

Functional and Clinical Outcome After Operative Versus Nonoperative Treatment of a Humeral Shaft Fracture (HUMMER): Results of a Multicenter Prospective Cohort Study

Dennis Den hartog, MD; Saskia Heleen Van Bergen, MSc; Kiran Mahabier, PhD; Michael Verhofstad, MD, PhD; Esther M.M. Van Lieshout, PhD; HUMMER Investigators Erasmus MC, University Medical Center Rotterdam and 28 others, Rotterdam, NETHERLANDS

Purpose: The best treatment of humeral shaft fractures in adults is still under debate. This study aimed to compare functional and clinical outcome of operative versus nonoperative treatment in adult patients with a humeral shaft fracture. We hypothesized that operative treatment would result in earlier functional recovery.

Methods: From 23 October 2012 to 3 October 2018, adults with a humeral shaft fracture AO type 12A or 12B were enrolled in a prospective cohort study in 29 hospitals. Patients were treated operatively or nonoperatively. Outcome measures were the Disabilities of the Arm, Shoulder, and Hand score (DASH; primary outcome), Constant-Murley score, pain (visual analog scale [VAS] score), health-related quality of life (Short Form-36 [SF-36] and EuroQoL-5 Dimensions-3 Levels [EQ-5D]), activity resumption (Numeric Rating Scale [NRS]), range of motion (ROM) of the shoulder and elbow joint, radiologic healing, and complications. Patients were followed for 1 year. Repeated measure analysis was done with correction for age, gender, and fracture type.

Results: Of the 390 included patients, 245 underwent osteosynthesis and 145 were primarily treated nonoperatively. Patients in the operative group were younger (median 53 vs 62 years; $P < 0.001$) and less frequently female (54.3% vs 64.8%; $P = 0.044$). Superior results in favor of the operative group were noted until 6-month follow-up for the DASH, Constant-Murley, abduction, anteflexion, and external rotation of the shoulder, and flexion and extension of the elbow. The EQ-5D, and pronation and supination showed superior results for the operative group until 6-week follow-up. Malalignment occurred only in the nonoperative group ($n = 14$; 9.7%). In 19 patients with implant-related complications ($n = 26$; 10.6%) the implant was exchanged or removed. Nonunion occurred more often in the nonoperative group (26.3% vs 10.10% in the operative group; $P < 0.001$).

Conclusion: Primary osteosynthesis of a humeral shaft fracture (AO type 12A and 12B) in adults is safe and superior to nonoperative treatment, and should therefore be the treatment of choice. It is associated with a more than 2-fold reduced risk of nonunion, earlier functional recovery, and a better ROM of the shoulder and elbow joint than nonoperative treatment. Even after including the implant-related complications, the overall rate of complications as well as secondary surgical interventions was highest in the nonoperative group.