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Percutaneous Cholecystostomy and the Prognosis of Patients with Acute Cholecystitis

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Abstract

Our objective was to examine outcomes of Percutaneous Cholecystostomy (PC) in patients hospitalized for acute cholecystitis. We compared clinical profiles, length of hospital stay and survival between patients with acute calculus cholecystitis who did (n=50) and did not (n=633) undergo percutaneous cholecystostomy. Those who underwent PC were older and with a poorer clinical profile; and their 30-day and 1-year mortality rates were higher (10% *vs*. 0.9%, and 20% *vs*. 4.9%, respectively, p<0.001 for both). In a logistic regression model, PC status was associated with increased 30-day mortality (OR 3.32, 95% CI 0.82-13.43, p=0.09) after adjustment for age, sex, American Society of Anesthesiologists score, disease severity index and cholecystectomy.

The most deleterious effect on hospital stay was observed among patients with moderately severe disease. Percutaneous cholecystostomy should be offered only to very high-risk patients. In patients unresponsive to conservative treatment with moderately severe disease, laparoscopic cholecystectomy is the preferred treatment.

Keywords: Acute cholecystitis; Percutaneous cholecystostomy; Hospitalization; Mortality

Introduction

Acute Cholecystitis (AC) is an infectious disorder of the gallbladder, usually caused by gallstones. The pathogenesis is a cystic duct obstruction that causes a dilated gallbladder, inflammation, and edema of the surrounding tissue. If left untreated, progression of the inflammatory process may lead to ischemia, gangrenous cholecystitis, and perforation. The prognosis of AC is generally favorable. Most patients (about 7585%) report reduced symptoms within days of initiating treatment [1]. However, some patients may develop complications despite conservative treatment measures.

Cholecystectomy is the "gold standard" treatment for cholecystitis [2], even in the acute phase. Ideally, patients with uncomplicated AC undergo laparoscopic cholecystectomy within 72 h of diagnosis [3], to reduce length of hospital stay, duration of illness, and complications [4-6]. However, when surgery is considered "risky", or when conservative treatment fails, Percutaneous Cholecystostomy (PC) is performed.

PC reduces gallbladder pressure, and in patients with a calculous cholecystitis, is considered a definitive treatment [7]. However, in some cases of AC, it is used as "bridge therapy" until cholecystectomy is feasible [8]. Encouraging reports of effective and safe laparoscopic cholecystectomy, also for severely ill patients with AC [9-15], have raised questions regarding the performance of PC. The purpose of this study was to examine outcomes of patients hospitalized for AC who were treated with PC as a bridging therapy.

Methods

We reviewed the medical records of all patients admitted to the Wolfson Medical Center during the years 2008-2014 with a diagnosis of acute calculous cholecystitis. Patients were excluded from the analysis if they underwent cholecystectomy during their initial hospitalization, or if gangrenous cholecystitis was radiologically diagnosed. Patients who were hospitalized due to recurrent episodes of cholecystitis, with the first episode prior to 2008, were also excluded.

Data collected included: demographic characteristics (age, sex, marital status), severity of disease (mild, moderate, and severe [3]), American Society of Anesthesiologists (ASA) score

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Table 1: Comparison of patient demographics and comorbidities according to percutaneous cholecystostomy status.

