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Trends in parastomal hernia repair in the United States: a 14-y review

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ABSTRACT

Background: Parastomal hernia is the most common complication after stoma creation. Parastomal hernias can create significant morbidity, including patient discomfort, small bowel obstruction, and need for emergency surgery. We examined national trends in parastomal hernia repair (PHR) including annual frequency of procedure, patient characteristics, and same-admission complications.

Materials and methods: The 1998-2011 Nationwide Inpatient Sample was used to identify patients who underwent a PHR (International Classification of Disease, Ninth Edition, Procedure Code [ICD-9 PR] 46.42). PHRs were classified as PHR with concurrent resiting (ICD-9 PR 46.43), PHR with concurrent ostomy reversal (ICD-9 PR 46.52 or 46.51), or primary PHR. Patient characteristics were collected. Complications, length of stay, cost and inpatient mortality were identified.

Results: The estimated number of annual PHRs increased from 4150 to 7623 ($P \leq 0.01$) for a total of 73,393 repairs. Thirty percent underwent a concurrent stoma reversal and 10% underwent a resiting. There was an upward trend in number of patients with ≥3 Elixhauser comorbidities (17%-44%, $P < 0.01$). Length of stay remained steady, with a median of 6.3 d and in-hospital annual mortality ranged from 1.8% to 3.9%. Mortality and emergency admission status were highest for patients who underwent primary PHR.

Conclusions: The incidence of PHR nationwide is increasing and more than half of patients undergo primary repair. Although the surgical focus has moved toward prevention, parastomal hernia is a persistent complication of stoma creation. Further exploration is warranted to determine contributing factors to the observed increase in PHR and changes in surgical technique.

Introduction

A parastomal hernia is the most common complication after stoma creation, occurring in up to 48% of ostomies depending on type of ostomy created.[1] Parastomal hernias can create significant morbidity, including patient discomfort, small bowel obstruction, and incarceration with the need for emergency surgery.[2,3] They are notoriously difficult to repair

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and no surgical repair option is without significant recurrence rates.[4]

Some literature has suggested there may be an increase in parastomal hernias due to the increased use of laparoscopy for stoma creation.[5] In addition, obesity is a strong risk factor for hernia after surgical intervention[6] and as obesity rates continue to rise this may result in increased rates of parastomal hernia.

However, little is known about the rates and techniques of parastomal hernia repair (PHR). We examined recent national trends in PHR in this study, including frequency of procedure, patient characteristics, and same-admission complications. We hypothesized that rates of PHR were increasing over time and the incidence of resiting was decreasing.

Material and methods

The 1998-2011 Nationwide Inpatient Sample (NIS) from the Healthcare Cost and Utilization Project (HCUP) was used to identify patients aged ≥18 y undergoing PHR. The NIS is a database used to estimate national hospital inpatient characteristics. It was developed as part of HCUP as one of many databases and software tools to analyze patient outcomes at a national level.[7] This study was exempt from institutional review board approval because NIS is publicly available and does not contain any personal identifying information.

We identified all patients aged ≥18 y who underwent a PHR defined by the presence of the International Classification of Disease, Ninth Edition Procedure Code (ICD-9-PR) 46.42 in any of the procedure fields. We included ostomy reversal and ostomy resiting. All additional procedures performed on the same day as the PHR were identified. The HCUP surgery flag software was then applied to the additional procedures and classified as surgery (narrow flag applied), procedures (broad flag applied) or none (neither flag applied).

Patients undergoing PHRs were grouped into three categories—patients who had a primary PHR (with or without mesh), patients who had a PHR with concurrent ostomy reversal (ICD-9-PR 46.52 or 46.51), and patients who had a PHR with stoma resiting (ICD-9-PR 46.51) based on additional procedure codes performed on the same day.

Patient data including age, race, sex and type of insurance were collected and analyzed. A comorbidity index was calculated using the Elixhauser method.[8] Emergency admissions were identified based on admission type as defined in the NIS database. We identified possible complications of the procedure by examining ICD-9 diagnosis codes (using complication codes identified by Santry *et al.*).[9] Inpatient mortality, length of stay (LOS), and hospital characteristics were also examined. The total cost of inpatient care for each patient was estimated by multiplying the total charge by all-payer inpatient cost to charge ratio when available and by group average all-payer inpatient cost to charge ratio otherwise. We adjusted the estimated cost for inflation using the price indexes for the Gross Domestic Product from the US Department of Commerce Bureau of Economic Analysis using 2010 as the index base. Annual values for the price index starting in 2001 were obtained on February 6, 2015.

Our primary outcome of interest was the number and types of PHRs performed each year from 1998 to 2011 in the United States. Secondary outcomes of interest were patient characteristics, complications, and LOS. Frequencies of these outcomes were calculated by year and sampling weights provided by the NIS were used to estimate yearly frequencies. Data analysis and statistics were performed with SAS Enterprise Guide version 6.1 (SAS 9.4; SAS Institute, Cary, NC) and with STATA v14.2 (StataCorp, College Station, TX). Comparisons between two groups were performed using the Chi-square analysis for categorical variables and the Student's *t*-test for continuous variables. Linear regression analysis was used to determine the significance of time trends.

Logistic regression was used to examine predictors of mortality, both in univariate and multivariable analyses. For all analyses, a *P* value of <0.05 was considered significantly.

Results

Overall study cohort characteristics

From 1998 to 2011, the estimated number of PHRs performed annually in the United States increased from 4150 to 7623 ($P < 0.01$, coefficient = 230, $R^2 = 0.85$, Fig. 1) for a total of 73,393 repairs. Of these, 30% underwent a concurrent stoma reversal and 10% underwent a repair with resiting (Fig. 2). Most patients were female, their mean age was 66 y, and over one-third of patients had ≥3 comorbidities (Table 1). Overall, 20% were emergency admissions. Patients with private insurance were significantly less likely to have an emergency admission (14% *versus* 23%, $P < 0.01$), but this difference was not significant when comparing insured (Medicare + private insurance) to the underinsured (Medicaid + self-pay, 23% *versus* 20%, $P = 0.08$). Most cases were performed in urban hospitals and almost half were performed in teaching hospitals. The most common principle diagnoses are listed in Table 2 and concurrent procedures are listed in Table 3. The most frequent postoperative complication was acute renal failure (Table 4). Inpatient mortality was 2.7% and the median LOS was 6.3 d. The inflation-adjusted median cost of care for each hospitalization was $14,533.

Trends over time

Over the 14-y study time, the proportion of females undergoing PHR remained steady (59%). The proportion of parastomal repairs with resiting decreased from 17% in 1998 to 7% in 2011 ($P < 0.01$, Fig. 2). The proportion of parastomal repairs with reversal increased from 24% in 1998 to 35% in 2011 ($P < 0.01$, Fig. 2). The increase in reversal was seen primarily in non-emergent PHRs. The proportion of privately insured patients was stable over the period (26%-31%, $P = 0.10$). However, the number of patients with ≥3 Elixhauser comorbidities increased (17%-44%, $P < 0.01$, Fig. 3), and mortality significantly decreased (Table 5, Fig. 3). The percent of emergency admissions was not significantly different over the time period (16%-18%, $P = 0.15$), but these patients were more likely to get a primary repair rather than a resiting during the later years of the study. The proportion of patients treated in urban hospitals and teaching hospitals increased over the study time period ($P < 0.01$ for both, Table 5).