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ORIGINAL ARTICLE

Evaluation of the Role of Performing Pyloric Drainage Procedures on the Clinical Outcome Following Esophagectomy

Ahmed Daoud*, Moustafa Elhamami, Walid Abu Arab
Department of Cardiothoracic Surgery, Faculty of Medicine, Alexandria University, Alexandria, Egypt.

***Corresponding Author:**
Ahmed Daoud

E-mail:
ah.dawood68@gmail.com

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ABSTRACT

Background: Delayed stomach emptying and stomach outlet obstruction are one of the most annoying complications that usually occur after esophagectomy as the procedure usually entails bilateral vagotomy which affects gastric motility after surgery. Impaired stomach motility was found to increase the risk of having postoperative anastomotic leakage and aspiration pneumonia after esophagectomy. The main aim of our study was to evaluate the role of pyloric drainage on the clinical outcome of the patients who received esophagectomy.

Methods: The study is a prospective clinical study that included all patients who received esophagectomy for esophageal cancer at cardiothoracic surgery department, Alexandria University, Alexandria, Egypt, during the period from January 2020 to January 2024. Patients were divided into 2 groups according to whether they received pyloric drainage procedure (Group A) or not (Group B), and this was mainly decided according to surgeon preference as some surgeons prefer to perform pyloroplasty while others prefer leaving an intact pylorus.

Results: Regarding the presence of postoperative anastomotic leakage, there was no statistically significant difference between both groups as the incidence of leakage in group A was 12.5%, while in group B was 14.3%. The incidence of pulmonary complications in both groups was similar, constituting 12.6% and 14.3% for group A and group B respectively. Three patients in group A (18.8%) were suffering from manifestations of delayed gastric emptying and evaluation by oral contrast study and upper GIT endoscopy revealed that one of them was suffering from bile reflux.

Conclusions: Performing a prophylactic surgical pyloric drainage procedure esophagectomy may be unnecessary as there was no significant difference regarding persistent symptoms of delayed gastric emptying, anastomotic leakage and pulmonary complications in other patients who received esophagectomy without surgical pyloric drainage.

Keywords: Esophagectomy; Pylorus; Pyloroplasty; Delayed gastric emptying.

INTRODUCTION

Esophagectomy is a complicated and challenging procedure that usually requires a highly skilled surgical team in a well-equipped and experienced medical facility [1]. Esophagectomy procedure usually carries a high degree of morbidity and mortality as it entails surgery in more than an anatomical region namely, chest, abdomen and neck. Esophageal malignant tumors or refractory benign disease are mainly the main indications for esophagectomy, and stomach is the mostly used conduit after esophageal resection [2].

Complications after esophagectomy are very common and commonly affect the quality of life of the patient to a big extent [3]. Impaired motility of the stomach and obstruction of the gastric outlet are one of the most annoying complications that usually occur after esophagectomy as the procedure usually entails bilateral vagotomy which affects gastric motility after surgery. The patient usually complains from vomiting, nausea, anorexia and early satiety [3,4].

Impaired stomach motility and obstruction of the pyloric end were found to increase the risk

of having postoperative anastomotic leakage and aspiration pneumonia after esophagectomy. Pyloroplasty or myotomy are the commonest surgical methods to avoid delayed stomach emptying and obstruction of the stomach outlet, but until now there has been no strong scientific evidence that prefers performing pyloric drainage procedures to decrease postoperative delayed gastric emptying [4].

Many studies and trials have been conducted and found that there was no clear advantage in performing pyloric drainage over omitting its performance as there was no valuable difference in the symptoms of impaired stomach emptying between patients who received pylorus drainage procedure versus those who had esophagectomy with intact pylorus. Moreover, performing pyloroplasty or pyloromyotomy was found to have significant complications like bile reflux which gives an advantage to omitting the pyloric drainage procedure and performing esophagectomy with intact pylorus [4,5].