	All	No n=633	Yes n=50	p Value
Age (years)	**61.9 ± 19.3**	**60.8 ± 19.2**	**76.0 ± 12.4**	**<0.001**
Age 65 years and over (%)	**49.1**	**46.4**	**84**	**<0.001**
Female sex (%)	54.3	55.1	44	0.128
Comorbidities				
Diabetes mellitus (%)	30.20%	29.5	36.7	0.414
Renal failure (%)	7.30%	7	10	0.55
Ischemic heart-disease (%)	20.60%	19.3	33.3	0.071
Cerebrovascular accident (%)	1.60%	**1.1**	**6.7**	**0.019**
Cholecystectomy (%)	41.60%	41.4	44	0.719
Baseline laboratory data				
Hemoglobin (g/dL)	13.3+1.7	**13.3 ± 1.6**	**12.7 ± 1.5**	**0.01**
WBC (per cmm^3)	12.7+4.8	**12.5 ± 4.6**	**14.8 ± 5.7**	**0.001**
Creatinine (mg/dL)	0.93+0.56	**0.9 ± 0.5**	**1.0 ± 0.4**	**0.033**
UREA (mg/dL)	**37.6 ± 21.6**	**36.7 ± 21.1**	**48.1 ± 24.8**	**0.003**
Sodium (meq/L)	**137 ± 3.4**	**137 ± 3.2**	**135 ± 3.9**	**<0.001**
Albumin (g/dL)	**3.4 ± 0.6**	**3.4 ± 0.5**	**3.1 ± 0.7**	**0.005**
Total bilirubin (mg/dL)	1.26+1.30	1.2 ± 1.3	1.2 ± 0.9	0.943
Alkaline phosphatase (IU/dL)	110+101	109 ± 99	120 ± 126	0.472

upon admission, admission laboratory test results, comorbidities, duration of hospitalization, date of cholecystectomy, the number of hospitalizations following initial admission, recurrent hospitalizations due to cholecystitis, and the date of death (when relevant). In patients who underwent PC, additional data were collected regarding complications of PC, including accidental dislodging of a drain.

Between patients who had and had not undergone PC, length of hospital stay, 30-day and 1-year mortality after AC hospitalization, and the number of recurrent hospitalizations were compared using regression models, adjusted for age, sex, disease severity, and ASA score.

The study was approved by the ethics committee of Wolfson Medical Center.

Statistical analysis

Analyses were performed using SPSS software version 23 (IBM, USA). Continuous variables were compared between the 2 groups using the t-test. Non-continuous variables were compared using the chi-squared test. To study the effect of PC on the length of hospital stay and 1-year mortality rates, linear and logistic regression models were used, with age; sex, disease severity, and ASA score as covariates. Subsequently, patients were grouped according to disease severity, and the same models were applied for each severity group.

Results

During the study period, 683 patients were admitted to surgical departments with a diagnosis of AC. Of them, 69 (10%) required additional hospitalizations, with a total of 764 hospitalizations. Table 1 presents data on comorbidities, and blood test results on admission, for the entire cohort and according to PC status. For the entire cohort, the mean age was 62 years; 336 (49.1%) were over age 65 years. During the index admission, 284 patients (41.6%) underwent cholecystectomy. The 30-day mortality rate was 1.6% for the entire cohort. Of the 683 patients, 439 (64.3%) were with mild disease, 205 (30%) with moderate disease, and 39 (5.7%) with severe disease. Most patients had ASA grade 2 or 3 (427, 62.5%), a minority had grade 4 or 5 (23, 2.8%). The most prevalent comorbidity was diabetes mellitus (30.2%).

Association between cholecystostomy and length of hospital stay

Fifty patients (7.3%) underwent PC.A higher proportion of patients who did than did not undergo PC were aged 65 years and older (84.0 *vs.* 46.4%), and after a cerebrovascular accident (6.7 *vs.* 1.1%); and their laboratory tests indicated a poorer clinical profile: lower mean values of hemoglobin, sodium, and albumin, and higher mean values of WBC, creatinine, and urea (Table 1).

Among patients who were treated with PC, disease severity was greater (mean disease severity index 2.0 ± 0.6 *vs.* 1.4 ± 0.6, p<0.001) and hospital stay was longer (12.8 ± 9.7 days, *vs.* 6.5 ± 7.0 days, p<0.001). No differences were observed between patients who did and did not undergo PC, in the number of recurrent hospitalizations. Elective cholecystectomy was performed in less than 50% of patients regardless of their PC status.

