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Featured Article

A fast tract to foregut surgery: Pandemic-driven protocol development

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ABSTRACT

Background: COVID-19 has overwhelmed many health care systems which has affected the landscape of elective surgery. A pandemic driven protocol was developed to perform foregut surgeries as a Same Day Surgery (SDS) discharge for all comers to reduce resource utilization.

Methods: Retrospective review of all patients who underwent elective laparoscopic foregut surgery (hiatal hernia, paraesophageal hernia, heller myotomy, and fundoplication) from 8/1/2020–1/31/2022 by a single surgeon after the implementation of a SDS protocol. Patients were compared to a pre-pandemic cohort, from 8/1/2019–4/30/2020, when overnight admission was standard practice.

Results: There were 36 pre-pandemic patients, and 41 pandemic patients successfully discharged the same day of surgery. We failed to detect a statistically significant difference between the two groups regarding 30-day ED visit rate (p-value of 0.4557) and 30-day readmission rate (p-value of 0.6790).

Conclusion: The creation of a SDS protocol for foregut surgery is a safe way to deliver much needed care to the community while decreasing resource utilization.

1. Introduction

COVID-19 has overwhelmed many health care systems and altered the landscape of surgical practices world-wide. The healthcare economic repercussions from the COVID pandemic within the United States is immense, with the allocation of resources focused on preparation and management of designated COVID units and cessation of elective surgical cases. Studies have estimated greater than \$20 billion in revenue loss during the pandemic.¹ In the UK, guidelines and recommendations were created to decrease the burden on the overwhelmed health care system, prioritizing emergent and urgent cases to protect patients and workers alike. For a period, there was also a decrease in the use of laparoscopy and endoscopy to reduce the theoretical risk of aerosolization of the virus.^{2,3} Every health care system has been faced with the challenge of graduated introduction of elective procedures and surgeries base on acuity and length of hospital stay to limit hospital admissions during the pandemic.

Similarly, restrictions were placed on elective procedures to reduce the use of unnecessary resources and hospital admission at our institution. Cases were designated a level of priority with life or limb threatening cases taking precedence, followed by oncologic and life limiting cases. All other cases were deemed non-emergent or urgent and thus postponed, which included all laparoscopic foregut surgeries (hiatal

hernia repair, paraesophageal hernia repair, Heller myotomy, and antireflux fundoplication). As waves of the pandemic ebbed and flowed, elective lower acuity cases were re-introduced if an overnight stay was not required. Prior to the COVID-19 pandemic, it was standard practice for patients undergoing a laparoscopic foregut surgery to have an overnight observation admission. An upper GI contrast study was routinely obtained on postoperative day one to evaluate the postoperative esophagogastric anatomy and evaluate for leak. If no abnormalities were appreciated, patients were advanced to a full liquid diet and subsequently discharged if diet was tolerated.

Previous studies have examined the feasibility, safety, outcomes, and costs associated with laparoscopic foregut same-day surgery (SDS). Many of these studies discuss the importance of patient selection and illustrate their strict enrollment criteria for same-day surgery consideration, excluding those with underlying comorbidities, recurrent hiatal hernia repairs, or certain features of their pathology (type 3 or 4 hiatal hernias for example).⁴⁻⁶

To play our part in minimizing resource utilization, while still providing our community with much needed foregut surgery, we changed our practice protocol to deliver these operations as a same day surgery (SDS). Surgeries performed included laparoscopic anti-reflux surgeries, hiatal hernia repairs, paraesophageal hernia repairs, recurrent hiatal hernia repairs, and Heller myotomies. The SDS protocol was

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utilized for all patients who underwent elective foregut surgery regardless of advanced age, comorbidities, size of hiatal repair, recurrence status, or case complexity. The aim of the study was to review the efficacy, feasibility, and safety of performing all types of foregut surgeries after the implementation of a SDS protocol.