The main aim of our study was to evaluate the role of pyloric drainage on the clinical outcome of the patients who received esophagectomy in the immediate postoperative period as well as in the follow up period up to 6 months following surgery.

METHODS

Study design

The study is a clinical and prospective one that included all patients who received esophagectomy for esophageal cancer at cardiothoracic surgery department, Alexandria University, Alexandria, Egypt during the period from January 2020 to January 2024.

Patients were categorized into 2 main groups according to whether they received pyloric drainage procedure or not and this was mainly decided according to surgeon preference as some surgeons prefer to perform pyloroplasty while others prefer leaving an intact pylorus.

Group A included patients who received esophagectomy with pylorus drainage (pyloroplasty).

Group B included patients who received esophagectomy without pyloric drainage.

Inclusion criteria: Patients diagnosed with tumor in the esophagus or esophagogastric junction either in an early tumor stage or an advanced stage with administration of neoadjuvant therapy.

Exclusion criteria: Patients with preoperative diagnosis of gastric motility disorder, debilitated or high risk patients with morbid diseases and can not tolerate the procedure.

The postoperative outcomes were evaluated for the 30 eligible patients including presence of pulmonary complications, anastomotic leak, complications of pulmonary system, postoperative hospital stay, presence of manifestations of delayed gastric emptying in the postoperative hospital stay period and persistence of these manifestations up to 6 months after surgery.

Patients in group A (16 patients) were compared to group B patients (14 patient) regarding the previous outcomes.

After discussion of the surgical procedure with the patients, written approval was taken from each patient. The study was also approved by the Institutional Review Board and the Ethics Committee under the number: 15/233, 24/1/2023. The investigation was conducted in accordance with the Declaration of Helsinki, the World Medical Association's Code of Ethics for human studies.

Preoperative workup

All patients enrolled in our study were subjected to the following investigations: careful clinical evaluation, complete laboratory investigations, endoscopy for upper gastrointestinal tract and chest CT scanning.

Operative techniques

1. Three stage (Mc Keown) (6) procedure:

Chest part: Mobilization of the thoracic part of the esophagus is done through right thoracotomy.

Neck incision: the cervical esophageal part is dissected using left longitudinal incision in the neck along medial margin of sternocleidomastoid muscle.

Abdominal stage: Stomach mobilization is completed using laparotomy incision in the midline and division of lesser and greater

omentum carefully with preservation of right gastroepiploic artery.

Gastric conduit is then delivered to the neck to complete the anastomosis in the neck.

2. Ivor Lewis (7) approach:

Stomach mobilization part: Stomach is dissected and mobilized in the same way as the three stage esophagectomy.

Thoracic dissection and anastomosis: Through a right posterolateral thoracotomy, the thoracic esophagus is completely dissected and the stomach conduit is pulled to the chest with construction of thoracic anastomosis using stapler.

3.Minimally invasive esophagectomy (MIE):

Right side VATS is used instead of thoracotomy for mobilization of the esophagus completely using 4 ports sites. Laparoscopy is used for stomach mobilization using 5 ports and cervical anastomosis is constructed using left neck incision in a hand sewn manner

Gastric tube construction: gastric tube is made using the linear stapler with 2 layers of running sutures for reinforcement. (Figures1,2)

Pyloric drainage techniques:

The pylorus draining technique used in our study in group A patients was pyloroplasty. A longitudinal incision was made in the pyloric ring including all layers, seromuscular layer and mucosal layer. Then, closure of the opening in a transverse direction using interrupted vicryl 3/0 sutures including all layers. Another layer of vicryl 3/0 sutures is taken to invert the first suture line to the inside. Omental flap reinforcement over the suture lines was done to decrease the chance for leakage.

