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# The impact of unplanned conversion to an open procedure during minimally invasive pancreatotomy



Zachary E. Stiles, DO,<sup>a</sup> Paxton V. Dickson, MD,<sup>a</sup> Jeremiah L. Deneve, DO,<sup>a</sup>  
Evan S. Glazer, MD PhD,<sup>a</sup> Lei Dong, MS,<sup>a</sup> Jim Y. Wan, PhD,<sup>b</sup>  
and Stephen W. Behrman, MD<sup>a,\*</sup>

<sup>a</sup> Division of Surgical Oncology, Department of Surgery, University of Tennessee Health Science Center, Memphis, Tennessee

<sup>b</sup> Division of Biostatistics, Department of Preventive Medicine, University of Tennessee Health Science Center, Memphis, Tennessee

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## ABSTRACT

**Background:** Minimally invasive pancreatic resection (MIPR) is being increasingly utilized. Outcomes for patients experiencing unplanned conversion to an open procedure during MIPR have been incompletely assessed. We sought to determine the short-term outcomes and factors associated with unplanned conversion during MIPR.

**Methods:** A retrospective cohort study using the American College of Surgeons National Surgical Quality Improvement Program pancreatotomy-targeted data set was conducted. Successful MIPR was compared with unplanned conversion. Propensity matching was used to separately compare unplanned conversion during MIPR with planned open pancreatotomy.

**Results:** Unplanned conversion occurred in 24.6% of 350 attempted minimally invasive pancreatoduodenectomy (MIPD) and 19.6% of 1174 attempted minimally invasive distal pancreatotomy (MIDP). Conversion was associated with greater overall morbidity and 30-day mortality compared with successful MIPR for both MIPD and MIDP. After matching, unplanned conversion resulted in outcomes equivalent or inferior to open pancreatotomy. Factors significantly associated with unplanned conversion during MIPD included intermediate gland texture, vascular resection, hypertension, disseminated cancer, and chronic steroid use. For MIDP, male sex, hard gland texture, vascular resection, smoking, and recent weight loss were independently associated with conversion. A robotic approach was inversely associated with conversion for MIPD and MIDP.

**Conclusions:** Unplanned conversion during MIPR is associated with greater morbidity and 30-day mortality. Conversion resulted in outcomes that, at best, mimicked those of open

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\* Corresponding author. Professor of Surgery, Division of Surgical Oncology, University of Tennessee Health Science Center, 910 Madison Avenue, 2nd Floor, Memphis, TN, 38163. Tel.: +1 901 448 7635; fax: +1 901 448 7306.

E-mail address: [sbehrman@uthsc.edu](mailto:sbehrman@uthsc.edu) (S.W. Behrman).

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pancreatectomy. Several risk factors including the need for vascular resection are associated with unplanned conversion and should be acknowledged when planning an operative approach.

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## Introduction

Minimally invasive pancreatic resection (MIPR) has been increasingly used in recent years.<sup>1-5</sup> Although initial experience focused on distal resection,<sup>6</sup> the feasibility of more complex procedures such as laparoscopic and robotic pancreatoduodenectomy has since been introduced at specialized centers.<sup>3,7-9</sup> Overall, outcomes for MIPR have proven to be noninferior to open resection in high-volume centers,<sup>10-15</sup> and a recent survey revealed that many surgeons feel MIPR is ultimately beneficial in properly selected patients.<sup>6</sup>

Published rates of conversion to an open procedure during MIPR have varied from 1.7% to 15% for minimally invasive pancreatoduodenectomy (MIPD) and 0% to 30% for minimally invasive distal pancreatectomy (MIDP).<sup>4,16-22</sup> Arguably, conversion to an open procedure during MIPR should not be considered a complication itself,<sup>23</sup> yet very little is known regarding the outcomes for patients who experience unanticipated conversion. The factors predictive of unplanned conversion during MIPD that may be used to guide patient selection remain incompletely defined while emerging data related to distal pancreatectomy suggests that there may be patient- and pathologic-related factors that would aid in proper selection of an operative approach.<sup>24</sup>

The present study intends to compare patients experiencing unplanned conversion during MIPR to those undergoing successfully completed minimally invasive resection. We hypothesized that conversion would result in inferior postoperative outcomes and that there may be operation and patient-specific factors predictive of unplanned conversion. Finally, we compared unsuccessful MIPR to planned open resection to determine if intraoperative conversion results in outcomes inferior to a planned, open pancreatectomy.

## Materials and methods

### Data source

The 2014 and 2015 American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) participant user file (PUF) and the ACS-NSQIP pancreatectomy procedure-targeted data set was used.<sup>25,26</sup> The ACS-NSQIP is a validated and audited national database which tracks perioperative outcomes from a wide variety of surgical procedures performed at over 600 participating institutions nationwide. Patient-specific data are collected regarding demographics, preoperative comorbidities, and diagnostic indications (International Classification of Diseases code). Operation-specific variables are registered including information regarding the procedure performed (based on Current Procedural Terminology [CPT] codes). Thirty-day outcomes reported include length of stay (LOS), need for reoperation, NSQIP-defined

complications, and mortality. The pancreatectomy procedure-targeted data set captures additional variables unique to these procedures as previously defined.<sup>27</sup> As the data captured by the ACS-NSQIP is de-identified, this study was deemed exempt by the University of Tennessee Health Science Center institutional review board.

### Patient selection

The 2014 and 2015 pancreatectomy procedure-targeted data sets were merged with the corresponding general ACS-NSQIP PUFs and queried for cases of proximal (i.e., Whipple-type procedures; CPT codes “48150”, “48152”, “48153”, and “48154”) and distal (CPT codes “48140”, “48145”, and “48146”) pancreatic resections. Total pancreatectomy (CPT code “48155”) and other types of resection were excluded, as were emergent or nonelective cases and patients classified as American Society of Anesthesiologists Class 5 or described as having preoperative “sepsis”, “septic shock”, or “systemic inflammatory response syndrome”. After categorizing by operative approach, patients undergoing attempted MIPD and MIDP were selected and then divided into those who underwent successful MIPR and those experiencing unplanned conversion. A flow diagram detailing case selection is shown in [Figure](#).

### Comparison with successful MIPR—outcomes

Patients undergoing successful MIDP or MIPD (laparoscopic or robotic) were compared with patients identified as experiencing “unplanned conversion” during MIPD or distal pancreatectomy. Outcomes of interest included operative time, LOS, need for invasive intervention (i.e., percutaneous drainage or reoperation), the incidence of complications reported by the ACS-NSQIP, and 30-day mortality.

### Analysis of perioperative and patient-specific variables

Patient-specific and perioperative factors were assessed to determine their association with the occurrence of unplanned conversion during MIPR. This included demographic data, pre-existing comorbid conditions, indications for resection (malignant versus benign), presence of jaundice, preoperative biliary stenting, and the use of neoadjuvant chemotherapy and/or radiation. The need for vascular resection as well as gland texture and duct size was also evaluated. Patient/operation-specific factors approaching significance on univariate analysis ( $P < 0.15$ ) were entered into a multivariable analysis to determine variables predictive of unplanned conversion.

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