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Case-fatality from acute pancreatitis is decreasing but its population mortality shows little change

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ABSTRACT

Background/objectives: The reasons for changing epidemiology of acute pancreatitis (AP) are poorly defined. We hypothesized that trends for severity, case-fatality and population mortality from AP will provide an insight into the rising burden of AP in the population. We evaluated trends in the hospitalizations, case-fatality, severity and population mortality related to AP in the US population.
Study: We used the National Hospital Discharge Survey to calculate age, sex and race standardized hospitalizations of and case-fatality rates for AP, and Vital Statistics to calculate AP-related population mortality from 1983 to 2010, using 2010 US census as the reference.
Results: Number of discharges per 100,000 population with primary diagnosis of AP increased 2 times from 42.4 (95% CI 38.2–46.5) during 1983–1986 to 85.4 (95% CI 62.8–108.1) during 2007–2010. During corresponding intervals, case-fatality from AP decreased 62% from 2.02% (95% CI 2.01–2.04) to 0.79% (95% CI 0.78–0.80), but population mortality per million population due to AP as primary cause remained stable from 9.28 (95% CI 8.94–9.62) to 9.91 (95% CI 9.56–10.26), and from AP as any cause decreased significantly (but only 12%) from 20.87 (95% CI 20.36–21.38) to 18.48 (95% CI 18.00–18.96). Prevalence of severe AP increased from 5% (95% CI 4.95–5.05%) during 1991–1994 to 9.78% (95% CI 9.73–9.83%) during 2007–2010.
Conclusion: An increasing prevalence of severe disease suggests true population increase to be an important contributor to the rising incidence of AP. A lack of proportional increase in population mortality suggests the impact of medical advances in the evaluation and management of AP.

Introduction

Studies from several populations have documented a progressive increase in the incidence of acute pancreatitis (AP) over the last 3–4 decades [1–4]. The number of discharges with a primary inpatient diagnosis of AP in the United States has almost doubled from 1988 to 2009 [5,6]. In fact, AP is now the most common gastrointestinal cause of hospital admissions in the US [6]. The exact cause of rising incidence of AP is unclear. Increasing obesity (leading to an increase in gallstone disease and gallstone-related AP) and increased detection due to wide availability and routine performance of serum pancreatic enzymes to evaluate abdominal pain are speculated to be the main reasons [7].

Corresponding to the rising incidence rates, a progressive decline in case-fatality of AP has been observed [3], likely from advances in management (e.g. better intensive care treatment, optimization of the timing and type of interventions needed in the setting of local complications, etc.). However, the use of case-fatality to assess the impact of treatment on AP-related mortality has limitations. Patients with mild AP have a lower likelihood of adverse outcomes or death [8]. If increased detection is contributing to the rising incidence [9], then decreasing case-fatality can be explained merely by a higher prevalence of mild disease among patients diagnosed with AP. Case-fatality can also decrease from improvement in management by enabling patients with severe AP to survive the index hospitalization. Case-fatality however would not capture delayed mortality occurring from local or systemic complications for which patients may or may not get readmitted.

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To better analyze trends for AP related mortality, evaluating all deaths related to AP in the population would be an unbiased approach.

We hypothesized that a true increase in the disease is an important contributor to the rising burden of AP, and that trends for severity, case-fatality and population mortality from AP will provide an insight into the rising burden of AP in the population. To test this hypothesis we used the National Hospital Discharge Survey (NHDS), a nationally representative inpatient dataset in the US to evaluate trends in the number of discharges, case-fatality and disease severity of AP. Furthermore, we used data from Vital Statistics to evaluate trends in the population mortality from AP. Together, these analyses provide a unique perspective of the epidemiologic trends of AP.

Materials and methods

This study was approved by the Institutional Review Board of the University of Pittsburgh.

Data source

National Hospital Discharge Survey (NHDS)

The NHDS is a national probability sample survey conducted annually by the National Center for Health Statistics (NCHS) since 1965. NHDS utilizes a stratified, multi-stage probability design which involves probability samples of primary sampling units (PSUs) from the National Health Interview Survey sample (stage I), short-stay nonfederal hospitals (whose mean days of care is less than 30 days) within PSUs (stage II), and a sample of discharges within hospitals (stage III). A two-stage sampling plan was followed till 1987 and from 1988 onwards a three-stage sampling plan was implemented.