Post-operative care:

Patients were routinely nursed in the ICU in the first 24 hours after surgery and the duration may be prolonged if needed according to each patient. Patients stayed without feeding per mouth in the first 5 days until radiological evaluation is done to exclude leakage (Figure 3). Feeding by mouth usually started at the fifth postoperative day, after doing the oral contrast study that confirms absence of leak, with clear fluids then semisolid food. After the start of oral feeding, all patients were carefully observed for manifestations of delayed gastric emptying and bile reflux like persistent vomiting, intractable nausea, abdominal pain and early satiety. Medical treatment in the form of prokinetics and medications that enhance gastric emptying were initially given for all symptomatic patients.

Oral contrast radiological evaluation and upper GIT endoscopy was ordered for severely symptomatic patients. Upper GIT endoscopy assessment mainly was done for severely symptomatic patients not responding to medical treatment to evaluate the pyloric ring for presence of pyloric obstruction as well as to record the presence of bile reflux irritating the lower esophagus.

Post-operative follow-up after discharge from hospital: Both study groups were followed up at three months and six months period after hospital discharge and were counseled about manifestations of delayed gastric emptying and bile reflux like nausea and persistent vomiting.

Oral contrast radiological study and upper GIT endoscopy were ordered only if the patient is still complaining from persistent manifestations.

Statistical analysis:

Data was given to the computer and analyzed using IBM SPSS software package version 20.0. **(**Armonk, NY: IBM Corp, released in 2011**)**. Categorical data was figured as numbers and percentages. Chi-square test was used to differentiate between both groups. On the other hand, Fisher Exact correction and Monte Carlo correction test were conducted when more than 20% of the items have expected countless than 5. For continuous data, they were tested for normality by the Shapiro-Wilk test. Quantitative data were applied as range (minimum and maximum), mean, standard deviation and median Student t-test was used to compare two groups for normally distributed quantitative variables while. In addition, Mann Whitney test was used to differentiate two groups for not normally distributed quantitative variables. The significance of the results obtained was judged at the 5% level.

RESULTS

Regarding the patients' demographics and preoperative data, there was no statistically significant difference between both groups. The mean age for group A patients was 62.38 ± 6.08 years, while the mean age for group B was 64.21 ± 4.89 years. The majority of patients were males in both study groups constituting about 14 patient (87.5%) and 10 patient (71.4%) in group A and group B respectively.

12.5% of the patients in group A were diabetics and 12.5% were hypertensives, while in group B the percentage of diabetes and hypertension was 7.1% and 21.4% respectively.

Regarding preoperative tumor histopathology, 87.5% of patients in group A were adenocarcinoma and 12.5% were squamous cell carcinoma, while in group B patients adenocarcinoma constituted about 64.3% and squamous cell pathology about 35.7%. Both groups were nearly similar regarding the location of tumors as 25% and 28.6% of the tumors were lower thoracic, 37.5% and 42.9% were midthoracic and the GEJ location constituted 37.5% and 28.6% for group A and group B respectively. (Table 1)

Regarding the surgical approach used, Ivor Lewis esophagectomy was the commonest approach used constituting about 75% and 64.3%, Mc Keown esophagectomy about 18.8% and 21.4% and MIE constituted about 6.3% and 14.3% for group A and group B respectively. There was no statistically significant difference between both groups regarding the type of anastomosis used as 68.8% and 64.3% were circular stapled anastomosis while 31.3% and 35.7% were hand sewn anastomosis for group A and group B respectively. (Table 2)

The mean ICU stay post-surgery for group A was 2.06 ± 1.06 day, while for group B was 2.43 ± 1.34 day. Regarding the presence of postoperative anastomotic leakage detected on oral contrast study, there was no significant difference between both groups as the incidence of leakage in group A was 12.5%, while in group B it was 14.3%. The incidence of pulmonary complications in both groups was similar, constituting 12.6% and 14.3% for group A and group B respectively.

Manifestations of delayed gastric emptying were present 18.8% from group A patients, while in group B it was present in 21.4%. Three patients in group A (18.8%) were suffering from manifestations of delayed gastric emptying and evaluation by oral contrast study and upper GIT endoscopy revealed that one of them was suffering from bile reflux. The radiological and endoscopic evaluation for symptomatic patients in group B revealed that one patient was having pyloric obstruction.

