The Association between Minimally Invasive Gastrointestinal Cancer Surgery and Readmissions due to Venous Thromboembolism.

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Introduction

Postoperative venous thromboembolism (VTE) is a leading cause of 30-day mortality following major cancer surgery.[1] Approximately 2% of patients undergoing cancer surgery develop deep vein thrombosis (DVT) or pulmonary embolism (PE), and up to 50% of immediate postoperative mortality is attributable to VTE.[1,2] Overall VTE is significantly more likely after gastrointestinal, lung, prostate, and ovarian/uterine cancer operations, and of those experiencing a VTE, mortality increased over 6-fold.[3] In addition to the increased health care costs, readmissions may result in poorer outcomes for patients, especially when readmissions are to a hospital different from the hospital where the surgery was performed (non-index hospitals). Minimally invasive surgery (MIS) for gastrointestinal (GI) problems has resulted in reduced perioperative morbidity, enhanced postoperative recovery, and better cosmetic outcomes compared with open surgery.[4] Data on readmissions due to VTE after GI cancer surgery is limited, especially data comparing the difference seen in patients undergoing open vs. laparoscopic procedures. Laparoscopic surgery is associated with a lower incidence of venous thromboembolism compared with open surgery.[5] Laparoscopic surgery has shown to result in fewer VTE readmissions after surgery for gynecologic malignancies.[6] We aimed to determine the association between surgical approach and readmissions from VTE for patients undergoing gastrointestinal (GI) cancer surgery.

Methods

We performed secondary analysis of the 2016 Health Care Utilization Project- Nationwide Readmissions Database (NRD).[7] We selected all adult patients (age ≥18 years), undergoing complex cancer operations from January 1, 2016 to September 30, 2016. This allowed for all patients to have a minimum 90-day follow-up period. All adult patients undergoing complex GI cancer surgery for a corresponding cancer diagnosis were identified using International Classification of Diseases, Tenth Revision, Procedure Coding System codes and were classified into an open surgery or MIS group. Complex GI cancer surgeries were characterized as colectomy, esophagectomy, gastrectomy, liver/biliary resection, pancreatectomy, and proctectomy. Readmissions with a primary cause of acute deep vein thrombosis (DVT) and/or Pulmonary embolism (PE) were analyzed. Patients with chronic VTE diagnoses listed or prior admission were removed. Figure 1 shows the patient selection process. Differences in 90-day VTE admission rates were compared between the two groups and then also separately for each procedure using multivariable logistic regression models. All models adjusted for patient and hospital characteristics. A p-value of less than 0.5 was considered significant.

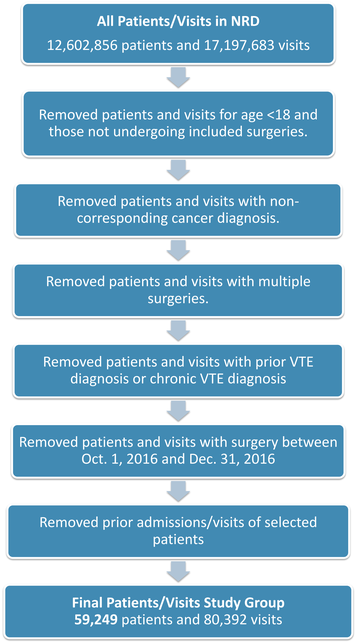


Figure 1: Patient selection

Results

Of the 60,327 patients included in the study, 27,874 (46.2%) underwent MIS and 32,453 (53.7%) underwent Open procedures. MIS patients were more likely to be electively admitted, younger, have less comorbid conditions, and less disease severity (all p<0.05). Open procedures had a higher rate of major complications (27.1% versus 22.9%, p<0.001), longer median length of stay (6 versus 3 days, p<0.001) and higher in-hospital mortality (1.7% versus 0.6%, p=0.05) when compared to MIS ones. A total of 648 (1.09%) patients were readmitted within 90 days of surgery for VTE, of which 358 (0.60%) were readmitted for PE, and 290 (0.49%) for DVT. 90-day VTE readmission rates were 1.23% for open procedures, and 0.93% for MIS procedures (p =0.05). 90-day readmission rates by procedure are listed in Table 1.

Procedure	Number of Eligible Patients		90-day readmission due to VTE (%)	
	Laparoscopic	Open	Laparoscopic	Open
Esophagectomy	1033	1088	14 (1.36%)	19 (1.75%)
Gastrectomy	1874	2712	17 (0.91%)	34 (1.25%)
Liver/Billiary Resection	1038	3271	15 (1.45%)	38 (1.16%)
Pancreatectomy	1281	3186	22 (1.72%)	54 (1.69%)
Colectomy	17916	16894	154 (0.86%)	197 (1.17%)
Proctectomy	4423	4533	35 (0.79%)	49 (1.08%)
All Procedures Combined	27565	31684	257 (0.93%)	391 (1.23%)

Table 1: 90-day readmission rates by procedure

On multivariate analysis when all procedures were looked at combined, then laparoscopic surgeries were associated with a 34% lower chance of 90-day readmission. When looking at individual procedures, open colectomies were associated with a 36% higher chance of 90-day VTE readmissions (OR=1.36, 95% CI=1.10-1.68) when compared to MIS. We found no statistically significant difference in the rates for other procedures (Table 2).

Variable		Odds Ratio	95% CI	P value
All Procedures	Open	1 [Reference]	N/A	N/A
	Laparoscopic	0.66	(0.59-0.73)	<.001
Colectomy	Open	1 [Reference]	N/A	N/A
	Laparoscopic	0.74	(0.59-0.91)	0.004
Esophagectomy	Open	1 [Reference]	N/A	N/A
	Laparoscopic	0.78	(0.38-1.55)	0.47
Liver/Biliary Resection	Open	1 [Reference]	N/A	N/A
	Laparoscopic	1.26	(0.66-2.24)	0.47
Pancreatectomy	Open	1 [Reference]	N/A	N/A
	Laparoscopic	1.02	(0.60-1.66)	0.49
Proctectomy	Open	1 [Reference]	N/A	N/A
	Laparoscopic	0.73	(0.57-1.03)	0.05
Gastrectomy	Open	1 [Reference]	N/A	N/A
	Laparoscopic	0.72	(0.39-1.29)	0.26

Table 2: Multivariate Logistic Regression

Conclusions

In this risk adjusted analysis using a national dataset, we found no difference in VTE readmission rates between open and MIS GI cancer procedures except for colectomies. MIS procedures for most GI procedures had lower mortality rate, length of stay, and major complication rate.

Open procedures generally resulted in a higher number of VTE readmissions within 90 days when compared to laparoscopic procedures (1.23% vs 0.93%). One of main limitations of our study is that the NRD only tracks hospital admissions. Patients presenting with milder forms of VTE to clinics or other outpatient healthcare facilities were missed by our study. Furthermore, the NRD doesn't track the management of patients, so we could not determine the number of patients who were discharged on VTE prophylaxis or those who received VTE prophylaxis during their initial stay. These data should be considered when determining the surgical approach for patients with GI malignancies.

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