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Laparoscopic transhiatal esophagectomy for esophageal adenocarcinoma identified at laparoscopic Roux-en-Y gastric bypass

Halle B. Ellison[a], David M. Parker[a,*], Ryan D. Horsley[a], Daaron McField[a], Michael E. Friscia[b], Anthony T. Petrick[a]

[a] Geisinger Medical Center, Department of General Surgery, 100 North Academy Ave., Danville PA, 17821, United States
[b] Geisinger Medical Center, Department of Thoracic Surgery, 100 North Academy Ave., Danville PA, 17821, United States

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ABSTRACT

INTRODUCTION: More than one third of Americans are obese. Obesity is a risk factor for gastroesophageal reflux disease (GERD) and esophageal adenocarcinoma (EA). The only durable treatment for morbid obesity and its comorbid conditions is bariatric surgery. There is no consensus among bariatric surgeons, however, regarding the role of preoperative screening upper endoscopy in bariatric surgery.
PRESENTATION OF CASE: Two cases of incidental EA were identified by completion EGD following laparoscopic Roux-en-Y gastric bypass (LRYGB). EGD was done for anastomotic surveillance and provocative leak testing. Esophageal masses were identified and biopsies demonstrated adenocarcinoma. In both cases a laparoscopic transhiatal esophagectomy (LTHE) was completed using the gastric remnant as conduit; the biliopancreatic limb was divided proximal to the jejunojejunostomy and anastomosed to the proximal roux limb to complete the reconstruction.
DISCUSSION: Obesity is a risk factor for GERD and EA. The role of EGD prior to bariatric surgery is unclear. Studies have demonstrated routine EGD prior to bariatric surgery may diagnose foregut pathology; however, few of the findings alter the planned treatment. The cost effectiveness of this strategy is questionable. There are reports of EA developing after bariatric surgery; however, we found no previous case reports of EA identified at LRYGB.
CONCLUSION: Our institution has opted for selective preoperative endoscopy in patients with preoperative gastrointestinal symptoms. In post gastric bypass patients LTHE can be performed with good results.

1. Introduction

Obesity is an epidemic in the United States (US) and affects more than one third of the population. Among Americans 20 years of age and older 78.4 million have a body mass index (BMI) of 30 kg/m^2 and greater [1]. Obesity is a risk factor for gastroesophageal reflux disease (GERD) and is associated with increased risk of esophageal adenocarcinoma (EA) [2]. The incidence of EA is currently increasing faster than any other malignancy in the US [3,4] with an estimated incidence of 18,170 in 2014 [5]. Obesity is one factor contributing to this trend [6,7].

Bariatric surgery is recognized as durable treatment for obesity and its comorbid conditions. Given the increasing incidence of EA and the utilization of bariatric surgery as a treatment for morbid obesity, one might infer that patients undergoing bariatric surgery are at risk for developing EA. There is a paucity of data regarding esophagectomy after Roux-en-Y Gastric Bypass (RYGB) for malignancy or definitive guidelines for preoperative endoscopy prior to bariatric surgery. We present two cases of esophageal adenocarcinoma discovered at the time of laparoscopic RYGB. Additionally, we describe the surgical management with laparoscopic transhiatal esophagectomy, a technique that has not yet been described in the literature following bariatric surgery.

2. Materials and methods

The first patient was a 66 year old male with a BMI of 48 kg/m^2 at presentation. His obesity related comorbidities included obstructive sleep apnea (OSA), diabetes mellitus (DM), hypertension (HTN), dyslipidemia, non-alcoholic fatty liver disease and degenerative joint disease. He did not have a history of GERD and was not on acid suppressive therapy. He was a former cigarette smoker who quit 13 years prior to evaluation for bariatric surgery. His risk factors for EA included age, gender, Body Mass Index (BMI) and history of tobacco use. He underwent a laparoscopic RYGB with routine

* Corresponding author at: Department of General Surgery,100 North Academy Ave MC 21-70, Danville PA, United States.
E-mail address: dparker@geisinger.edu (D.M. Parker).

