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Original article

Predictive factors for and incidence of hospital readmissions of patients with acute and chronic pancreatitis

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ABSTRACT

Background/objective: Acute and chronic pancreatitis are common gastroenterological disorders that have a fairly unpredictable long-term course often associated with unplanned hospital readmissions. Little is known about the factors that increase or decrease the risk for a hospital readmission. The aim of this study was to identify positive and negative predictive factors for hospital readmissions of patients with acute and chronic pancreatitis after in-hospital treatment.

Methods: In a retrospective analysis data from the hospital information and reimbursement data system (HIS) were evaluated for 606 hospital stays for either acute or chronic pancreatitis between 2006 and 2011. Additional clinical data were obtained from a questionnaire covering quality of life and socio-economic status. A total of 973 patient variables were assessed by bivariate and multivariate analysis.

Results: Between 2006 and 2011, 373 patients were admitted for acute or chronic pancreatitis; 107 patients of them were readmitted and 266 had only one hospitalization. Predictors for readmission were concomitant liver disease, presence of a pseudocyst or a suspected tumor of the pancreas as well as alcohol, tobacco or substance abuse or coexisting mental disorders. Patients who had undergone a CT-scan were more susceptible to readmission. Lower readmissions rates were found in patients with diabetes mellitus or gallstone disease as co-morbidity.

Conclusion: While factors like age and severity of the initial disease cannot be influenced to reduce the readmission rate for pancreatitis, variables like alcohol, tobacco and drug abuse can be addressed in outpatient programs to reduce disease recurrence and readmission rates for pancreatitis.

Introduction

A readmission is defined as a re-hospitalization of a patient due to the same principal diagnosis as for the first hospital stay within a defined period of time. This can be an indicator of either premature discharge [1], poor quality of hospital services [2–4], insufficient ambulatory care [5] or a disease with a high probability of recurrence [6]. According to the German hospital financing system (G-DRG) a readmission within 30 days will usually mean that the first admission and the readmission are bundled and thus reimbursed as one rebate case. This usually leads to insufficient coverage of the objective cost incurred by the hospital and causes a financial deficit. There are therefore economic reasons in addition to medical ones for investigating the risk factors for hospital readmissions and especially early readmissions.

List of abbreviations: AP, acute pancreatitis; AUDIT-C, Alcohol use disorders identification test; CI, confidence interval; CP, chronic pancreatitis; CVT, Cramér-V-test value; EQ5D, European quality of life 5-dimensions; G-DRG, German diagnosis related groups; HIS, hospital information and reimbursement data system; HSI, Heaviness of Smoking Index; ICD-10-GM, International statistical classification of diseases and related health problems, German modification; LAST, Luebeck Alcohol Dependence and Abuse Screening Test; OPS, Operation and procedure code (German procedure classification); PCCL, patient clinical complexity level; ROC, Receiver operating characteristic; SD, standard deviation; SNAQ, short nutritional assessment questionnaire.

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In 2005, the average Medicare payment per potentially preventable readmission was $ 7200 in the United States. At the same time, 13.3% of early (i.e. within the first 30 days after initial stay) readmissions are thought to be avoidable. Thus, preventable early readmissions could generate annual savings of about 12 billion Dollars [3]. Gastrointestinal diseases are a major cause of readmission [7] and among them [6] acute and chronic pancreatitis are disproportionately represented [8]. Acute pancreatitis (AP) has an incidence of 10-79/100,000 and the incidence of chronic pancreatitis (CP) is around 23/100,000 [9–11]. There seems to be a broad consensus that the incidence and number of hospital admissions due to acute or chronic pancreatitis is increasing [12–14]. 19% of patients with AP suffer from recurrence of the disease and therefore undergo early readmission within the first 30 days after the initial discharge, i.e. the risk of early readmission of patients with AP is particularly high [15]. Therefore pancreatic disorders, in particular acute and chronic pancreatitis are excellent examples for the high medical and economic relevance of an analysis of readmissions. Assessment of the risk and predictive factors for readmissions could make an important contribution to improvements in quality of care and lead to cost containment [15]. However, our knowledge of these risk factors is rather limited. Whitlock et al., 2010 [15] analyzed patients with AP regarding re-hospitalizations within the first 30 days. They found that alcohol consumption, which was also the etiologic factor of the disease, persistence of symptoms and non-restored oral food intake at discharge, were risk factors for early readmission. For disease recurrence the severity of the initial episode was also identified as a risk factor [6]. Furthermore, delayed cholecystectomy was found to be a risk factor for a readmission in gallstone induced AP [16–19]. So far no in-detail analysis of predisposing factors for readmission of patients with pancreatitis-related diseases covering an extended period of time after the initial hospital treatment has been performed that included concomitant disorders as well as medical diagnostic and therapeutic procedures. This prompted us to conduct such an analysis in a tertiary referral center.