To examine the association of PC with length of hospital stay (LOS), a general linear model was used, where LOS was the dependent variable, PC and cholecystectomy surgery status were the fixed factors, and age, sex, ASA score and disease severity index were the covariates. The model showed that PC was significantly associated with longer LOS, while cholecystectomy was associated with shorter LOS. In addition, ASA score and disease severity index significantly influenced LOS, while age and patient sex did not. When plotting the estimated marginal means according to PC and cholecystectomy status, PC was associated with longer LOS among patients who underwent cholecystectomy, yet no association was observed among those who did not (Figure 1). Similar models were applied to each disease severity group. Among patients with moderately severe disease, cholecystectomy was associated with a tendency towards shorter LOS (8.5 ± 0.7 *vs.* 10.2 ± 0.7 days, p=0.096) while PC was associated with longer LOS (10.6 ± 0.9 *vs.* 8.1 ± 0.4 days, p=0.014). Among patients with severe disease, PC was associated with reduced LOS only among patients who underwent cholecystectomy (11.6 ± 13.3 *vs.* 14.5 ± 8.6 days), but this difference was not statistically significant (p=0.880).

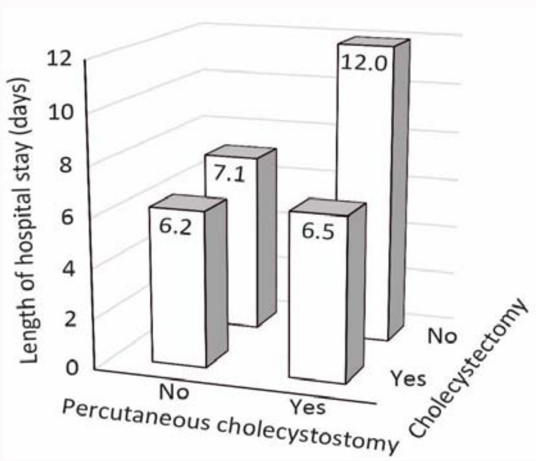

Figure 1: Estimated marginal means for length of hospital stay according to percutaneous cholecystostomy and cholecystectomy status.

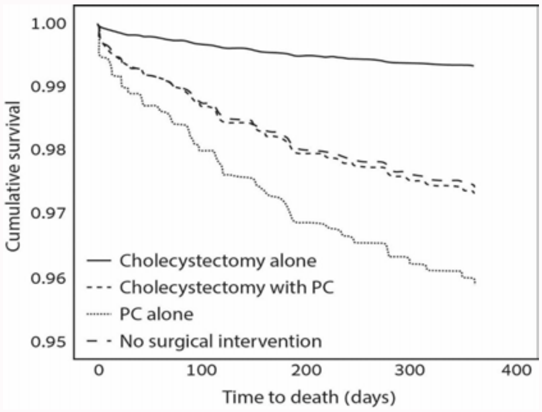

Figure 2: Cox regression analysis for 1-year survival rate according to cholecystostomy status.

Association between PC and mortality

Thirty-day and 1-year mortality rates were higher in the PC group (10% *vs.* 0.9%, and 20% *vs.* 4.9%, respectively, p<0.001 for both). A logistic regression model was used to analyze the parameters associated with 30-day mortality; age, sex, ASA score, disease severity index, and cholecystectomy and PC status were the covariates. PC status was associated with increased 30-day mortality (OR 3.317, 95% CI 0.819-13.430, p=0.093), as was the ASA score (OR 3.776, 95% CI 1.253-11.373, p=0.018). Male sex showed a tendency towards increased mortality (OR 4.623, 95% CI 0.808-26.439, p=0.085). Cholecystectomy and more severe disease were not associated with 30-day mortality.

In an analysis of 1-year survival, patients were classified into 4 groups according to PC and cholecystectomy status (procedures, only PC, only cholecystectomy, and neither procedure). A Cox regression model included age, sex, disease severity, ASA scores, and the combined cholecystectomy and PC status as the covariates. The best prognosis was observed among patients who had cholecystectomy alone (HR 0.162, 95% CI 0.040-0.650, p=0.010) followed by patients who did not undergo either procedure or who underwent both procedures; the results were similar for these two groups. Patients who underwent only PC insertion had the worst prognosis, but the difference between this and the other groups did not reach statistical significance. Age was positively associated with increased mortality (HR 1.075, 95% CI 1.040-1.110, p<0.001). Disease severity index was marginally significant (HR 1.540, 95% CI 0.957-2.476, p=0.075), while patient sex and ASA score were not. Kaplan Meier curves showed the poorest survival among patients who underwent only PC, and the best survival among those who underwent only cholecystectomy; survival for patients who underwent PC and cholecystectomy was in between these two other groups (Figure 2).

