

Surgeon Perception of Fracture Healing and Nonunion Risk: A Scenario-Based Experiment from the Science of Variation Group

Authors:

Faheem Pottayil¹, Nadia Azib², Amin Razi², Science of Variation Group, David Ring²

¹Augusta University, Augusta, GA, USA

²The University of Texas at Austin, Austin, TX, USA

Email of Presenting Author: fpottayil@augusta.edu

Disclosures: Faheem Pottayil (N), Nadia Azib (N), Amin Razi (N), Science of Variation Group (N), David Ring (N)

Introduction:

Radiographic assessment of fracture healing can be subjective, and thresholds for diagnosing nonunion vary among surgeons. This study evaluated how patient, symptom, and radiograph-related factors influence surgeons' perceived likelihood of nonunion in operatively and non-operatively treated upper-extremity fractures.

Methods:

A cross-sectional, randomized, scenario-based experiment was conducted through the Science of Variation Group (SOVG). Orthopedic surgeons completed online vignettes depicting operatively and non-operatively treated upper-extremity fractures. Radiographs were selected to show incomplete but progressing healing despite confirmed union. Randomized variables included treatment type, time since injury or surgery (3, 6, or 9 months), symptom intensity (intense pain, moderate discomfort, near-complete recovery), and patient age and gender. Surgeons rated the probability of nonunion on a scale from 0 (no chance) to 100 (absolute certainty). Mixed-effects linear regression models with random intercepts for surgeon assessed associations between respective vignette elements and nonunion ratings.

Results:

114 respondents completed operative and 171 non-operative surveys. The respondents were predominantly male (operative 95%, non-operative 93%), primarily based in the United States (54% and 53%) and Europe (27% and 26%), and most supervised trainees (76% and 77%). Compared with 3-month postoperative vignettes, 9-month cases were rated more likely to depict nonunion ($p = 0.022$), while 6-month cases showed no difference ($p = 0.26$). Moderate discomfort ($p = 0.001$) and near complete recovery ($p < 0.001$) were associated with lower nonunion ratings compared to intense pain. Radiographic scenarios showing persistent fracture lines or plate separation increased nonunion likelihood ($p < 0.01$). Age and gender of the patients in the scenario were not significant.

Discussion:

Surgeons' judgments of union were driven mainly by symptom intensity and radiographic appearance, not patient demographics. A longer time since injury modestly increased perceived nonunion likelihood, suggesting a temporal implication in clinical interpretation. This study indicates the possibility of a need for an objective and standardized radiographic and clinical definition for union.

Significance/Clinical Relevance:

Surgeons' perception of nonunion is shaped by both radiographic and symptom cues. Standardized definitions of union may reduce variability in judgment and improve communication in clinical and research settings.