ORIGINAL ARTICLE

USE OF PERCUTANEOUS ENDOSCOPIC GASTROSTOMY SITE FOR SPECIMEN RETRIEVAL AND EXTRACORPOREAL GASTRIC CONDUIT FORMATION, IN MINIMALLY INVASIVE OESOPHAGECTOMY

Misbah Khan, Namra Urooj, Aamir Ali Sayed, Shahid Khattak, Anam Muzaffar, Muhammad Ijaz Ashraf

Department of Surgical Oncology, Shaukat Khanum Memorial Cancer Hospital and Research Centre Lahore, Pakistan

Received: 26 February 2016 / Accepted: 12 April 2016

ABSTRACT

Purpose: Purpose of the present study is to report our technique of the use of percutaneous endoscopic gastrostomy (PEG) site excision biopsy wound, for specimen retrieval and gastric conduit formation, in minimally invasive oesophagectomy for oesophageal cancer.

Methods: It is a retrospective comparative study where we present data of our 100 resectable oesophageal cancer patients who underwent postneoadjuvant minimally invasive oesophagectomy from January 2012 to September 2015. All of the patients had an initial staging endoscopic ultrasound with PEG placement. The prestudy (conventional) approach, i.e., laparoscopic gastric conduit formation along with specimen pull up from the cervical/thoracic wound is compared to the present (Study) group.

Results: The two groups were similar for basic demographic variables, tumour stage, morphology and nutritional status. The primary endpoints were an operative time in minutes and any additional procedure-specific complications. The rate of procedure-specific complications (Abdominal excision wound complications or conduit failure) was low 11%. PEG site excision biopsy was positive in two cases; one adenocarcinoma and one squamous carcinoma, both were mid to lower oesophageal tumours not involving gastroesophageal junction.

Conclusions: Benefits of the approach are ease of gastric conduit formation along with an additional second layer with less operative time through the small wound, avoidance of tumour specimen removal all the way through mediastinum from the cervical incision, and excision of a potential site of oesophageal cancer metastasis, without any added morbidity.

Key words: Extracorporeal gastric conduit, minimally invasive oesophagectomy, percutaneous endoscopic gastrostomy

Introduction

Percutaneous endoscopic gastrostomy (PEG) tube is an efficient and inexpensive way of providing long-term enteral nutrition to patients with oesophageal cancer and dysphagia.[1-3] 50 cases of contact cancer at the puncture site due to the presence of occluding proximal tumours have been reported worldwide.[3-6]

Correspondence: Dr. Misbah Khan, Department of Surgical Oncology, Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan.
Email: misbahkhan@skm.org.pk

All or most of our patients with a diagnosis of oesophageal cancer and dysphagia undergo PEG tube placement for nutrition, as part of a uniform protocol during their initial endoscopic ultrasound (EUS) staging before neoadjuvant chemoradiation therapy.[7]

Conventionally, we started our minimally invasive oesophagectomy with laparoscopic gastric conduit formation and its pull up along with the attached tumour specimen through the cervical wound, which led to an early PEG site metastasis in one of our earlier cases. This led to our gradual evolution of present technique with first

on table PEG site frozen to complete excision of the PEG site, followed by use of excision wound for specimen retrieval and to the present use of Alexis 360º small retractors and an extracorporeal gastric tube formation.

The purpose of the study was to report our technique of minimally invasive oesophagectomy combined with a PEG site excision biopsy and utilisation of resulting wound for extracorporeal gastric conduit formation and tumour specimen retrieval.

Surgical technique

The technique involves the standard procedure for a minimally invasive transhiatal/3-stage/hybrid oesophagectomy with laparoscopic abdominal approach incorporating the utilisation of PEG excision biopsy site for gastric conduit formation.

Approach

The laparoscopic abdominal part of oesophageal resection is done in a modified Lloyd-Davis position with patient supine on the table and legs abducted on dedicated leg holders.

Thromboembolic prophylactic pneumatic compression devices are applied before positioning the patients. Standard five ports technique is employed for the abdominal part.

Description of main steps of technique

Following completion of laparoscopic complete gastric mobilisation on right gastroepiploic and right gastric pedicles, PEG site is disconnected close to the anterior abdominal wall with Echelon stapling device. Laparoscopic transhiatal or video-assisted thoracoscopic mobilisation of the oesophagus is performed [Figure 1]. Cervical oesophageal mobilisation is completed through the cervical approach, and cervical oesophagus is divided. A soft Ryle's tube French number 14 or 16 is tied to the distal end of the cervical oesophagus.

The outer PEG site is excised with an elliptical midline abdominal incision taking a 1 cm margin and sent for histopathology. Falciform ligament is divided to make easy delivery of conduit through the small wound. Wound protector Alexis (small) is introduced into the resulting wound and opened, stomach along with the oesophagus over attached Ryle's tube is brought into the wound (keeping other end of long Ryle's tube still in the cervical wound to secure posterior mediastinal route) [Figures 2 and 3].