NHDS reports hospitalizations according to demographic characteristics, medical conditions and other features. It covers discharges from non-institutional hospitals, exclusive of Federal, Military, and Veterans Administration hospitals, located in 50 States and District of Columbia with the average number of hospitals participating per year of roughly 500 with over 300,000 discharges sampled per year. Data collection (manual and automatic) is performed by trained staff of National Center for health Statistics (NHCS) or by the hospitals. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) is used for classifying medical diagnosis. National estimates are generated using multistage estimation procedure which involved three components: inflation by reciprocals of the sampling selection probabilities, adjusting for non-response and population weighting ratio adjustments. The population weighting adjustments are made to adjust for the oversampling or under sampling of discharges reported in the sampling frame for the data year. The adjustment is a multiplicative factor that has as its numerator the number of admissions reported for the year at sampling frame hospitals within each region-specialty-size group and its denominator the estimated number of those admissions for that same hospital group [10].

Vital statistics

The National Vital Statistics System (NVSS) is an intergovernmental data sharing mechanism by which NCHS collects and disseminates the Nation's official vital statistics. Vital registration systems operating in various jurisdictions in contract with NCHS collect registration of vital events like births, deaths, marriages, divorces and fetal deaths. Mortality data from NVSS are the main source for demographic, geographic and cause-of-death information.

For this study, data was extracted from Center for Disease Control Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) from 1983 to 2010 for deaths where AP was listed as the primary or any cause of death (ICD-9: 577.0, ICD-10: K85). CDC WONDER captures actual number of deaths year each, hence the numbers and mortality rates from AP are reported without any population weight estimate calculations [11,12].

Census data

The US Population and Housing census is collected by the United States Census Bureau every 10 years. The last census was conducted in 2010. Information on the census is publically available and can be downloaded from the US Census Bureau website using the American Fact Finder tool [13]. For this study, 2010 Census was used as the reference population for estimating all discharge and population mortality rates for AP.

Years of study

For the current study, we compiled data from the three sources for years 1983–2010. Year 1983 was chosen as the start of the study period due to inconsistencies in the reporting for the Race variable prior to 1982 and to allow for the study of trends in 4 year intervals. Race was categorized race into White, Black and Other for the dataset.

Cases and outcomes of interest

We identified all discharges in the NHDS with a primary diagnosis of AP (ICD-9 577.0). Information for inpatient hospital death was obtained from the discharge status. Case-fatality was defined as the proportion of inpatient hospital deaths among patients with a diagnosis of AP. As reported previously [14], disease severity was as defined as the presence of any one of the following: in-hospital deaths, presence of associated diagnostic or procedure codes for renal failure, respiratory failure, sepsis, intra-abdominal infections, use of vasopressin or activated drotrecogin alfa and abdominal surgery for complications of pancreatitis (see Appendix for codes used). Due to availability of relevant associated codes, disease severity classification was applied only for discharges from 1991 onwards. NHDS data documentation was reviewed and any modifications to the codes during the study period were taken into consideration for calculation of disease severity. Deaths where AP was listed as the primary or any cause of death in the vital statistics dataset were identified to determine population mortality from AP.

Statistics

We calculated the estimated number of discharges, overall and for each year with primary and any discharge diagnosis of AP during 1983–2010 from the NHDS database using weighted frequencies. Weighted frequencies were obtained by using SAS PROC SURVERYFREQ with weight option. Case-fatality rate was determined as the fraction of patients with a primary or any diagnosis of AP who died during the hospitalization.

To calculate the discharge and population mortality rates, we considered the entire US population during the study to be at risk. We calculated the crude discharge per 100,000 and population mortality rates per 1,000,000 population for the entire study period, each year and by intervals (see below). We adjusted the rates by age and sex to the 2010 US population using direct standardization and calculated the 95% confidence intervals (CI) using Poisson distribution. Rates were also calculated for discharges and population mortality and after stratification by age, sex and race. Severe AP is represented as the proportion of AP patients who had

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