2. Methods

The study was conducted in accordance with Spectrum Health institutional review board (IRB). Data was collected from existing medical records of patients who underwent elective laparoscopic fundoplication, hiatal hernia repair, paraesophageal hernia repair, recurrent hiatal hernia repair, and heller myotomy performed by a single surgeon in the Spectrum Health system between August 1, 2020, and January 31, 2022, after the implementation of a SDS discharge protocol for foregut surgeries. This cohort of patients was subsequently compared to the same surgeon’s pre-pandemic cohort of patients from August 1, 2019, to April 30, 2020, when overnight admission was standard of care. The protocol involves a morning surgery, followed by an oral contrast study (upper gastrointestinal series using water soluble contrast) once the patient is awake enough to tolerate liquids. The patients are maintained on maintenance IV fluids with a balanced crystalloid solution during this time. If the contrast study demonstrates an intact hernia repair without leak or obstruction, the patient is advanced to a full liquid diet and observed in the outpatient recovery area for 2–3 h. During this period, as needed liquid Tylenol, Hycet and Zofran are available to the patient for pain and anti-emetic control. The patient is then subsequently discharged if tolerating diet. There were no intraoperative alterations to the surgical procedure itself or anesthesia care (Fig. 1).

Data was extracted via retrospective chart review by the principal investigator. Preoperative data including endoscopic evaluation and baseline demographic data that includes body mass index (BMI), pre-existing comorbidities, smoking history, reflux history, antireflux medication use, as well as prior foregut surgical interventions were registered in an IRB approved REDCap database. Postoperative primary outcome was the number of patients successfully discharged home the

same day of surgery. Secondary outcomes were cost reduction associated with our change in practice protocol, thirty-day readmission rate, 30-day emergency department visits, and post-operative phone calls prior to two-week post-operative visit.

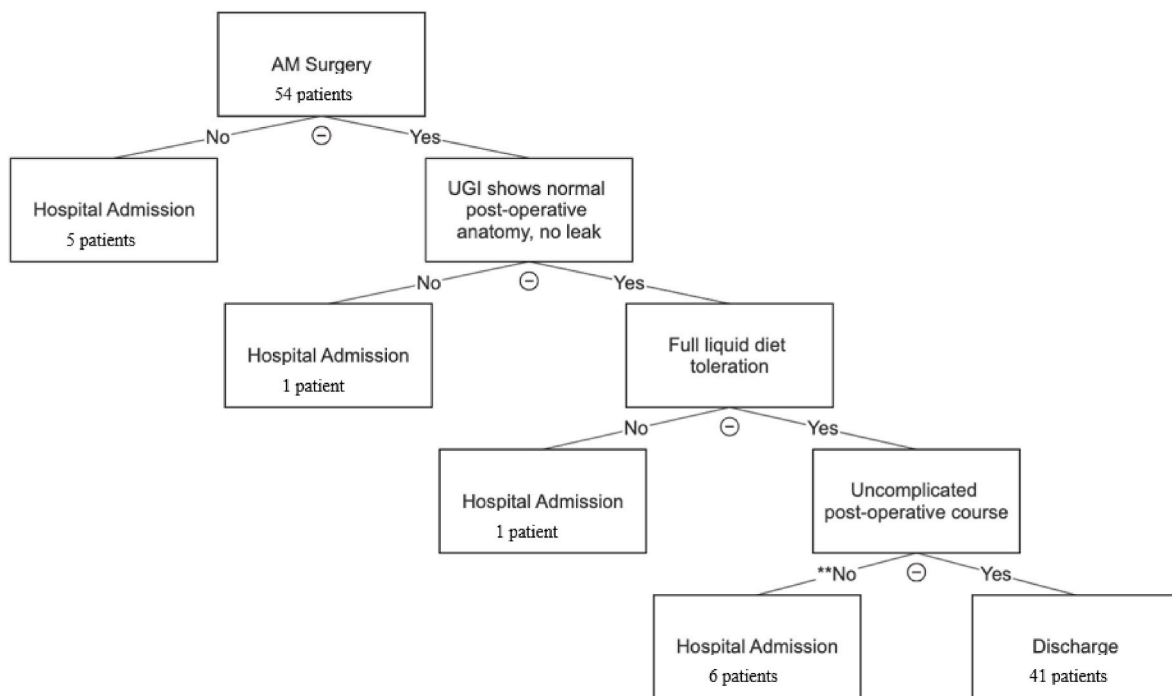
Quantitative, normally distributed data was expressed as the mean + SD, while non-normally distributed data was expressed as the median [25th percentile, 75th percentile]. Nominal data was expressed as a percentage. Comparisons between groups for normally distributed quantitative variables was performed using the two-sample independent t-test, while non-normally distributed quantitative data was analyzed using the Wilcoxon Rank Sum test. Nominal variables were evaluated using the Chi-Square test or the Fisher’s Exact test, depending on if more than 20% of the expected cell counts were less than 5. Significance will be assessed at $p < 0.05$.

