopaedic surgeons must inform patients of the possibility of experiencing pain 1 year or more post-operatively. Additionally, other factors not accounted for in this study such as neuropathic pain may be need to further investigated prior to nonunion surgery to accurately counsel patients about their expected postoperative pain relief.