

Humeral Diaphyseal Non-union Occurs More Commonly with Elevated Body Mass Index and Simple Fracture Types

Canadian Orthopaedic Trauma Society; *Prism Schneider, MD, PhD; Mary Amedeo, BS; Stephanie Yee, BS; Kimberly Rondeau, BS, MSc; Rudolf Reindl, MD, FRCSC; Gregory Berry, MD*
University of Calgary, Calgary, Alberta, CANADA

Purpose: Nonunion remains a common complication following humeral diaphyseal fractures, with reports of 4% nonunion rates for surgically treated fractures and up to 22% for nonoperative treatment. Prior risk factors from small studies or retrospective reviews have suggested advanced age, current smoking status, obesity, and unstable fracture pattern as possible risk factors for nonunion. This study aimed to systematically evaluate risk factors for humeral diaphyseal nonunion.

Methods: This is a prespecified secondary analysis from a large randomized controlled trial (RCT) comparing open reduction and internal fixation (ORIF) with nonoperative treatment (functional bracing) of humeral diaphyseal fractures. Eligible patients were followed clinically and radiographically for 1 year post-injury. Nonunion was defined as lack of radiographic progression of fracture healing on orthogonal radiographs combined with failure to improve clinically. *t* tests and χ^2 were used to compare those with and without nonunion, and logistic regression was used to evaluate potential risk factors for nonunion.

Results: A total of 168 patients were enrolled ($n = 84$ per treatment group), with an 85% 1-year follow-up rate. There were 13 patients diagnosed with nonunion, with 12 (92.3%) being in the nonoperative treatment group. There was no difference in age between those who went on to nonunion (46.7 ± 16.2 years) and those who healed without complication (43.3 ± 17.0 years; $P = 0.62$). Sex distribution between those with (53.8% female) and without nonunion (37.4%) was similar ($P = 0.48$). All nonunions occurred in simple AO/OTA A-type fractures (A1 = 38.5%, A2 = 23.1%, and A3 = 38.5%). Regression analysis identified elevated body mass index (BMI; odds ratio [OR] = 1.12; 95% confidence interval [CI] = 1.02 to 1.25; $P = 0.027$) as a risk factor for nonunion. There were 32 current smokers, with 3 patients experiencing nonunions (9.4%; $P = 0.16$). Surgical intervention for nonunion management in those initially treated nonoperatively occurred at 18.3 (± 10.5) weeks.

Conclusion: Inferior outcomes have been reported for nonoperatively treated humeral fractures requiring subsequent surgical treatment; therefore, early identification of risk factors for nonunion is important in guiding decision-making. This large RCT confirms that elevated BMI is a risk factor for nonunion, that all nonunions in this cohort occurred in simple transverse, short oblique, or spiral fracture patterns, and that nonoperative treatment carries a minimum 15% risk for nonunion.