

Understanding Volume-outcome Relationship in Severe Traumatic Brain Injury

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Introduction

Volume-outcome relationship in severe traumatic brain injury (TBI) population remains unclear. We examined the relationship between volume of severe TBI patients per hospital and in-hospital mortality, major complications, and mortality following a major complication (i.e. failure to rescue).

Methods

In a multicenter cohort study, data on 9,255 adults with severe TBI were derived from 111 hospitals participating in the American College of Surgeons Trauma Quality Improvement Program over 2009-2011. Hospitals were ranked into quartiles based on their volume of severe TBI during the study period. Hierarchical models were used to examine the association between hospital guartile of severe TBI volume and in-hospital mortality, major in-hospital complications and mortality following a major complication after adjusting for patient and hospital characteristics. A major complication was defined as a cardiovascular event (cardiac arrest with cardiopulmonary resuscitation, myocardial infarction or cerebrovascular accident), acute respiratory distress syndrome, pneumonia, sepsis or acute kidney injury requiring dialysis. In sensitivity analyses, we examined these associations after excluding transferred cases. To explore the mechanism underlying any mortality difference, we repeated the analysis after excluding early deaths (defined as death within 48 hours of admission) from the cohort. Multiple imputation methods were used to estimate missing values for motor GCS score (1.3%) and systolic blood pressure (0.6%).

Results

Overall mortality was 37.2% (n=3,447). 2,098 patients (22.7%) suffered from one or more major complication. Among patients with major complications, 27.8% (n=583) died. Compared to the quartile with the lowest volume (quartile 1), the adjusted odds ratio of death after severe TBI was 0.54 [95% confidence interval (CI): 0.33-0.88] for quartile 4, 0.62 (95% CI: 0.37-1.04) for guartile 3 and 0.81 (95% CI: 0.48-1.39) for guartile 2. However, there was no significant association between the hospital volume guartile and the odds of a major complication or the odds of death following a major complication in adjusted analyses (Figure 1). After excluding transferred cases, similar results were found. When we excluded patients who died early (within 48 hours), the survival advantage of high volume hospitals was not statistically significant.

Conclusions

High-volume hospitals were associated with lower in -hospital mortality following severe TBI. However, unlike the general trauma population, this mortality reduction was not associated with lower risk of major complications or death following a major complication.

Learning Objectives

1. High-volume hospitals is associated with lower hospital mortality following severe TBI.

2. Unlike the volume-outcome relationship in the general trauma population, this mortality reduction cannot be explained by differences in rate of major complications or failure to rescue following a major complications.



Quartile 4 has the highest volume of severe TBI patients and Quartile 1 has the lowest. Odds ratios were adjsuted for patient and hospital characteristis.