

Title: Epidemiology of C2 Fractures and Predictors of Surgical Management: Analysis of a National Registry

Background: Operative management of axis fractures (C2) usually depend on the stability and location of the break as well as patient demographics.

Research question: Describe the epidemiology of C2 fractures and evaluate predictors of surgical management.

Design: U.S. National inpatient Registry analysis.

Methods: Patients with C2 fractures were identified from the U.S. National Trauma Data Bank from 1/1/2017 to 1/1/2020. Patients were classified by C2 fracture diagnosis: odontoid (type I, II, III, other), Hangman's fracture, unspecified fracture, or multiple fractures and over thirty covariates and outcomes were compared. Multivariate logistic regression was used to identify independent predictors of operative management and decision-tree based models were developed to classify into operative vs. nonoperative management.

Results: There were 48,920 patients, 44.1% had an odontoid fracture, 32.3% had a hangman's fracture, 20.6% had an unspecified C2 diagnosis, and 3.0% had multiple fractures. All demographics, injury characteristics, outcomes, and procedures differed by C2 fracture type. Overall, 6,741 (16.0%) were operatively managed. Independent predictors of operative management were fracture type, fracture stability, age, sex, race, transfer status, ED GCS, and six comorbidities. The decision tree identified three variables that were associated with operative management of C2 fracture, by hierarchy: fracture displacement (stable vs unstable), type of fracture (odontoid type II or multiple fractures vs. non-type II odontoid, unspecified, or Hangman's fracture), and age (< 80 vs. ≥ 80 years). The misclassification rate was 15%.

Discussion: This is the largest published descriptive study of C2 fractures and current management in the US to date. Operative management differed by C2 fracture type, but fracture stability was the greater attribute in determining surgical management and age ≥ 80 years was the favored cutoff for surgical decision making.