ORIGINAL ARTICLE

Hospital admission volume does not impact the in-hospital mortality of acute pancreatitis

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Abstract

Background: Multiple factors influence mortality in Acute Pancreatitis (AP).

Methods: To evaluate the association of demographic, clinical, and hospital factors with the in-hospital mortality of AP using a population-based administrative database. The Maryland HSCRC database was queried for adult (≥18 years) admissions with primary diagnosis of AP between 1/94-12/10. Organ failure (OF), interventions, hospital characteristics and referral status were evaluated.

Results: There were 72,601 AP admissions across 48 hospitals in Maryland with 885 (1.2%) deaths. A total of 1657 (2.3%) were transfer patients, of whom 101 (6.1%) died. Multisystem OF was present in 1078 (1.5%), of whom 306 (28.4%) died. On univariable analysis, age, male gender, transfer status, comorbidity, OF, all interventions, and all hospital characteristics were significantly associated with mortality; however, only age, transfer status, OF, interventions, and large hospital size were significant in the adjusted analysis. Patients with commercial health insurance had significantly less mortality than those with other forms of insurance (OR 0.65, 95% CI: 0.52, 0.82, p = 0.0002).

Conclusion: OF is the strongest predictor of mortality in AP after adjusting for demographic, clinical, and hospital characteristics. Admission to HV or teaching hospital has no survival benefit in AP after adjusting for OF and transfer status.

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Introduction

Prior studies have identified a number of demographic and clinical risk factors for mortality in acute pancreatitis (AP), including advanced age, male gender, race, comorbidity, transfer status, persistent or multisystem organ failure, and infected necrosis.[1–3]

The preliminary results for this study were presented as a poster in the AGA Clinical and Experimental Acute Pancreatitis session on May 7, 2011 at Digestive Diseases Week, Chicago, IL.

Several recent large administrative database studies have reported that hospitals with a high volume (HV) of AP admissions have better outcomes and lower mortality rates[4,5] but these studies did not evaluate organ failure and/or the transfer status of patients. Prior studies have demonstrated that persistent and/or multisystem organ failure is the primary determinant of mortality in AP.[2,6–11] For this reason, the revised Atlanta classification defined severe AP as the presence of persistent organ failure.[12] Prior studies have also shown that transferred patients with AP have increased mortality when compared to non-transferred patients.[13,14] Given the myriad of factors which can potentially influence the relationship between hospital volume and in-hospital mortality in AP, it is important to adjust for as many confounders as possible since the results of these studies can have implications for clinical practice and health care policymakers.

The aim of the present study was to evaluate the association of multiple demographic, clinical, and hospital factors with the in-hospital mortality of AP using a population-based administrative database.

Methods

The Maryland Health Services Cost Review Commission (HSCRC) was established in 1971 and has been setting hospital payment rates since 1974. The HSCRC requires quarterly submission of data from all participating non-federal hospitals.[15] The HSCRC database contains information on the demographics, clinical diagnoses, interventions, length of stay, in-hospital mortality, and charges on all inpatient discharges from all non-federal hospitals in the state of Maryland.

The HSCRC database was queried for all adult patient (≥18 years of age) admissions with a primary diagnosis of AP using the *International Classification of Diseases,* 9th *Revision, Clinical Modification* (ICD-9-CM) code of 577.0 between 1/1/1994-12/31/2010. Demographic variables included patient age, gender, race, type of insurance, and transfer status. Transfer status is based on the hospital which has accepted a patient from a referring hospital. Hospitals with <10 admissions during the study period (n = 6), which closed (n = 4), or which focus exclusively on rehabilitation services (n = 4) were excluded from the analysis. The data that is available in the database is based on individual episodes of AP and not unique patients. Comorbidity was assessed using the Elixhauser method for administrative databases.[16]

Acute organ failure was defined using ICD-9-CM codes as described in a prior study on sepsis.[17] Renal failure (ICD-9-CM codes 584.0–584.9, 586), pulmonary failure (PF) (ICD-9-CM codes 518.81, 518.82, 518.85, 786.09, 799.1), and cardiovascular failure (CF) (ICD-9-CM codes 458.0, 785.5, 785.51, 785.59, 458.8, 458.9, 796.3) were the 3 types of acute organ failure evaluated. The presence of acute organ failure in ≥2 systems was defined as multisystem organ failure (MSOF). Interventions included hemodialysis (ICD-9-CM procedure code 39.95), mechanical ventilation (ICD-9-CM procedure codes 96.70–96.72) as well as intensive care unit (ICU) placement. Non-survivors were defined as those AP patients who died during hospitalization.

Teaching hospitals were defined as those hospitals which have graduate medical education programs. HV hospitals were defined as those which have ≥118 AP admissions per year as this was the cutoff reported in prior studies of AP utilizing the National Inpatient Sample Database.[5,18] Referral hospitals were defined as academic medical centers. Hospital bed size across Maryland were divided into three groups based on tertiles (<141, 141–280, and >280 beds).

Statistical analysis

The trends for the number of admissions for AP and in-hospital mortality between 1994 and 2010 were analyzed using the Cochran–Armitage test for trend. Univariable analysis was performed using χ^2 test for categorical variables and the Student's *t*-test for continuous variables. All variables significantly associated with mortality on the univariable multinomial logistic regression (set as a $p < 0.004$) were evaluated using the multivariable logistic regression. A p-value of <0.004 was considered statistically significant for the multivariable logistic regression analysis after adjusting the α-level for the number of predictors using the Bonferroni correction (0.05/14).[19] Statistical analysis was conducted using SAS v9.2 (SAS Institute Inc., Cary, NC).

Results

There were a total of 72,601 AP admissions across 48 hospitals over the 16-year period. There was a significant increase in the number of AP admissions (Fig. 1a) and decrease in mortality (Fig. 1b) (both $p < 0.001$ for trend). There were 22,515 (31%) admissions to teaching hospitals and 32,662 (45%) to HV hospitals. Table 1 shows the demographic, clinical, and hospital characteristics of all patients as well as non-survivors. There were a total of 885 (1.2%) patients who died. OF was present in 5955 (8.2%) admissions and 577 (9.7%) of these patients died. The mortality rate in MSOF was higher than single system OF (28.4% versus 5.6%).

Table 2 demonstrates the results of univariable and multivariable analysis of factors associated with in-hospital mortality. In the univariable analysis, the factors associated with mortality included older age, male gender, transfer status, increasing comorbidity, presence of OF, interventions including hemodialysis, mechanical ventilation, and ICU admission, and large hospital size. On multivariable analysis, only transfer status, presence of organ failure, interventions, and large hospital size continued to be significantly associated with mortality. The highest risk for mortality was MSOF (OR 9.36; CI, 7.27–12.10; $p < 0.0001$) followed by mechanical ventilation (OR 8.72; CI, 6.95–10.90; $p < 0.0001$). Patients with commercial health insurance had significantly less mortality when compared with other forms of insurance (OR 0.65; 95% CI, 0.52–1.23; p = 0.0002). Patients admitted to teaching hospitals (OR 0.8; 95% CI 0.64–0.99, p = 0.044) and HV hospitals (OR 0.83; 95% CI, 0.7–0.99; p = 0.046) also had less mortality but this was not statistically significant.

Table 3 shows the mortality rates in HV and low volume (LV) hospitals stratified by different severity subgroups of AP after excluding transfer patients. Overall, the mortality of patients

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