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A subgroup analysis of penetrating injuries to the pancreas: 777 patients from the National Trauma Data Bank, 2010-2014



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ABSTRACT

Background: This study is the first to analyze penetrating injuries to the pancreas within subgroups of severe traumatic brain injury (TBI), early deaths, and potential survivors. Our objectives were to identify national patterns of injury, predictors of mortality, and to validate the American Association for Surgery of Trauma Organ Injury Scale (AAST-OIS) pancreas injury grades by mortality. Secondary outcomes included hospital and intensive care unit length of stay and days on mechanical ventilation.

Methods: Using the Abbreviated Injury Scale 2005 and ICD-9-CM E-codes, we identified 777 penetrating pancreatic trauma patients from the National Trauma Data Bank that occurred between 2010 and 2014. Severe TBI was identified by ICD-9-CM diagnosis codes and Glasgow Coma Score (GCS; $n = 7$), early deaths were those that occurred within 24 h of admission ($n = 82$), and potential survivors included patients without severe TBI who survived longer than 24 h following admission ($n = 690$). We estimated multivariable generalized linear mixed models to predict mortality to account for the nesting of potential survivors within trauma centers.

Results: Our results indicated that overall mortality decreased from 16.9% to 6.8% after excluding severe TBI and early deaths. Approximately, 11% of patients died within 24 h of admission, of whom 78% died in the first 6 h. Associated injuries to the stomach, liver, and major vasculature occurred in approximately 50% of patients; rates of associated injuries were highest in patients who died within 6 h of admission. In potential survivors, mortality increased by AAST-OIS grade: 3.5% I/II; 8.3% III; 9.6% IV; and 13.8% V. Predictors of mortality with significantly increased odds of death were patients with increasing age, lower admission GCS, higher admission pulse rate, and more severe injuries as indicated by Organ Injury Scale grade.

Conclusions: From 777 patients, we identified national patterns of injury, predictors of outcome, and mortality by AAST-OIS grade within the subgroups of severe TBI, early deaths, and potential survivors. Because AAST-OIS is not a reported element in the National Trauma Data Bank, we correlated Abbreviated Injury Scale 2005 codes to injury grade

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and identified an increase in mortality. After controlling for covariance, we found that greater age, lower GCS in stab wounds, higher pulse, and presence of a grade V pancreatic injury independently predicted the likelihood of death in patients surviving beyond 24 h following penetrating injuries to the pancreas.

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Introduction

The area of the c-loop of the duodenum, pancreatic body, and surrounding vascular structures is an area that we have previously¹ termed “Tiger Country” (see Fig. 1) because of our experience in areas of conflict and the challenging nature of this particular anatomical region. In this study, we analyzed three subgroups of patients that had experienced a penetrating injury to a specific area of Tiger Country (i.e., the pancreas): severe traumatic brain injury (TBI); early deaths defined as patients who died within 24 h of admission; and potential survivors defined as patients without severe TBI who survived beyond 24 h of admission.

Penetrating injury to the pancreas reportedly occurs in 1.1% of patients,² and overall mortality ranges from 16% to 43%.²⁻⁶ When reviewing published reports, a likely explanation for this wide range is whether early fatalities are included in analysis. Multiple reports document that 67%-92% of deaths in this population occur within the first 24 to 48 h following injury.^{2,5-7} Most patients with early deaths die from associated cardiac, vascular, and neurologic injuries.⁵ Mortality of all patients versus those surviving beyond 48 h was 22.6% versus 7.7% in Young's study, 42.9% versus 31.4% in Seamon's study, 16.6% versus 6.3% in Akhrass' study, and 17.6% versus 4.5% in Rickard's study.^{2,5-7} However, although early deaths have been frequently mentioned in the literature, specific patient and injury characteristics have not been reported.^{2,4-11}

Pancreatic injuries are often masked by severe associated injuries and require a high index of suspicion for a timely and accurate diagnosis. Owing to difficulty in diagnosis and treatment, it is essential that physicians are cognizant of the predictors of morbidity and mortality associated with such trauma. Objectives of this study were to examine several predetermined subgroups of patients that had experienced a

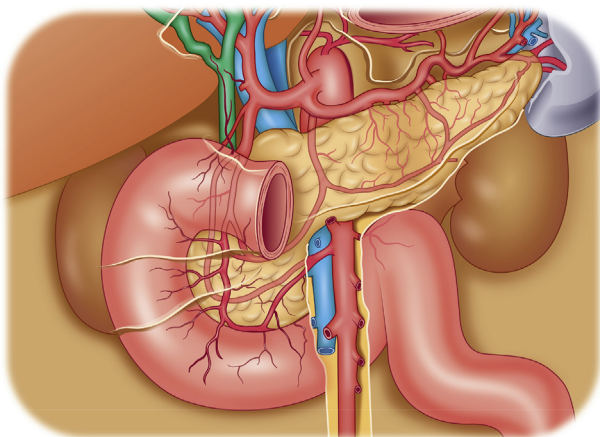


Fig. 1 – Anatomical boundaries of “Tiger Country”.

penetrating injury to the pancreas to identify independent predictors of in-hospital mortality.

Methods

Data source and study population

We identified penetrating pancreatic trauma patients from the National Trauma Data Bank (NTDB) Research Data Set between 2010 and 2014. The NTDB is supported by the American College of Surgeons and collects annual data from approximately 900 United States trauma centers. It is important to note that the Research Data Set is not a population-based data set, and it is unknown whether a unique patient had multiple trauma incidents. Before our search of the NTDB, we submitted this project to our Institutional Review Board. Through an expedited review, the Institutional Review Board approved our proposal as an exempt study. Since this analysis involved only the national database and its de-identified data, we did not need to obtain informed consent from human subjects.

Abbreviated Injury Scale 2005 with 2008 update (AIS05) was used to identify patients with pancreatic trauma, including codes 542812.2, 542814.3, 542822.2, 542824.3, 542826.4, 542828.4, 542830.4, and 542832.5 (see Table 1). Injuries caused by penetrating mechanisms were selected based on ICD-9-CM external causes of injury codes (E-codes) for firearm injuries (E922.x, E955.0-E955.4, E965.0-E965.4, E970, E979.4, and E985.0-E985.4) and cut/pierce injuries (E920.x, E956, E966, and E974). Furthermore, we identified patients with severe TBI using ICD-9-CM diagnosis codes (800.xx-804.xx and 851.xx-854.xx) in conjunction with Glasgow Coma Score (GCS) \leq 8. Patients included in our final sample had complete data for age, biological sex, admission systolic blood pressure (SBP), admission total GCS, admission pulse rate, admission Injury Severity Score-International Classification of Disease (ISS-ICD), mechanism of injury (i.e., firearm versus cut/pierce), and in-hospital mortality. We excluded 17 patients younger than 15 y of age as well as four patients who had two pancreatic AIS05 scores and an additional 333 patients with missing or obviously miscoded values (i.e., GCS $<$ 3 or $>$ 15, ISS $<$ 0 or $>$ 75, SBP $<$ 0, and/or pulse rate $<$ 0). Based on these criteria, we initially identified 777 patients. Of these patients, 7 (0.9%) had severe TBI and 82 (10.6%) were defined as early deaths; 2 (0.3%) patients with severe TBI suffered early death. A total of 690 patients were identified as potential survivors (i.e., those without severe TBI who survived longer than 24 h following admission) (see Fig. 2).

Outcomes

We evaluated procedure codes, associated injuries by AIS05, as well as comorbid conditions, complication rates, and

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