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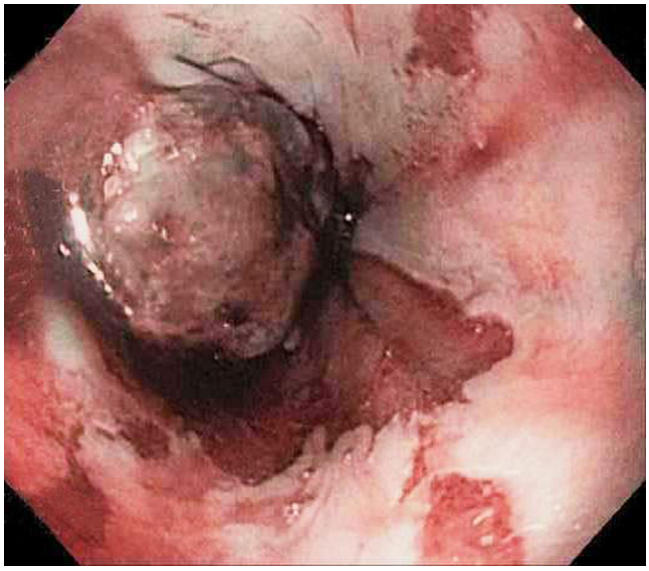

Fig. 1. Esophageal mass at 33 cm.

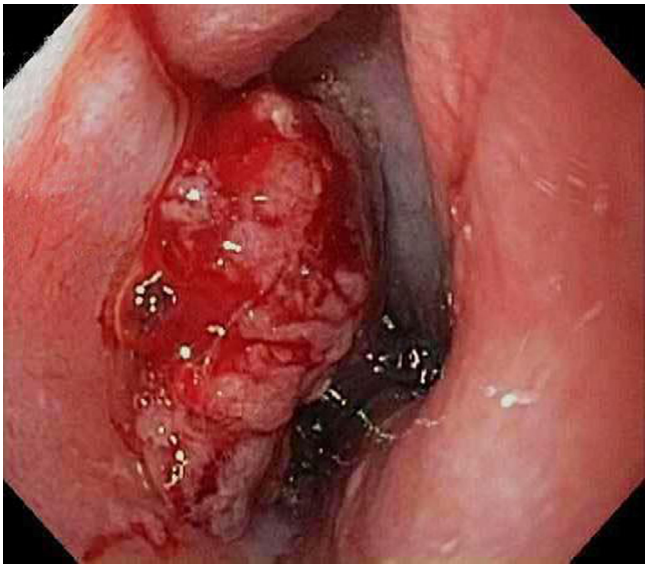

Fig. 2. Esophageal mass at 38 cm.

completion intraoperative endoscopy for anastomotic surveillance and leak testing. A mass, concerning for EA, was identified at 33 cm from the incisors (Fig. 1). A biopsy was obtained and intra-operative endoscopic ultrasound (EUS) was performed. The lesion was staged T1N0 by endosonographic criteria. Pathology demonstrated a well to moderately differentiated invasive adenocarcinoma arising in a background of Barrett's esophagus (BE) with high grade dysplasia. Her-2-Neu was not amplified. A post operative a positron emission tomography-computed tomography (PET-CT) was completed and the patient was restaged as IA (T1bN0M0).

The second patient was a 49 year old male with a preoperative BMI of 45 kg/m^2. His obesity related comorbidities included hypertension, diabetes mellitus, dyslipidemia, coronary artery disease and GERD. His reflux symptoms were controlled with Pantoprazole 20 mg daily. He was a former smokeless tobacco and cigarette user and quit 33 years and 2 years prior to evaluation for bariatric surgery. His risk factors for EA included age, gender, BMI, GERD and history of tobacco use. He also underwent a laparoscopic RYGB with completion endoscopy during which a mass was identified at 38 cm from the incisors (Fig. 2). Pathology results from intraoperative biopsy demonstrated a moderately differentiated adenocarcinoma with HER-2-Neu amplification. The post operative staging work up included Endoscopic Ultrasound (EUS) and PET-CT. A Fine needle aspiration (FNA) of an abnormal lymph node confirmed the presence of malignant cells. His disease was stage IIB, T1bN1M0. He completed neoadjuvant treatment with Carboplatin, Paclitaxel and total radiation dose of 5040cGy. After completing neoadjuvant therapy he was restaged with EUS and PET-CT; the lesion had regressed by EUS and there was decreasing fluorodeoxyglucose (FDG) activity at the tumor site.