The mean postoperative hospital stay was very similar in both groups as it was 9.13 ± 2.25 days versus 9.50 ± 2.35 days. Regarding the follow up after discharge from hospital, after 3 months from discharge, only 2 patients (12.6%) in group A remained symptomatic after medical treatment while after 6 months, only one patient remained symptomatic due to the bile reflux irritation of the lower esophagus. Only one patient in group B was having persistent symptoms after 3 months due to pyloric obstruction and it was successfully managed by endoscopic balloon dilatation. The follow-up after 6 months for group B patients revealed improvement in symptoms for patients with persistent manifestations and none of the patients remained symptomatic. (Table 3)

Table 1: Patient characteristics and preoperative data

	GroupA (n = 16)	**GroupB (n = 14)**	**p-value**
Sex			
Male	14 (87.5%)	10 (71.4%)	^{FE}p= 0.378
Female	2 (12.5%)	4 (28.6%)	
Age (years)			
Min. – Max.	54.0 – 72.0	55.0 – 71.0	0.373
Mean ± SD.	62.38 ± 6.08	64.21 ± 4.89	
Median (IQR)	61.5 (57.5 – 67.5)	65.0 (60.0 – 68.0)	
Past medical history			
No	12 (75.0%)	9 (64.3%)	0.710
DM	2 (12.5%)	1 (7.1%)	
HTN	2 (12.5%)	3 (21.4%)	
HTN & DM	0 (0.0%)	1 (7.1%)	
Tumor location			
Lower thoracic	4 (25.0%)	4 (28.6%)	^{MC}p= 0.904
Midthoracic esophagus	6 (37.5%)	6 (42.9%)	
GE Junction	6 (37.5%)	4 (28.6%)	
Pathology			
Adenocarcinoma	14 (87.5%)	9 (64.3%)	^{FE}p= 0.204
SCC	2 (12.5%)	5 (35.7%)	

IQR, inter quartile range; SD, standard deviation; p, p value for comparing the two studied groups; SCC, squamous cell carcinoma; GE, gastroesophageal junction; DM, diabetes mellitus; HTN, hypertension

Table 2: Operative data and early postoperative outcomes

	GroupA (n = 16)	**GroupB (n = 14)**	**p-value**
Procedure			
Ivor Lewis	12 (75.0%)	9 (64.3%)	^{MC}p= 0.855
MC Keown	3 (18.8%)	3 (21.4%)	
MIE	1 (6.3%)	2 (14.3%)	
Anastomosis			
Circular stapled	11 (68.8%)	9 (64.3%)	^{FE}p= 1.000
Hand sewn	5 (31.3%)	5 (35.7%)	
Leakage			
No	14 (87.5%)	12 (85.7%)	^{FE}p= 1.000
Yes	2 (12.5%)	2 (14.3%)	
ICU stay			
Min. – Max.	1.0 – 4.0	1.0 – 6.0	0.498
Mean ± SD.	2.06 ± 1.06	2.43 ± 1.34	
Median (IQR)	2.0 (1.0 – 3.0)	2.0 (2.0 – 3.0)	
Pulmonary complications			
No	14 (87.5%)	12 (85.7%)	^{MC}p= 0.784
Pneumonia	1 (6.3%)	2 (14.3%)	
Pleural effusion	1 (6.3%)	0 (0.0%)	
Post-operative stay			

	GroupA (n = 16)	GroupB (n = 14)	p-value
Min. – Max.	7.0 – 16.0	8.0 – 16.0	0.580
Mean ± SD.	9.13 ± 2.25	9.50 ± 2.35	
Median (IQR)	8.50 (8.0 – 9.0)	9.0 (8.0 – 9.0)	
Delayed gastric emptying			
No	13 (81.3%)	11 (78.6%)	^{FE}p= 1.000
Yes	3 (18.8%)	3 (21.4%)	

IQR, inter quartile range; SD, standard deviation; p, p value for comparing the two studied groups; MIE, minimally invasive esophagectomy.

