

Development and Validation of a Prediction Model for In-Hospital Mortality in Geriatric Hip Fracture Patients

Henk Jan Schuijt MD; Diederik Pieter Johan Smeeing MD; Franka S Würdemann MD; Han Hegeman MD; Olivia Geraghty ACNP-BC; Marijn Houwert MD; Michael John Weaver MD; Detlef Van Der Velde MD
Brigham and Women's Hospital, Boston, Netherlands

Purpose: The increase in the number of geriatric hip fracture patients is a global health concern. Patients aged 85 years or above are at high risk of adverse outcomes, making them the most clinically relevant patient group. Identification of high-risk patients is vital for guiding surgical management. There are currently no validated tools to predict mortality in hip fracture patients aged 85 years or above. The goal of this study was to develop and validate a prediction model for in-hospital mortality in hip fracture patients aged 85 years or older undergoing surgery.

Methods: This prospective multicenter cohort study used data collected by the Dutch Hip Fracture Audit, which collects data from 6 Dutch hospitals in different regions. This study included patients aged 85 years or older presenting to the emergency department with a hip fracture (OTA classification: 31-A or 31-B) undergoing hip fracture surgery. The outcome of this study was in-hospital mortality, which was recorded for all patients at discharge. A multivariable prediction model was built using logistic regression analysis.

Results: The development cohort consisted of 1014 patients. In-hospital mortality was 4%. Age, male sex, ASA (American Society of Anesthesiologists) classification and hemoglobin levels at presentation were robust predictors of in-hospital mortality. The area under the curve (c-statistic) for the initial model was 0.73 with a 95% confidence interval of 0.64 to 0.82. The bootstrap-adjusted performance showed good discrimination with a c-statistic of 0.77.

Conclusion: Age, male sex, higher ASA classification, and lower hemoglobin levels at presentation are robust independent predictors of in-hospital mortality in geriatric hip fracture patients and were incorporated in prediction model with good accuracy and no lack of fit. The c-statistic for this prediction model is good (0.77) but not excellent (>0.80). This is likely the result of the limited number of predictors that could be incorporated into the model, and the variability in degree of illness associated with each individual diagnosis. This simple prediction model can be used to guide medical decision making in real-time at presentation of patients at the emergency department. The algorithm can be programmed into electronic medical records software systems such as EPIC. An external validation study is needed to validate this model in populations other than Dutch geriatric hip fracture patients. The authors of this study are currently working on external validation and further improvement of the model in the American population at Brigham and Women's Hospital, Boston, using NSQIP (National Surgical Quality Improvement Program) data.