2.1. Surgical technique

Our group performs a standardized laparoscopic RYGB in an antecolic and antegastric fashion with a stapled linear anastomosis between the gastric pouch and Roux limb. The two patients had their index operation completed in this manner. Both patients subsequently underwent a laparoscopic transhiatal esophagectomy using the gastric remnant as a conduit. Once laparoscopic access was obtained, the pars flaccida was divided and the phrenoesophageal membrane was divided. The esophagus was circumferentially mobilized using a combination of blunt dissection and an ultrasonic energy device. The Roux limb was mobilized by dividing the Roux limb with a linear stapler just distal to the gastrojejunal (GJ) anastomosis. The gastric remnant was mobilized along the greater curve with preservation of the right gastroepiploic artery. The duodenum was Kocherized to attain additional lateral mobilization. The left gastric vessels were then divided with a linear stapler to complete the mobilization of the gastric remnant conduit. The biliopancreatic (BP) limb was divided proximal to the jejunojejunostomy (JJ) with a linear stapler. The distal end of the BP limb was then anastomosed to the proximal Roux limb to re-establish continuity and complete the jejunal reconstruction. A Heinecke-Mickulicz pyloroplasty was performed and prophylactic feeding jejunostomy tube was placed.

A left neck dissection was performed and the esophagus was identified and encircled with a Penrose drain. Dissection was carried down into the mediastinum bluntly with care to avoid injury to the trachea. The esophagus was freed proximally well below the larynx and divided. A large vein stripper was secured to the divided esophagus to complete the mediastinal dissection. An umbilical tape was secured to the divided esophagus and this was pulled through the mediastinum into the abdomen. The umbilical tape was then removed from the specimen and secured to the gastric remnant and used to pull the conduit into the neck. Intra-operative frozen sections obtained on the proximal and distal margins were negative in both cases. The length of the gastric remnant was sufficient to create a cervical esophagogastrostomy. The esophagogastrostomy was hand sewn and created in and end (esophagus) to side (gastric conduit) fashion.

3. Results

The first patient had a 13 week interval between the bariatric surgery and definitive esophagectomy. During the interval time period the patient lost 57 pounds. The patient's BMI at the time of LTHE was 37 kg/m^2. The second patient lost 73 pounds in the five month interval between laparoscopic RYGB and LTHE with a BMI of 32 kg/m^2. Following LTHE both patients had a hospital length of stay of six days.

The first patient's post-operative course was complicated by a transient recurrent laryngeal nerve palsy which resolved. The final pathologic evaluation revealed a focal high-grade dysplasia arising in Barrett's esophagus. There was no definitive evidence of

invasion or vascular involvement. He experienced an anastomotic stricture at 10 weeks and had serial upper endoscopy with dilation performed. A follow up PET-CT noted to have a hypermetabolic mass adjacent to the right thyroid lobe at 22 months post laparoscopic RYGB and 19 months post LTHE. Ultrasound guided biopsy demonstrated adenocarcinoma favoring esophageal primary. The patient underwent adjuvant therapy with Herceptin and FOLFOX and a total radiation dose of 2500 cGY. A restaging PET-CT after completion of his treatment 27 months after LTHE demonstrated low activity. On last follow up the patient's BMI was 29.52 kg/m^2.

The second patient had a complete pathologic response to the neoadjuvant chemoradiation. The final histologic examination of the specimen revealed Barrett's esophagus with focal low grade dysplasia. There was no evidence of invasive carcinoma or high grade dysplasia. The margins were all negative for dysplasia or tumor. He experienced an anastomotic leak on post-operative day eight. The leak was controlled through the left neck wound and healed without permanent sequelae. There was no evidence of disease at time of last follow up, 36 months post laparoscopic RYGB, 30 months post LTHE and thelast BMI was 37.03 kg/m^2.

