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A policy of omitting an intensive care unit stay after robotic pancreaticoduodenectomy is safe and cost-effective

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ABSTRACT

Background: Immediate postoperative admission to the intensive care unit (ICU) after pancreaticoduodenectomy (PD) is still a standard practice at many institutions. Our aim was to examine whether omission of an immediate postoperative ICU admission would be safe and result in improved outcomes and cost after robotic pancreaticoduodenectomy (RPD).

Methods: In December 2014, a non-ICU admission policy was implemented for patients undergoing RPD. Before this date, all RPDs were routinely admitted to the ICU on post operative day = 0. Using a prospective database, outcomes of the patients in the no-ICU cohort were compared with those of the patients routinely admitted to the ICU before implementation of this policy.

Results: The ICU ($n = 49$) and no-ICU cohorts ($n = 47$) were comparable in age, gender, body mass index, Charlson comorbidity index and American Society of Anesthesiologists scores, receipt of neoadjuvant therapy, operative time, estimated blood loss, tumor size, and pathologic diagnosis (all P values = NS). Clavien complications, pancreatic leak, reoperation, readmission, and mortality were similar between both the groups (all P values = NS). Hospital length of stay (LOS) was shorter for the no-ICU group (median 6.8 *versus* 7.7 d, $P = 0.01$). This reduced LOS and omission of routine postoperative ICU admission translated into a cost reduction from $23,933 (interquartile range $19,833-$28,991) in the ICU group to $19,516 (interquartile range $17,046-$23,893) in the no-ICU group, $P = 0.004$. The reduction in LOS and cost remained significant after adjusting for all related demographics and perioperative characteristics.

Conclusions: A standard policy of omitting a postoperative ICU admission on post operative day 0 after RPD is safe and can result in reduced LOS and overall savings in total hospital cost.

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Introduction

Pancreaticoduodenectomy (PD) is arguably one of the most complex abdominal surgical procedures performed today. Although advances in surgical technique and postoperative care have contributed to improved outcomes, the extensive dissection and intricate restoration of digestive continuity are still associated with a morbidity that approaches 50% even at high-volume centers. "Enhanced recovery after surgery (ERAS) protocols have emerged to provide comprehensive and evidence-based guidelines for improved perioperative care.[1] The advent of these protocols in pancreatic surgery has led to decreased hospital length of stay (LOS) without compromising outcomes".[2-6]

"Despite the implementation of ERAS pathways," routine intensive care unit (ICU) admission after PD remains common practice at many institutions today. A paucity of data exists to support this practice, particularly in view of accumulating evidence suggesting that routine ICU admission after other major procedures is not associated with improved patient outcomes.[7,8] In one of the few reports available, Bentrem *et al.* determined that most patients who undergo PD do not require admission to the ICU.[9] Although this group identified independent predictors of needing an immediate postoperative ICU admission after PD, they did not assess the downstream beneficial effects of omitting an ICU admission on patient outcomes and cost.

Based on the accumulating evidence that routine ICU admission can be omitted after major surgery and the coupled need to improve outcomes and reduce cost, our pancreatobiliary (PB) service recently implemented a No-ICU admission policy after PDs. Because most PDs (>90%) on this service are approached using the robotic platform, we sought to evaluate the impact of this policy on outcomes and cost of robotic pancreaticoduodenectomy (RPD). The aim of this project, therefore, was to examine whether omission of an immediate postoperative ICU admission (on post operative day [POD] zero) would be safe and result in decreased hospital LOS and reduced cost for patients undergoing RPD.

Methods

Study conception and patient selection

In December 2014, the PB service at the University of Pittsburgh Medical Center (UPMC) implemented a "No-ICU" admission policy after all standard PDs. Before that policy, all PDs were routinely admitted to the ICU on POD = 0 for close observation. This study is an analysis of outcomes of all consecutive patients who underwent RPD after this policy implementation ("no-ICU" group = January 2015-October 2015) compared with a prepolicy cohort of consecutive RPDs routinely admitted to the ICU within the prior year (ICU group = January 2014-December 2014). Although the "No-ICU" policy was intended for open and robotic PDs alike, this study only focuses on RPDs because they account for >90% of PDs performed by this PB service. Approval from the University of Pittsburgh Institutional Review Board was obtained.

Standard RPD was defined before the time of policy implementation as 1—not requiring vascular resection and reconstruction (these RPDs were exempt from this policy and are admitted to the ICU postoperatively for close observation) and 2—performed by one of the three PB service attending physicians (H.J.Z., M.E.H., and A.H.Z.) all of which have surpassed the RPD learning curve benchmark identified previously by our group.[10] RPDs performed by other surgeons in the UPMC health care system were excluded because these constitute a minority of all RPDs performed (<4%) and represent outcomes of surgeons still within their robotic learning curve. Importantly, any standard RPD destined for floor recovery (after policy implementation) but admitted to the ICU on POD = 0 due to "unexpected intraoperative events and/or surgeon discretion," was grouped and analyzed with the "no-ICU" cohort on an intent-to-treat basis.

All three surgeons on the PB service perform the RPD in similar fashion, using similar reconstructive methods including a duct-to-mucosa modified Blumgart pancreaticojejunostomy and an antecolic gastro/duodenojejunostomy.[11] In addition, drains are used in all cases, and a policy of early drain removal is used (drain removal on POD 3-4). Octreotide is not routinely used in the prophylaxis of postoperative pancreatic fistulae. The patients were managed on the same service covered by a fellow and midlevel nurse and/or physician assistant. In this manner, bias related to case selection, operative technique, and patient management was minimized.

Patient demographics and definitions

Data were collected retrospectively from a prospectively maintained database. Patient demographics included age, gender, Charlson comorbidity index (CCI) score, body mass index (BMI), American Society of Anesthesiologists (ASA) score, and receipt of neoadjuvant therapy. Operative data included operative time (OT), estimated blood loss (EBL), and pathologic tumor characteristics. LOS was calculated from the date of procedure until the date of discharge. Subsequent ICU admission was defined as the transfer of a patient (during the index RPD admission) from the surgical floor to the ICU regardless of initial POD0 disposition. Perioperative morbidity was scored according to the Clavien–Dindo (minor complications = 1 + 2, major complications = 3 + 4) classification.[12] Postoperative pancreatic fistulae were defined and categorized according to the International Study Group on Pancreatic Fistula classification.[13] All procedural outcomes were followed up to 90 days.

Cost analysis

Detailed costs for each patient were obtained from the proprietary UPMC Cost Management System with assistance from the finance department at UPMC. The Cost Management System is structured on an activity-based costing model where costs are allocated to patients based on the amount of resources consumed. Cost data were determined for the index admission and any readmissions within 90 d. Costs are represented by the expense categories of drugs, blood, supplies, salaries and benefits, depreciation, unit operating, and unit