Table 3: Clinical outcome 3 months and 6 months after discharge

	GroupA (n = 16)	GroupB (n = 14)	P-value
3 months			
Free	14 (87.5%)	13 (92.9%)	^{MC}p= 1.000
Bile reflux	1 (6.3%)	0 (0.0%)	
Vomiting	1 (6.3%)	1 (7.1%)	
6 months			
Free	15 (93.8%)	14 (100.0%)	^{FE}p= 1.000
Bile reflux	1 (6.3%)	0 (0.0%)	
Vomiting	0 (0.0%)	0 (0.0%)	

p, p value for comparing the two studied groups.

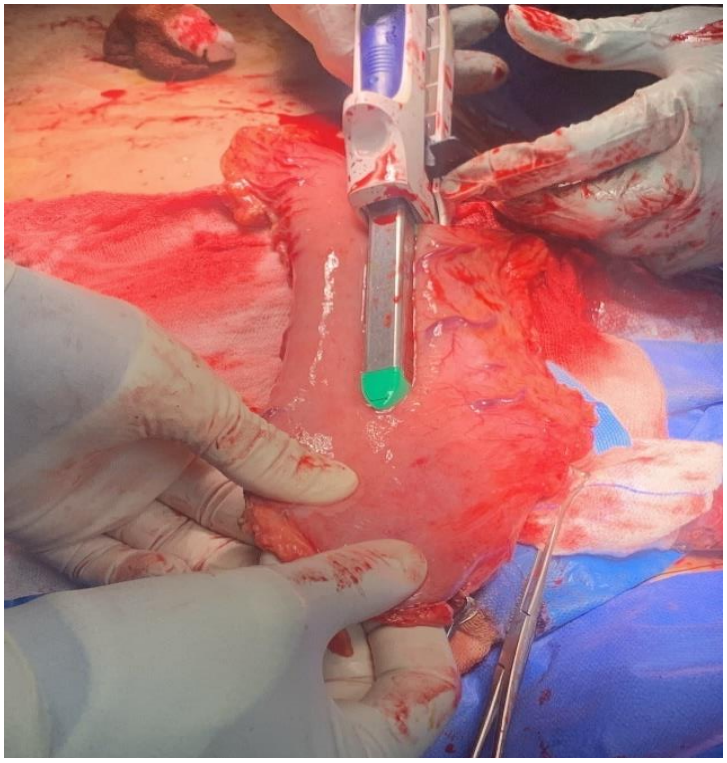

Figure 1 : Gastric tube construction using staplers

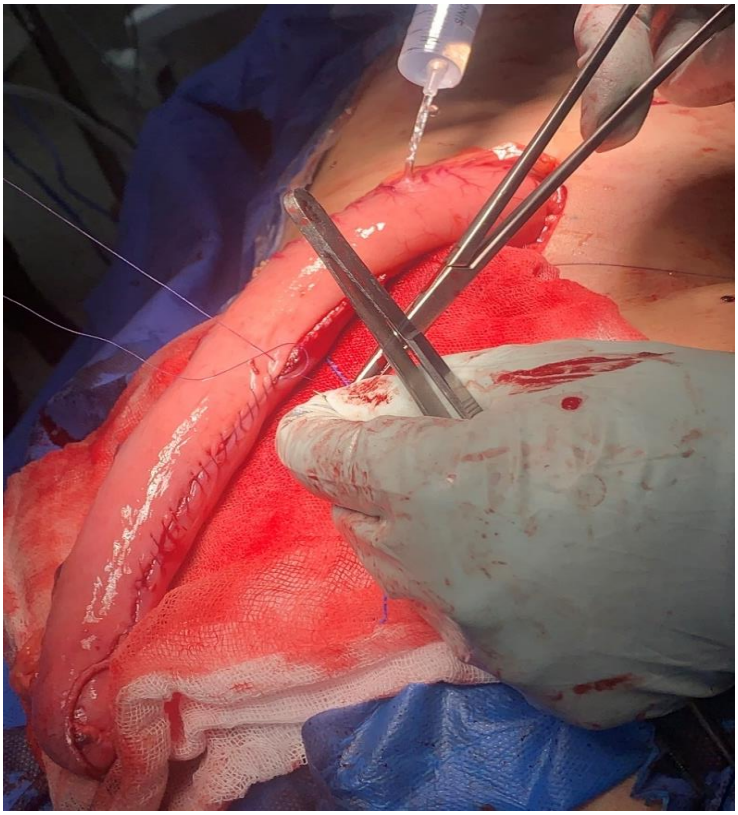

Figure 2: Gastric tube completed with reinforcement sutures

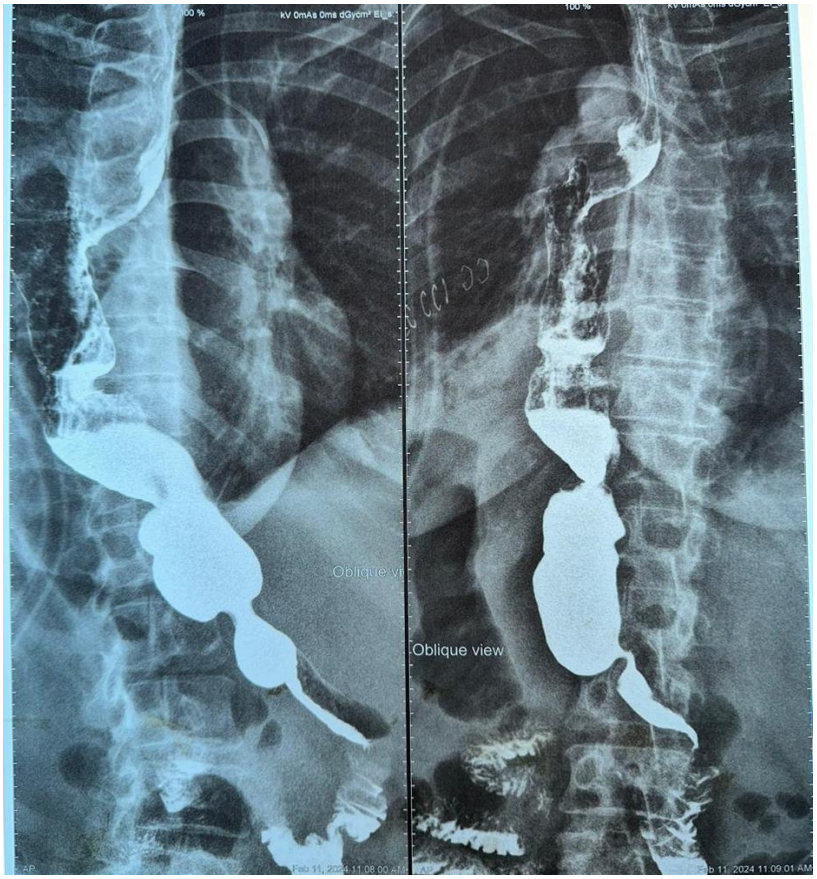

Figure 3: Postoperative barium swallow showing passage of dye distal to pyloric ring

DISCUSSION

Esophagectomy procedure remains the most important part in the cure of esophageal neoplasm even after the great improvement in the new modalities like neoadjuvant chemotherapeutic agents and immunotherapy [8]. Unfortunately, esophageal resection has many serious postoperative complications that affect the quality of life of the patients to a great extent [8].

Delayed stomach emptying and obstruction of stomach outlet is one of the most common adverse effects following esophagectomy due to affection of the innervation of the stomach following the bilateral vagotomy that usually occurs with esophageal resection [8].