4. Discussion

Esophageal cancer is the eighth most common cancer worldwide [8] yet comprises 1% of all cancers diagnosed in the US [7]. It is estimated 18,170 new cases of esophageal adenocarcinoma will be diagnosed in the US in 2014 with 15,450 deaths due to disease [5,7]. The incidence of esophageal cancer and gastroesophageal tumors however is increasing faster than any other malignancy in the United States [3,9]. Known risk factors for this disease include age, male gender, GERD, Barrett's esophagus, tobacco, alcohol and obesity [7].

Data in the US have demonstrated an association between increasing BMI and existence of GERD [2]. A BMI greater than 30 kg/m^2 is associated with an increased risk for symptomatic GERD with an odds ratio (OR) of 1.94 [2]. Obesity has been reported to increase the odds of EA by 2.4 in men and 2.1 in women [10]. GERD is a risk factor for developing BE [11] and occurs in approximately 10% to 15% of patients with long standing GERD. Barrett's esophagitis is the most important etiologic factor in developing adenocarcinoma of the esophagus [12]. The incidence of cancer in BE has increased from 4 to 23 cases per million [13]. A BMI of $\geq$30 kg/m^2 increases the odds of having BE by 1.35 times [14]. It remains unclear if BMI is associated with progression of metaplasia to dysplasia or if the increased risk of BE is confounded by symptomatic GERD [14].

With the increasing incidence in obesity there has been an increase in the number of bariatric surgical procedures [15]. In 2003 there were 121,771 bariatric procedures performed in the United States [16]. This increased to 135,985 in 2004 and plateaued by 2008 [16]. Over the same time period the proportion of laparoscopic bariatric procedures increased from 20.1% to 90.2% [16].

There is controversy regarding the role of pre-operative upper endoscopy in patients undergoing bariatric surgery [17,18]. Some authors advocate that all patients with upper gastrointestinal symptoms have upper endoscopy prior to undergoing bariatric surgery [17]. The rationale for this routine practice is that pathology may be identified which should be treated prior to surgery or may alter the planned procedure [18]. Humphreys et al. report a series of 371 patients who underwent routine pre-operative upper endoscopy prior to gastric band placement [17]. Two cases of esophageal adenocarcinoma were identified and confirmed. In their series one patient underwent minimally invasive esophagectomy (the technique is not further described) for a pT1N0M0 lesion; one patient who was not fit for esophagectomy had endoscopic mucosal resection (EMR) followed by gastric band placement. Despite the detection of these two cases of malignancy the authors concede that pathology identified at routine pre-operative endoscopy did not significantly alter planned patient management [17].

The cost of routine preoperative screening endoscopy, particularly in an era where there is a high volume of bariatric surgical procedures being performed is poorly defined. In addition, while the risk of preoperative upper endoscopy is low with an incidence of 019% the procedure is still associated with some risk [19]. The American Society for Gastrointestinal Endoscopy (ASGE) Standards of Practice Committee issued a guideline in 2015. The guidelines support the decision to perform upper endoscopy on the presence of upper gastrointestinal symptoms such as reflux and dysphagia [20]. "An upper endoscopy should be performed in all patients with upper-GI-tract symptoms who are to undergo bariatric surgery (Level 2C)" [20]. Upper endoscopy should be considered in patients undergoing a sleeve gastrectomy to evaluate for hiatal hernia to prevent de novo gastroesophageal reflux and to evaluate for pre-existing esophagitis [20]. The ASGE also recommends non-invasive H. pylori testing preoperatively for asymptomatic patients who are not having endoscopy prior to bariatric surgery [20]. Some authors propose further studies are necessary to assess the cost effectiveness of routine preoperative screening endoscopy because the incidence of detection of premalignant and malignant pathology is low [14].

In our center routine preoperative upper endoscopy is not performed. However, the detection of these two cases and review of the literature has lowered our threshold to perform a preoperative endoscopy in patients with long standing GERD or significant foregut symptoms. Notably, one patient had no prior history of GERD or upper GI symptoms. He therefore would not have been identified as a candidate for preoperative endoscopy by the criteria proposed in the ASGE guidelines [17]. In the series reported by Melstrom all three patients who developed esophageal cancer after RYGB had symptomatic reflux [6]. Our group has performed over 4000 bariatric procedures with routine intra-operative endoscopy and have detected only the two cases of esophageal adenocarcinoma presented.

