Conversion of Robotic Pancreaticoduodenectomy to Open Resection

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Background

- Research on robotic approach for pancreaticoduodenectomy (PD) has been limited to Academic Comprehensive Cancer Programs but has demonstrated adequate tumor and lymph node resection, safety, and feasibility.
- Little data exists focusing on patient selection for robotic approach and intra-operative conversion from robotic to open (and the costs associated).

This study focuses on a series of PDs booked as robotic at an Integrated Network Cancer Program (INCP) and subsequent completion of robotic versus conversion to open.

Methods

- All PDs booked robotically (performed by two primary attending surgeons with assistance of residents) were examined since the institution of our robotic hepatopancreatobiliary program (2014-2020) at an INCP not associated with an academic center.
- Completed cases requiring conversion to open were compared to those remaining robotic using Student's t-test, Mann-Whitney U-test, Fisher's Exact Test, and Pearson's Chi-Square.

Results

- 118 patients were booked for robotic PD.
- Eight cases were aborted – either for metastatic disease or unresectable tumors (see Figure 1).
- Twenty cases were converted to open (Figure 2).
- Of cases which were completed, there was no significant difference in patient factors amongst those cases who were converted to open and those that remained robotic (see Table 1).
    - However, patients requiring conversion to open appeared to have a higher weight than those who did not.
- There was no significant difference in conversion to open rate by year (Figure 3).
- There was a significant difference in conversion to open rates by operating surgeon.

Figure 1: Reason for Case Abortion

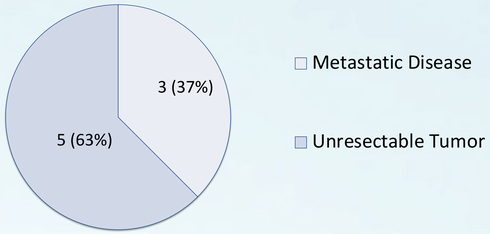


Figure 2: Reason for Conversion to Open

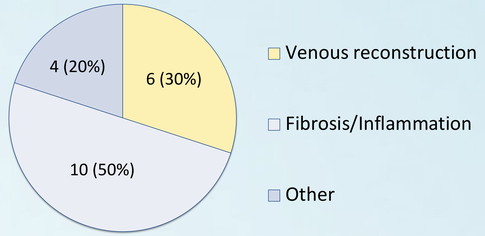
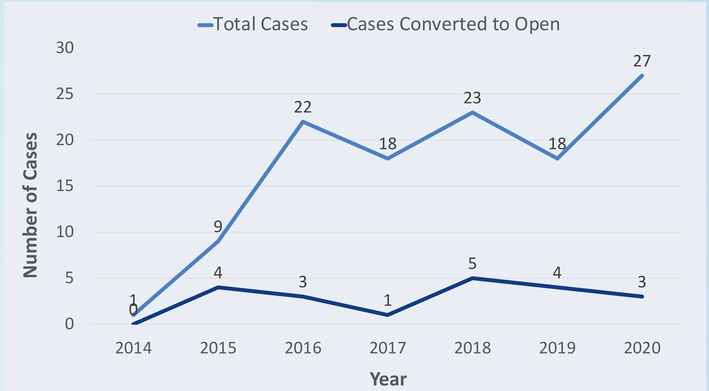


Table 1: Patient Factors of Patients Remaining Robotic vs. Converted to Open

	All Subjects (n=110)	Remained Robotic (n=92)	Converted to Open (n=18)	p-value
Age, years (Mean, SD)	64.95 (11.190)	65.1 (11.0)	64.3 (12.3)	0.675*
Height, inches (Median, IQR)	67.8 (64.0-71.0)	67.0 (64.0-70.9)	69.0 (65.5-72.0)	0.128**
Weight, pounds (Median, IQR)	178.5 (154.8-200.0)	175 (153.3-198.5)	190 (159.0-216.3)	0.240**
BMI, kg/m^2 (Median, IQR)	26.5 (23.9-30.5)	26.2 (23.8-31.4)	26.8 (24.7-29.5)	0.710**
Male (N, % of total)	66 (60.0 %)	53 (57.6%)	13 (72.2%)	0.187‡
Pre-Op ASA				0.098‡
2 (N, %)	31 (28.2%)	26 (28.3%)	5 (27.8%)	
3 (N, %)	69 (62.7%)	60 (65.2%)	9 (50.0%)	
4 (N, %)	10 (9.1%)	6 (6.5%)	4 (22.2%)	
Pre-Op Chemo (N, %)	33 (30%)	29 (31.5%)	4 (22.2%)	0.314‡
Pre-Op Radiation (N, %)	11 (10.0%)	8 (8.7%)	3 (16.7%)	0.258‡
Indication				0.775‡
Pancreatic adenocarcinoma (N, %)	51 (46.4%)	43 (46.7%)	8 (44.4%)	
Duodenal/ampullary tumor (N, %)	25 (22.7%)	22 (23.9%)	2 (11.1%)	
IPMN (N, %)	19 (17.3%)	16 (17.4%)	3 (16.7%)	
Pancreatic NET (N, %)	5 (4.5%)	3 (3.3%)	2 (11.1%)	
Cholangiocarcinoma (N, %)	5 (4.5%)	4 (4.3%)	1 (5.6%)	
Other (N, %)	5 (4.5%)	4 (4.3%)	1 (5.6%)	
Surgeon				0.011‡
Surgeon 1 (N, %)	74 (68.5%)	68 (73.9%)	6 (37.5%)	
Surgeon 2 (N, %)	26 (24.1%)	17 (18.5%)	9 (56.3%)	
Surgeon 1 & 2 (N, %)	6 (5.6%)	5 (5.4%)	1 (6.3%)	

* Student's t-test; ** Mann-Whitney U-test; ‡ Pearson Chi-Square

Figure 3: Total Cases and Conversion to Open Over Time



Conclusions

Patient factors including age, general health status (ASA), weight, BMI, indication for PD, history of chemotherapy or radiation do not predict conversion from robotic to open PD.

- Previous studies have demonstrated significant learning curve with all robotic surgery. This study confirms that more experience with robotic PD leads to fewer conversions to open.
- This study suggests that many patients may be candidates for robotic PD in the hands of an experienced robotic HPB surgeon.
- More investigation is needed to understand possible effect of weight on conversion rate.
- Those patients who may require vein reconstruction due to close proximity of tumor to vessels (borderline resectable tumors) and those patients with previous pancreatitis or significant fibrosis and inflammation may not be ideal candidates for robotic PD.