Multicenter Retrospective Cohort Study of "Talk and Die" After Traumatic Brain Injury

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■ BACKGROUND: **Patients who "talk and die" after traumatic brain injury (TBI) are potentially salvageable. The reported incidences and risk factors for the "talk and die" phenomenon are conflicting and do not take into account recent improvements in trauma care. The aim of this study was to determine the incidences of "talk and die" after TBI in a modern trauma care system, as well as associated risk factors.**

■ METHODS: **We identified patients who experienced TBI (abbreviated injury scale 3–5) between 2004 and 2015 who talked on admission (i.e., their verbal component on the Glasgow Coma Scale was ≥3 on admission) using a nationwide trauma registry (the Japan Trauma Data Bank). The end point was in-hospital mortality. We compared patients who talked and died with those who talked and survived.**

■ RESULTS: **During the study period, 236,698 patients were registered in the database. Of the 24,833 patients who were eligible for analysis, 956 (4.0%) patients subsequently died in the hospital. The in-hospital mortality rate significantly decreased over the past 12 years. Older age; male sex; a higher injury severity score; a lower Glasgow Coma Scale score; comorbidities (congestive heart failure, chronic kidney disease, liver cirrhosis, and hematologic disorders); hypotension on arrival; subdural hemorrhage; contusion; and vault fracture were independently associated with higher in-hospital mortality.**

■ CONCLUSION: **Even in modern trauma care systems, some patients still talk and die after TBI. We identified certain risk factors in patients with TBI that elicit the requirement for close observation, even if these patients talk after TBI.**

BACKGROUND

Brain injury is a major cause of death following trauma. Such traumatic brain injury (TBI) is classified into primary (i.e., damage that occurs during the initial insult) and secondary (i.e., injury that results from complications of the initial affliction). If a patient is able to talk on admission, the primary injury is considered to be less severe and the patient is potentially salvageable.

Since Reilly et al[1] described "talk and die" in 1975, many studies have investigated the factors responsible for mortality in this potentially salvageable group of patients.[2-7] However, such studies were small, had limited ability to identify risk factors, and yielded conflicting results. Furthermore, most studies were performed before 2007 and do not reflect recent important changes including the increased availability of computed tomography (CT) scanning facilities and the publication of improved guidelines.[8-12] In this study, we aimed to investigate the incidence of, and risk factors for, in-hospital mortality of patients who talked after TBI.

Key words
- Mortality
- Risk factor
- Skull fracture
- Subdural hematoma
- Talk and die
- Traumatic brain injury

Abbreviations and Acronyms
AIS: Abbreviated injury scale
CI: Confidence interval
CT: Computed tomography
GCS: Glasgow Coma Scale
ISS: Injury severity score
JTDB: Japan Trauma Data Bank
RTS: Revised trauma score
TBI: Traumatic brain injury
VIF: Variance inflation factor

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METHODS

We performed a retrospective cohort study using data derived from the Japan Trauma Data Bank (JTDB), which was established in 2003 under the main auspices of the Japanese Association for the Surgery of Trauma (Trauma Registry Committee) and the Japanese Association for Acute Medicine (Committee for Clinical Care Evaluations). The aim of the JTDB is to collect nationwide trauma patient data in Japan, including patient characteristics, vital signs on arrival, inspections and treatments, revised trauma scores (RTSs),[13] diagnosis codes using the abbreviated injury scale (AIS), injury severity scores (ISSs),[14] and information on discharge from the hospital. Between 2004 and 2015, there were 260 emergency hospitals including >95% of tertiary emergency medical centers in Japan that participated in the JTDB. Registry data that are collected from the JTDB are compiled annually and disseminated in the form of research datasets.

Study Populations

The current study included patients who talked after TBI. Exclusion criteria were as follows: 1) younger than 16 years old, 2) systolic blood pressure <40 mm Hg, and 3) presence of severe injury (AIS score ≥3) on body regions other than the head.

Definition

The main end point was in-hospital mortality. TBI was defined as an injury score of 3–5 on the AIS for the head. Talking after an injury was defined as a score of ≥3 on the verbal component of the Glasgow Coma Scale (GCS) on admission. The year of hospital admittance was dichotomized as early (2004–2009) or late (2010–2015).