Data regarding the incidence of esophageal cancer after bariatric surgery is limited. However, a recent review of the literature was completed in 2013 and reported only 11 cases of esophageal cancer detected after bariatric surgery [18]. There are less than 25 reported cases of esophageal cancer developing after bariatric surgery with an incidence of less than 0.1% [6,21]. Proponents of preoperative endoscopy argue that findings may alter surgical management in bariatric patients. In a series of 448 patients undergoing preoperative endoscopy a positive finding altered medical management in 18% of patients [22]. However, the findings only led to a change in the timing of surgery or a change in surgical technique in less than 1% of patients [22]. The case series, however, lacked documentation of gastrointestinal symptoms prior to endoscopy. It is our opinion that low rate of positive findings that alter surgical management do not justify the cost of routine screening endoscopy prior to bariatric surgery. Further prospective studies are necessary to assess the cost effectiveness and complication rates of routine preoperative endoscopy in asymptomatic patients.

The technique of laparoscopic transhiatal esophagectomy has not previously been reported in post RYGB patients with esophageal cancer. Prior published reports on minimally invasive approaches after bariatric surgery included a combined laparoscopic and thoracoscopic Ivor Lewis esophagogastrectomy in a patient who previously had undergone gastric bypass [23]. A second case described an abdominal approach to mobilize the gastric pouch followed by right thoracotomy for esophageal mobilization [14]. Kuruba et al. described their technique of resection of EA

after RYGB with an Ivor Lewis esophagogastrectomy via an open approach with a bilateral subcostal incision [15].

The reconstruction described in prior reports is similar to our technique except that in our cases the reconstruction was performed laparoscopically. It was not necessary to resect the Roux limb between the gastrojejunostomy (GJ) and Jejunojejunostomy. The margins were not compromised and preservation of intestinal length may have the additional benefit of avoiding malnutrition. While there is additional anastomosis required to reconstruct the normal anatomy it is our opinion that this does not lead to an increased risk of leak when completed by experienced surgeons.

Although open approaches for esophagectomy have been more common in patients with a history of bariatric surgery, minimally invasive esophagectomy is an option. There is a paucity of data regarding long term outcomes for the laparoscopic approach and the role of laparoscopic esophagectomy as a surgical treatment option for all patients continues to evolve. A recent *meta*-analysis comparing oncologic outcomes between minimally invasive and open esophagectomy techniques found no statistically significant staging or survival differences; lymph node yield was statistically significantly higher in the minimally invasive group [24]. With regard to surgical technique for esophagectomy a 'one size fits all' approach may not be realistic. As EA in the post bariatric surgery population continues to be recognized it is important to report different technical approaches to resection and reconstruction.

5. Conclusion

Over the past several decades in the United States rates of obesity, and GERD and have increased. This is in parallel to the increase in the number of bariatric surgical procedures performed. Despite the low incidence of esophageal adenocarcinoma in bariatric patients there should be increased awareness of this possibility. The surgical management of esophageal cancer after bariatric surgery presents a unique challenge to surgeons not familiar with the altered anatomy. Additionally, the selection criteria for patients who may benefit from routine preoperative upper endoscopy needs to be further defined to maximize cost containment while providing optimal surgical care. The present case series is the first to describe not only detection of esophageal cancer at laparoscopic RYGB but also the first described technique of laparoscopic transhiatal esophagectomy post laparoscopic RYGB.

Conflict of interest

None.

Funding

None.

Ethical approval

Geisinger IRB protocol #2013-0103.

Consent

I have obtained written consent from the patients and that you can provide this should the Editor ask to see it.

Author contribution

Halle Ellison MD—data collection/ Analysis/ Writing the paper. David Parker MD—Study design, data collection, Writing the paper. Ryan Horsley DO—writing the paper. Daaron McField—writing the paper. Michael Friscia MD—study concept. Anthony Petrick MD—study concept.

Guarantor

David M. Parker MD, Anthony T. Petrick MD.

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