Discussion

Our data suggest that PC insertion is associated with longer LOS and higher 1-year mortality. LOS was longer in patients who underwent PC by about 50%, compared to those who did not undergo PC, after adjustment for age, ASA, and disease severity. In an attempt to minimize biases, we compared between patients with similar disease severity or ASA scores, according to the performance of PC. The results showed longer LOS for PC, even among those with low ASA scores. Our results were documented also by Zehetner et al. [16] who found that, in a matched pair analysis, LOS was longer in the PC than the LC group, despite the shorter procedure time.

Comparing patients who did and did not undergo PC, 30-day mortality was 10 times greater in the PC group than the non-PC group, across all age groups, and 8 times greater in patients aged > 65 years. One-year mortality was 5 times greater in all ages, and 2.5 times greater among those aged >65 years. Multivariate analysis revealed that PC status itself was associated with a more than 3-fold increase in 30-day mortality rates, after controlling for age, sex, ASA score, and disease severity. In addition, serum creatinine levels at admission, age, and ASA score were the highest predictors of mortality at 30 days and at one-year from initial cholecystitis. Those results are in accordance with Zehetner et al. [16] results, which demonstrated that PC insertion was associated with a higher 30-day mortality rate, though without statistical significance.

We presume that the lack of improvement with conservative treatment was the driving factor in the decision to insert PC in our patients. Even after adjusting for PC, the ASA score was associated with longer LOS and possibly with 30-day mortality. Therefore, it is unclear whether PC is beneficial in patients presenting with mild or moderately severe disease at admission yet unresponsive to conservative treatment. Since LOS is a marker of the time to clinical improvement, it is interesting to note that the most deleterious effect on LOS was observed among patients with moderately severe disease who underwent PC. This raises the question as to whether surgery should be performed during the hospitalization of patients with moderately severe disease who do not respond to antibiotic therapy.

Of importance, as in other studies published [9]; patients who underwent PC had more severe illness, as assessed by the ASA score, clinical status, and laboratory tests. Therefore, it is hard to distinguish the actual association of the PC drainage procedure with LOS; this is a challenge that could not be resolved in the current study.

This study has a number of limitations. Elective cholecystectomy was performed in fewer than 50% of patients. Interestingly, the performance of this procedure was similar between patients who did and did not undergo PC; this concurs with a previous report [17]. Several explanations are possible for this finding: patients may have chosen not to return for elective cholecystectomy, or they may have undergone cholecystectomy in a different medical center, from which data could not be collected, leading to a misleadingly low rate of cholecystectomy in our sample. We decided not to examine surgery duration and complications due to the small sample size.

As a retrospective study, the possibility of selection bias is always present, and difficult to assess accurately. Additionally, our sample size was relatively small, which may reduce the accuracy of our regression models. These difficulties may be remedied with a large-sample, prospective, randomized trial of the effects of the PC procedure.

In conclusion, this study found that percutaneous cholecystostomy in patients with acute calculus cholecystitis is associated with worse prognosis, longer hospitalization periods, and higher 30-day and one-year mortality. Additionally, older age and higher ASA score were associated with multiple measures of adverse outcomes in acute cholecystitis patients. Despite the limitations of this study, the findings suggest that percutaneous cholecystostomy should be reserved only for very high-risk patients who are not candidates for surgery. Patients who are candidates for surgery may have better prognosis if they do not undergo percutaneous cholecystostomy but will be scheduled immediately or even after failure of conservative treatment to laparoscopic cholecystectomy.

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