3. Results

There were 36 patients in the pre-pandemic group and 54 patients in the pandemic group, 41 of which were discharged the same day as surgery (76%). The two cohorts were similar in age, gender, and BMI and no statistical differences in patient demographics between the two groups was identified (Table 1). There were various reasons as to why patients were not able to discharge on the day of surgery; with inability to obtain a UGI study due to a late case start being the most common (5/13). Other reasons include inadequate pain control (3/13), inability

Table 1 Demographics.

Variable	Pre-Pandemic (N = 36)	Pandemic (N = 41)	p-Value
Gender (Female)	26 (72%)	23 (56%)	0.1422
Age (y)	59 ± 16	60 ± 17	0.6631
BMI	32.1 ± 7.0	29.5 ± 5.5	0.0681
Diabetes	2 (6%)	3 (7%)	1.0000
Active Tobacco Use	5 (14%) (N = 35)	4 (10%) (N = 40)	0.7257
COPD	5 (15%) (N = 34)	2 (5%) (N = 41)	0.2338
CKD	2 (6%)	3 (7%)	1.0000



**Urinary retention, poor pain control, inability to wean oxygen

Fig. 1. Same day surgery discharge pathway.

to wean from oxygen (2/13), abnormal UGI study (1/13), and dysphagia (1/13). There was a similar distribution in case variety between the two groups (Table 2). Of the 13 patients who were admitted overnight five were hiatal hernia repair, five were paraesophageal hernia repair (two recurrent), and three patients had a Heller myotomy.

We failed to detect a statistically significant difference between the two groups regarding 30-day readmission rates 2/36 for the pre-pandemic group vs 4/41 for the pandemic group (6% vs 10% respectively) $p = 0.6790$. Similarly, no difference was found in 30-day ED visit rate 4/36 for the pre-pandemic group vs 7/41 for the pandemic group (11% vs 17% respectively) $p = 0.4557$. We did find there to be a statistical difference in the number of phone calls made to the office in the pre-pandemic group with 8/36 when compared to the pandemic group with 19/41 (22% vs 46% respectively) $p = 0.0269$ (Table 3). Cost savings were evaluated by the institution's financial department. An average of \$854 in hospital charges to the patient per admission day was found, which gives a total savings of approximately \$35,000 for the 41 patients who were able to be successfully discharged.

4. Discussion

There has been greater than 1 million COVID-19 related deaths and near 85 million cases in the United States over the last two and a half years. The pandemic has placed great strain on the health care system as a whole requiring allocation of resources to create, staff, and maintain COVID-19 units. Direct costs of COVID-19 related to hospitalizations and indirect costs related to postponed services during the peak of the pandemic were catastrophic to the health care system. The American Hospital Association estimated a financial impact of greater than \$200 billion in losses for American hospitals from March through June of 2020.⁷ The American College of Surgeons created guidelines for the cancellation, triaging, and eventual resumption of non-emergent surgical procedures. They suggested higher acuity cases (i.e., cancer, transplant, cardiac, etc.) to be resumed first, followed by outpatient surgeries, and lastly low acuity cases that would require an inpatient hospital stay.^{8,9}