Methods

Patients that were admitted to hospital between 2006 and 2011 with the admission diagnosis of acute or chronic pancreatitis were screened regarding a later readmission with a pancreatitis-related diagnosis. Secondary data were obtained from the hospital information and reimbursement data system (HIS) of University Medicine Greifswald, a tertiary referral center with extensive experience in the care of patients with pancreatic diseases. Principal and secondary diagnoses as well as in-hospital diagnostic and therapeutic medical procedures encoded by the German procedure classification system (OPS) were recorded. In addition, every patient who was admitted because of a pancreatic disorder was asked to fill out a questionnaire that contained questions regarding quality-of-life (EQ5D), nutrition (SNAQ), smoking and alcohol drinking habits, socio-economic status and pain. This questionnaire and the retrieval of data from the HIS were approved by the local ethics committee of the University of Greifswald. A list of all items that were used in the questionnaire is given in Supplemental Table 1. All analyses were executed by IBM SPSS 20 and Microsoft Excel 2010.

Inclusion criteria

We included patients that were treated at University Medicine Greifswald with the main diagnosis acute pancreatitis (ICD-10-GM: K85.xx) or chronic pancreatitis ICD-10-GM: K86.0 (alcoholic chronic pancreatitis) or K.86.1 (chronic pancreatitis by other origin) between 2006 and 2011.

Exclusion criteria

Patients with incomplete or inconsistent information from the HIS were excluded. When data from the questionnaire were incomplete, the existing information was still analyzed in bivariate analyses but could not included in multivariate analyses because of the test design.

Bivariate analysis

For metric-scaled items correlation coefficients were calculated. For nominal scaled items the Phi- or its generalized form, the Cramér-V-test (CVT), a modification of the χ^2-Test which allows a delineation of the strength of the association between a readmission and the tested item but not of its direction, was used to determine significant relations between readmission and the item. For nominal scaled, binary variables Odds Ratios (OR) were calculated.

Multivariate analysis

Logistic regression with two values of the depending variable (readmission 'yes' and 'no') was used. This procedure was split into three steps:

Step a

Sorted by the strength of association to a readmission in bivariate analysis, the items were put into the multivariate regression model successively. Only items with a significant connection to readmission in bivariate analysis were used for the logistic regression. If one of the variables had no significant connection to readmission in Wald-statistics (critical value: 0.05), it was removed from the model and it was continued with the next item on the list.

Step b

After all variables with a significant value in Wald-statistics were implemented, outliers were identified and removed. Outliers were defined as cases where the model predicted the wrong group in an extreme deviation from the observed one. If the difference of predicted value by the logistic function and the true value was greater than the doubled standard deviation the case was excluded as an outlier.

Step c

The model without the outliers was checked again whether some of the prior excluded variables could be picked up into the model. Steps b and c were performed several times until the routine showed the optimal fit.

Model-quality

In order to check the quality of the model, Nagelkerkes R^2, Hosmer-Lemeshow-test and ROC-statistics were performed. The aim was to identify the model with the best test results in total. Values for Nagelkerkes R^2 should be better than 0.4 [20] and Hosmer-Lemeshow-test should have a small χ^2-value with a level of significance even above 0.05. To improve the quality of classification in the final model, the cut-off value for separation into the groups (readmission "yes" or "no") was set to the number of patients which had a readmission divided by the total number of patients in the model. The difference of the classification quality is shown by the ROC-statistics. For variables in the final model, tolerance-values were computed to exclude multicollinearity (critical value <0.25).

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