Statistical Analysis

For descriptive statistics, numeric variables are presented as medians with interquartile ranges, while categorical variables are presented as counts and percentages. We tested for differences in baseline characteristics between patients who survived versus those who did not using the chi-squared or Fisher exact test for categorical data and the Mann-Whitney U test for continuous data. We used a multivariable logistic regression model to determine the independent association of each variable with in-hospital mortality. A set of explanatory variables was chosen a priori on the basis of biologic plausibility and a priori knowledge. These selected variables included age; sex; year of admittance; GCS score on arrival at the hospital; comorbidities; hypotension (<90 mm Hg systolic) on arrival; RTS; ISS; whether head CT was performed for initial surveying; and the nature of the head injury. Variance inflation factors (VIFs) were used to check for multicollinearity. Adjusted odds ratios and 95% confidence intervals (CIs) were calculated. All statistical tests were 2-tailed, and a P value < 0.05 was considered significant. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria); specifically, it is a modified version of R commander designed to add statistical functions frequently used in biostatistics.[15]

Ethical Approval

This study was conducted with the approval of the institutional review board at the Tokyo Metropolitan Bokutoh Hospital. The review board waived the requirement for written informed consent as the data in this study were anonymized.

RESULTS

A total of 236,698 patients were registered in the JTDB, of whom 39,302 met the initial study criteria. After 14,469 patients were excluded, 24,833 were ultimately eligible for analysis (Figure 1). Of these, 956 (4.0%) patients subsequently died in the hospital. The median duration between admittance and death was 8 days. Three quarters of in-hospital deaths were observed within 20 days after admission (Figure 2). The patients' characteristics are summarized in Table 1, while the results of our multivariable analyses are shown in Table 2. VIFs for multicollinearity were lower than 5.9 among the explanatory variables, indicating a lack of collinearity in the model. Logistic regression revealed an independent association between higher mortality and hospital admittance in the early period; older age; lower GCS score on arrival; higher ISS; hypotension on arrival; comorbidities (congestive heart failure, chronic kidney disease, liver cirrhosis, and hematologic disorders); subdural hemorrhage; contusion; and vault fracture. In contrast, the diagnosis of diffuse axonal injury was significantly associated with lower in-hospital mortality. The in-hospital mortality rates of patients who were admitted during the early and late periods were 4.8% and 3.6%, respectively; the mortality risk was significantly decreased in the late period, during which the relative risk of in-hospital mortality was 0.73 (95% confidence interval: 0.64–0.84).

DISCUSSION

In this study, the in-hospital mortality rate of patients who talked after TBI was 4.0%; the rate was lower during the past 12 years. We identified the characteristics, comorbidities, and types of head injury that were independently associated with in-hospital mortality of patients who talked. To the best of our knowledge, this is the largest cohort study of its kind conducted to date and has

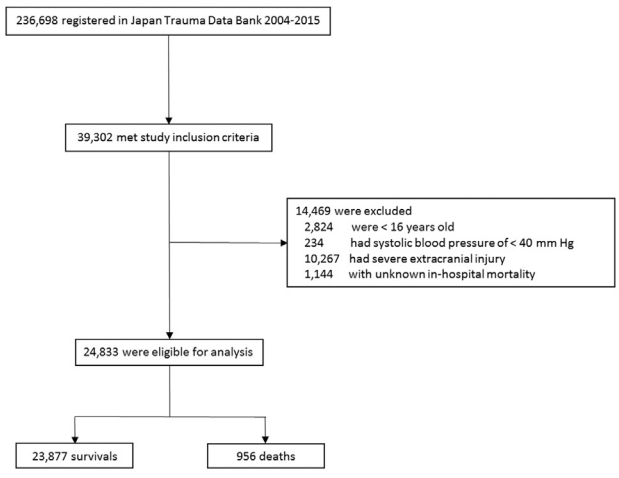

Figure 1. Flowchart showing the enrollment of patients who talked after traumatic brain injury.