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ORIGINAL ARTICLE

Impact of medical or surgical admission on outcomes of patients with acute cholecystitis

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Abstract

Background: Although acute cholecystitis (AC) is a surgical disease, patients with the condition may be admitted to medical-related services (MS). This may lead to delayed cholecystectomy thereby affecting outcomes and quality of care.

Methods: Between July 2010 and March 2013, 329 patients under 70 years old presented to a community-based tertiary care hospital with AC and underwent same admission cholecystectomy. Outcomes were compared between patients admitted to MS and surgical services (SS).

Results: Two hundred fifteen patients (65.3%) were admitted to a MS. Patients under the MS had longer LOS (3.0 days vs. 2.0 days, $p < 0.001$), waiting time to surgical consultation (7.3 h vs. 5.0 h, $p < 0.001$) and to cholecystectomy (1.0, 0–2 days vs. 1.0, 0–1 day, $p < 0.001$), and increased hospital costs ($3685 vs. $4,688, $p < 0.001$) compared to the SS. Readmission and mortality rates were not significantly different between groups.

Conclusion: Patients under 70 years old with AC undergoing cholecystectomy admitted to MS had increased LOS, delay to the operation, and hospital costs compared to those admitted to a SS. Admission of patients with AC to a SS needs to be emphasized to reduce costs and improve quality of care.

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Introduction

The United States (US) healthcare system has undergone dramatic changes in recent years with increased efforts aiming to decrease costs and improved quality of care delivered.[1] The legislation reform has been largely influenced by reducing unnecessary costs that may not translate in improved outcomes.[1] Concurrently, the Center for Medicare and Medicaid Services (CMS) is trending toward pay-for-performance and increased compensation plans, thereby pushing surgeons to condense costs.[2]

Acute cholecystitis (AC) is one of the most common surgical disorders leading to hospital admissions with more than 917,000 cholecystectomies performed annually in the US.[3] Among digestive diseases requiring hospitalization, AC is the most common and most costly with estimated overall cost of hospitalization for AC exceeding $6.3 billion annually.[4]

Although some controversy still exists regarding the ideal timing for cholecystectomy in AC, there is sufficient evidence to support early cholecystectomy.[5–10] The mean cost of care for surgery compared by same-day cholecystectomy disproportionately increased by 22% on the second hospital day, 37% on the third day, 64% on fifth day and by 100% on seventh day.[8] Previous reports from diverse trauma centers showed decreased length of hospital stay (LOS) and costs under an Acute Care Surgery (ACS) model compared to general surgery service.[11,12] Interestingly, some patients with AC are admitted to non-surgical services in the US.[13,14] Current data assessing at the frequency of patients with AC admitted to medical-related services are lacking. To our knowledge, this is the first study to date that aimed to evaluate the impact of the admitting service

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(surgical versus medical) on early outcomes and quality measures of patients with AC undergoing cholecystectomy.

Methods

The data were collected retrospectively from the hospital administrative claims database including patients with a primary diagnosis code (using the International Classification of Diseases [ICD], Clinical Modification, Ninth Edition) for AC (540, 540.1, 575) from July 2010 to March 2013. The database includes modifiers (weights) that enable extrapolation of the included patient population to a national scale and is part of the Healthcare Cost and Utilization project, supported by the Agency for Healthcare Research and Quality as part of the federal-state industry partnership initiative.[8] Available data include patient age, gender, ethnicity, LOS, total charges, disposition, comorbidities, net income, DRG (diagnosis-related group), ICD-9-defined procedure and diagnosis codes. DRGs have been used in the US since 1982 to determine the amount of Medicare reimbursement to hospitals for each patient, because patients within each category are clinically similar and are expected to use the same level of hospital resources. The DRG is assigned to a patient based on ICD diagnoses, procedures, age, gender, discharge status, and the presence of complications or comorbidities and was used as a predictor for outcomes in the analysis. Comorbidities included cardiac, pulmonary, vascular, deep venous thrombosis, stroke, diabetes mellitus, chronic kidney disease, hypertension, obesity (BMI 30–39 kg/m^2) and morbid obesity (BMI >40 kg/m^2).

All patients were admitted to the emergency department (ED) at a community-based academic tertiary care hospital with diagnosis of AC and underwent cholecystectomy during the same admission. The patients were assigned to a medical (MS) or surgical service (SS) by the ED staff on an individualized basis depending primarily on the request of primary care physician or at the discretion of the surgical attending on call. Assignments to MS or SS were placed irrespective of time of the day (day or night) or weekends. There is no protocol to standardize the decision making process in these cases. The surgical team is available 24 h a day, and all consultations in the ED or at regular floors are seen within 30 min after placement. The operations are scheduled based on surgeons' and operating room availability.

Patients younger than 18 years of age or older than 70 years, those undergoing temporary percutaneous cholecystostomy tube drainage, endoscopic retrograde cholangiopancreatography (ERCP), and patients with gallstone pancreatitis or choledocholithiasis were excluded from the analysis. Similarly, patients undergoing elective cases for biliary colic, chronic cholecystitis or biliary dyskinesia were excluded. The cut-off of 70 years of age was selected to avoid bias in the analysis of patients with severe comorbidities.

The primary outcome of this study was hospital LOS. Secondary study end-points were time for surgical evaluation, time for cholecystectomy, hospital costs, hospital net income, readmission and mortality rates. Net income is defined as an indicator of hospital's profitability and is calculated by taking revenues and subtracting the healthcare costs. Institutional Review Board (IRB) approval for this study was obtained, waiving the need for informed consent.

Statistical analysis

Continuous values were expressed as median and interquartile range (IQR). Categorical variables were expressed as frequency distributions. Univariate analysis was performed using chi-square analysis for categorical variables and Mann–Whitney U-test for continuous nonparametric variables. Variables with $p < 0.2$ in univariate analysis were entered into a multivariate analysis, which consisted of logistic linear regression. p-Values less than 0.05 were considered statistically significant. Statistical analysis was performed with SPSS v. 23.0 (IBM Corp, NY, USA).

Results

During a 33-month period, 329 patients presented to the ED with AC and subsequently underwent cholecystectomy during the same admission. The clinical characteristics of patients are summarized in Table 1. Patients were more frequently admitted to the MS than to the SS. Patients admitted to the SS were significantly younger than those admitted to the MS (Table 1) The majority of patients underwent laparoscopic cholecystectomy in both groups and the conversion rate was also similar. Patients admitted to the medical service had more cardiac comorbidities, diabetes mellitus, hypertension, and morbid obesity.

In the univariate analysis, patients under the MS had longer LOS and increased delay time for surgical consultation and for cholecystectomy than those admitted to a SS (Table 2). This was translated in increased hospital costs in MS and decreased net income as compared to the SS (Table 2). Readmission and mortality rates were not significantly different between groups.

Multivariate analysis was performed to model each of the outcomes controlling for medical or surgical group and other variables found to be significant on univariate analysis. Patients under a MS had significant increased LOS, waiting time for surgical consultation and for definitive surgery, and hospital costs as compared to the surgical group irrespective of comorbidities (Table 3). The factors associated with increased hospital LOS included time to surgical consult, DRG and renal comorbidity.

Discussion

The advent of minimally invasive surgery enabled laparoscopic cholecystectomy as the gold standard therapy for AC with approximately 1 million procedures performed and $6 billion dollars in cost annually in the United States.[3] Although

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