Performing a pyloric draining technique during esophageal resection for alleviation of sluggish gastric motility is still a matter of debate and there is no strong evidence that gives an advantage for performing pylorus draining intervention versus keeping an intact pylorus [5]. Surgical pylorus draining could improve gastric emptying after surgery, but it could have serious complications like bile reflux irritating the lower esophagus and affecting the quality of life of the patients [5].

On the other hand, omitting pyloroplasty step during esophagectomy and keeping the pylorus intact could have a little effect on gastric emptying after surgery but most cases respond to medical treatment in the form of prokinetic and antiemetic drugs. Although some of the patients could have persistent symptoms of sluggish gastric motility post-esophagectomy without pyloroplasty, most of these cases could be easily managed endoscopically by balloon dilatation [5,8].

The results of our study showed that there was no statistically significant difference between both study groups who have received pyloroplasty or not regarding the incidence of post surgical impaired stomach emptying or the incidence of postoperative anastomotic leakage and pulmonary complications.

Regarding the manifestations of delayed gastric emptying, it was present in 18.8% of group A patients, while in group B it was present in 21.4%. However, there was a non-significant increase incidence of bile reflux in group A patients as 6.3% had persistent symptoms of bile reflux due to lower esophageal irritation by bile.

Although some of the published articles support the beneficial effect of performing pyloric drainage, others support that keeping an intact pylorus could have no difference on the occurrence of sluggish stomach emptying and pyloric obstruction after esophagectomy. Doran et al. [9] have conducted a study that was in favor of doing pyloroplasty during esophagectomy due to its safety and protect against the need of postoperative pyloric dilatation.

On the other hand, another recent meta-analysis by Nevis et al. [10] have concluded that surgical pyloric drainage may not have any significant clinical impact for esophagectomy patients as no valuable difference was found between the two groups of patients regarding anastomotic leakage, pulmonary complications, delayed gastric emptying and the need for further pyloric intervention. In addition, Zhang et al. [11] have performed a detailed review about different techniques of pyloric drainage and the necessity of doing it and have concluded that routine performance of prophylactic pyloroplasty is unnecessary and have also found that the construction of gastric tube was better than whole stomach conduit for prevention of impaired stomach emptying. Palmes et al. [12] concluded in his study that surgical pyloric drainage during esophagectomy should be omitted as it does not seem to prevent sluggish stomach motility and it may cause serious biliary reflux esophagitis.

Our study results were consistent with most of the published reviews as we found no significant difference between both groups regarding serious postoperative complications and most of the symptoms related to impaired gastric motility could improve with medical treatment. The construction of the gastric conduit is also an important point to consider as all our cases had a gastric tube conduit created by the linear stapler rather than using whole

stomach conduit which also could have a beneficial effect regarding the prevention of postoperative sluggish stomach emptying.

However, our study could have some limitations like the small number of patients and the surgeon preference regarding doing the pyloric drainage intervention as this could affect the results.

Further future trials are recommended. Especially large, randomized trials are needed to investigate the potential benefits and drawbacks of performing prophylactic pyloric drainage procedure during esophagectomy.

CONCLUSIONS

Performing a prophylactic surgical pyloric drainage procedure during esophagectomy may be unnecessary as there was no significant difference regarding persistent symptoms of delayed gastric emptying, anastomotic leakage and pulmonary complications in other patients who received esophagectomy without surgical pyloric drainage. Pyloroplasty could be associated with postoperative biliary reflux esophagitis which gives an advantage for keeping an intact pylorus. Delayed gastric emptying usually occurs in patients following esophagectomy either with pyloroplasty or without pyloric drainage and most cases improve with time and medical treatment. Further large randomized clinical trials are recommended to standardize the need for performing pyloric drainage procedure with esophagectomy and the ideal method of its performance.

Conflict of Interest: None.

Financial Disclosure: None.

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