Our institution is the tertiary referral center for hiatal hernias, antireflux and esophageal dysmotility surgeries with over 500 foregut cases performed annually by eight different surgeons prior to the pandemic. Throughout the course of the pandemic these surgeries were deferred due to their non-emergent nature and the traditional one-night hospital stay required. To continue providing care to our community without adding to the healthcare burden, a same day surgery protocol for foregut surgery was developed. Though these have been studied in the past, most studies have strict selection criteria often left to the discretion of the operating surgeon or only evaluated a single type of surgery, inherently introducing selection bias.⁴⁻⁶ Every patient who underwent a laparoscopic foregut surgery after August 1st, 2020 by one surgeon, was placed down the foregut SDS discharge protocol regardless of age, comorbidities, type of foregut surgery performed, complexity of case, size of paraesophageal component, or recurrence status. No patients were excluded from the protocol. Inability to obtain UGI due to late case start was the most common reason for patients to be admitted, followed by inability to wean from oxygen, ongoing pain, nausea, and dysphagia. We were unable to detect a statistically significant difference in 30-day readmission rates or 30-day ED visit rates between the groups, but we did notice an increased number of office calls prior to scheduled follow up in the SDS group (p -value 0.0269). Our financial department found that there is on average \$854 in hospital charges to the patient for each admission day. With 41 patients successfully discharged the day of surgery approximately \$35,000 in hospital costs were saved as a result of the SDS foregut protocol. Patient total cost savings were variable based on insurance type and not used for analysis. The ability to deliver this care to the community while keeping beds open for COVID-19 patients at the peak of the pandemic is invaluable. Implementation of the protocol required education followed by concerted and coordinated effort

Table 2
Case distribution.

Variable	Pre-Pandemic (N = 36)	Pandemic (N = 41)	p-Value
Hiatal Hernia	5 (14%)	7 (17%)	0.7007
Paraesophageal Hernia	19 (53%)	23 (56%)	0.7704
Heller Myotomy	13 (36%)	11 (27%)	0.3803
Redo Paraesophageal	4 (11%)	5 (12%)	1.0000
Surgery Duration (minutes)	130 [104, 154]	133 [111, 146]	0.8863

Table 3
Results.

Variable	Pre-Pandemic (N = 36)	Pandemic (N = 41)	p-Value
30-Day Readmission	2 (6%)	4 (10%)	0.6790
30-Day ED Visit	4 (11%)	7 (17%)	0.4557
Office Phone Calls	8 (22%)	19 (46%)	0.0269

with all teams involved (surgical, anesthesia, nursing, and radiology staff).

There are a few limitations to our study. Given our small sample size with cases performed by a single surgeon at a single institution, our results may not be generalizable. Several other foregut specialists within the group have begun adopting this protocol into their own practice given the positive results of the study. Furthermore, the protocol itself may not be reproducible at other institutions who may not have the fluoroscopy services readily available or a full nursing complement in the recovery area to monitor these patients for several hours post-operatively. Same day surgery protocols for other general surgery procedures that traditionally require an inpatient stay should be further investigated to help decrease costs and resource utilization, while maintaining access to health care in times of need.

5. Conclusion

The COVID-19 pandemic continues to pose a challenge for the allocation of resources across health systems. The creation of SDS discharge protocol for traditional overnight stay foregut cases is safe and a way to decrease hospital admission and increase bed availability while still delivering much needed surgical care to the community at large.

Summary sentences

To evaluate the effectiveness of a COVID-19 pandemic driven protocol that was developed to perform foregut surgeries as a same day surgery discharge, which included all hiatal hernias, paraesophageal hernias, and Heller myotomies.

Declaration of competing interest

The authors of this original work declare no financial or non-financial conflicts of interest.

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