

ORIGINAL ARTICLE

The impact of recent hospitalization on surgical site infection after a pancreatectomy

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Abstract

Background: Surgical site infections (SSI) are a major cause of increased morbidity and cost after a pancreatectomy. Patients undergoing a pancreatectomy frequently have had recent inpatient hospital admissions *prior* to their surgical admission (recent pre-surgical admission, RPSA), which could increase the risk of SSI.

Methods: The 2009–2011 Healthcare Cost Utilization Project California State Inpatient Database was used. Chi-square tests, Student's *t*-tests and multivariable logistic regression were used.

Results: Three thousand three hundred and seventy-six patients underwent a pancreatectomy, and 444 (13.2%) had RPSA. One hundred and eighty (40.5%) RPSAs were to *different* hospitals other than where patients' pancreatectomy took place. In univariate analysis, patients with RPSA had a significantly higher rate of post-operative SSIs, and this was associated with a longer length of post-operative stay, higher post-operative hospital costs and increased postoperative 30-day readmission rates (Table 1). In Multivariate analysis, RPSA was an independent predictor of post-operative SSI [odds ratio (OR) = 1.68, *P* = 0.013], and the risk of SSI increased with increasing RPSA length of stay (OR = 1.07 per day, *P* = 0.001).

Conclusions: Recent pre-surgical admission is an important risk factor for SSI after a pancreatectomy. Many patients with RPSA are not admitted pre-operatively to the same hospital where the pancreatectomy occurs; in such circumstances, SSI rates may not be a sole reflection of the care provided by operating hospitals.

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Background

Surgical Site Infections (SSI) are a major cause of increased cost and morbidity after a pancreatectomy.¹ SSI after a major hepatopancreatobiliary (HPB) operation increases hospital costs by an average of \$11 462 per event.² In addition, SSIs are considered a hospital-acquired condition and are being used as a quality metric for patient care. Hospitals currently receive financial penalties for high rates of SSI after certain types of surgery, such as coronary artery bypass, and it is likely that these penalties will be extended to other types of operations in the coming years. Furthermore, complications such as SSI can

delay adjuvant therapy after oncological surgery, which could ultimately impact on survival.³

Risk factors for post-operative SSI can be divided into patient- and procedure-related.⁴ Many of these risk factors are targeted by methods such as the Surgical Care Improvement Program (SCIP) as well as through patient medical optimization.⁵ However, patients undergoing a pancreatectomy frequently have had recent inpatient hospital admissions prior to their surgical admissions (recent pre-surgical admission, RPSA), which could also increase the risk of post-operative SSI. Recently, hospitalized patients are more likely to be colonized by antibiotic resistant, virulent bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA), which can predispose patients to infections.⁶ In addition, hospitalized patients are more likely to receive interventions which can

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Table 1 Characteristics of pancreatotomy patients with and without recent pre-surgical admission (RPSA) (*n* = 3376)

Characteristic	No. (Column %) or Mean (SD)		P-value
	No RPSA (<i>n</i> = 2932, 86.9%)	RPSA (<i>n</i> = 444, 13.2%)	
Age, year	63.5 (12.8)	64.3 (12.2)	0.210
Gender			
Male	1429 (48.9%)	240 (54.1%)	0.108
Female	1476 (50.3%)	201 (45.3%)	
Missing	27 (0.9%)	<11 ^a	
Race			
White	1751 (59.7%)	234 (52.7%)	0.005
Non-white	1181 (40.3%)	210 (47.3%)	
Comorbidities			
Congestive heart failure	89 (3.0%)	17 (3.8%)	0.372
Chronic lung disease	341 (11.6%)	54 (12.2%)	0.745
Diabetes	669 (22.8%)	124 (27.9%)	0.179
Chronic renal failure	154 (5.3%)	30 (6.8%)	0.193
Chronic pancreatitis	285 (9.7%)	60 (13.5%)	0.014
Obesity	274 (9.4%)	34 (7.7%)	0.250
Weight loss	325 (11.1%)	83 (18.7%)	<0.001
Liver disease	167 (5.7%)	20 (4.5%)	0.307
Alcohol abuse	108 (3.7%)	16 (3.6%)	0.934
Median state income quartile ^b			
1 st quartile	484 (16.5%)	122 (27.5%)	<0.001
2 nd quartile	632 (21.6%)	96 (21.6%)	
3 rd quartile	824 (28.1%)	109 (24.6%)	
4 th quartile	935 (31.9%)	107 (24.1%)	
Missing	57 (1.9%)	<11 ^a	
Pancreatotomy type			
Whipple	1944 (66.3%)	380 (85.6%)	<0.001
Total	102 (3.5%)	18 (4.1%)	
Distal	886 (30.2%)	46 (10.4%)	
Diagnosis			
Malignant	1972 (67.3%)	360 (81.1%)	<0.001
Benign	960 (32.7%)	84 (18.9%)	
Biliary obstruction	506 (17.3%)	136 (30.6%)	<0.001
Surgical admission preoperative length of stay, day	1.4 (4.4)	1.7 (4.7)	0.132

Table 1 Continued

Characteristic	No. (Column %) or Mean (SD)		P-value
	No RPSA (<i>n</i> = 2932, 86.9%)	RPSA (<i>n</i> = 444, 13.2%)	
Hospital pancreatotomy volume quartile			
1 st quartile (<26 patients)	738 (25.2%)	133 (30.0%)	0.0724
2 nd & 3 rd quartile (26–149 patients)	1504 (51.3%)	206 (46.4%)	
4 th quartile (>149 patients)	690 (23.5%)	105 (23.7%)	

^aCells with fewer than 11 patients per variable are relabelled as '<11' in compliance with the HCUP data use agreement.

^bMedian State Income Quartiles are calculated by HCUP using the patient's zip code and the state of California's income data.

predispose to infection, such biliary stenting^{7,8} and a blood transfusion.⁹ The aim of this study was to examine whether patients who are hospitalized within 30 days prior to surgery for any reason are at a higher risk of post-operative SSI after a pancreatotomy.

Patients and methods

Study design and patient population

This study was a retrospective cohort study using the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization (HCUP) State Inpatient Database (SID)¹⁰ for California from 2009 to 2011 to identify patients undergoing a pancreaticoduodenectomy [International Classification of Diseases, Ninth Revision, Clinical Modification (ICD9-CM) procedure codes: 52.51 and 52.7], a total pancreatotomy (ICD9-CM procedure code: 52.6) and a distal pancreatotomy (ICD9-CM procedure codes: 52.52). Variables are included in this database to track sequential visits for a patient within a state and across facilities and hospital settings. These variables include a person-level identifier (VisitLink) and a timing variable (DaysTo-Event) which can be used to determine the days between hospital events for a patient. Using this approach, patients were identified with admission to any hospital from 1 to 30 days before their surgical admission and from 1 to 30 days post-surgical discharge. For simplicity, only the last admission prior to surgery and the first readmission after surgery were considered. RPSA was defined as inpatient stays > 48h with a date of discharge within 30 days prior to admission for a pancreatotomy. Patients under the age of 18 years and patients with missing VisitLink or DaysToEvent variables were excluded. Also excluded were patients who underwent hospital-to-hospital transfer for a pancreatotomy (*n* = 159) as this was thought to represent a separate phenomenon from RPSA.

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