A wide stomach tube 4–5 cm is constructed with linear staplers taking proximal cardia and less than one-third of lesser curve with the specimen for adequate resection margins. The stapled line is secured with interrupted or continuous proline 4/0 suture. Proximal gastric tube at the proposed site of the anastomosis is anchored to the distal end of Ryle's tube with a single silk 2/0 stitch, and gastric

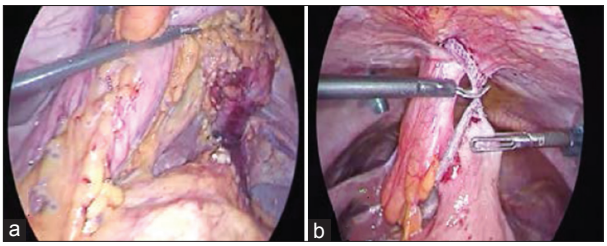

Figure 1: Laparoscopic gastric mobilisation completed (a), percutaneous endoscopic gastrostomy site is disconnected close to anterior abdominal wall (b)

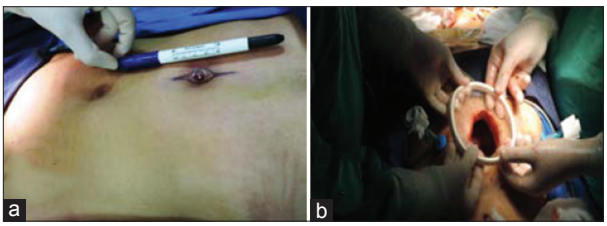

Figure 2: Elliptical midline abdominal incision taking a 1 cm margins (a), wound protector Alexis (small) introduced for retraction and wound protection (b)

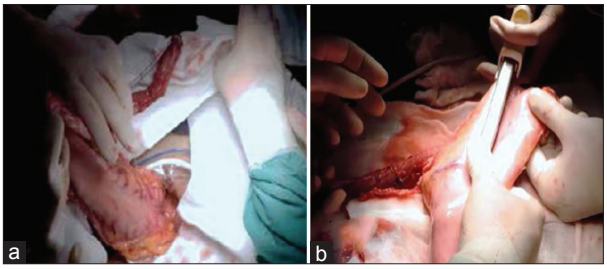

Figure 3: (a) Stomach along with the oesophagus and attached Ryle's tube is brought into the wound. (b) Gastric tube is constructed with linear staplers, the stapled line is secured with interrupted or continuous proline 4/0 suture

tube pulled up over it from the cervical wound. Rest of the gastro-oesophageal reconstruction proceeds in the usual way, after removal of Ryle's tube. Single layer interrupted end-to-end handsewn anastomosis is the standard practice at our centre. Pneumoperitoneum can be reachieved for remaining laparoscopic abdominal steps by gloving the Alexis retractor with a surgical glove [Figure 4].

Benefits

Benefits of the approach are ease of gastric conduit formation, along with an additional second layer of proline, in less time, through the small wound along with avoidance of tumour specimen removal all the way from mediastinum through the cervical incision.

Methods

We present a data of our 100 resectable oesophageal cancer patients with a postneoadjuvant minimally invasive oesophagectomy from a period of January 2012 to September 2015. The study was granted an exemption status by the institutional review board of the hospital, and all data were collected through our hospital information system. All the patients had an initial staging computed tomography (CT) and EUS with PEG placement done followed by neoadjuvant chemoXRT. Furthermore, postneoadjuvant staging CT scan was done on all of the included patients to establish resectability. The prestudy (conventional) approach, i.e., laparoscopic gastric conduit formation along with specimen pull up from the cervical/thoracic wound is compared to the present modified technique (study) group. All cases were jointly performed by one of the two surgical oncologists and one thoracic surgeon over the period of this study. The primary outcome measures were an operative time in minutes and any additional procedure-specific complications. The study does not take into account other postoperative complication specific to oesophagectomy procedure such as respiratory, minor Class I and II anastomotic leaks, strictures and mortalities.

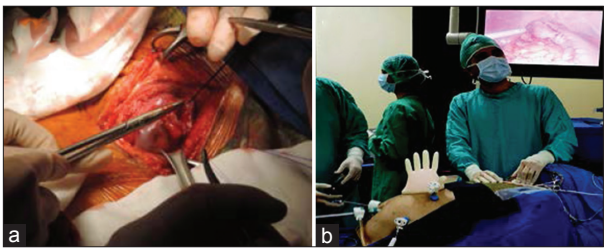

Figure 4: Gastro-oesophageal reconstruction in single layer interrupted end-to-end handsewn anastomosis (a), pneumoperitoneum can be reachieved for remaining laparoscopic steps (b)

Exclusion

Patients who had an oesophagectomy performed through open or minimally invasive converted to open technique were excluded. Furthermore, patients with an emergency oesophageal surgery or patients with no neoadjuvant chemoXRT or no PEG placement before neoadjuvant treatment were excluded. Siewart type III gastroesophageal junction (GEJ) tumours were not included in the present study.

Statistical analysis

It is a retrospective cohort review. We looked at frequencies and proportions. Associations were established with cross tabulations, Pearson Chi-square test for categorical variables and *t*-test for continuous variables. All tests were two-tailed. $P = 0.05$ or less was taken as the level of significance. Multivariate linear logistic regression analysis was performed for differences in operative time between the two groups.

Results

No additional morbidity or cost was encountered following employment of this technique except for the use of an Alexis retractor (size; small) for each procedure. Procedure-specific complications rate was low. The group was further compared with a set of patients with total laparoscopic gastric tube formation and specimen retrieval through thorax or neck. The two groups were similar for basic demographic and clinical variables as in Table 1, except for the type of oesophagectomy performed.

The rate of overall procedure-specific complications [Table 2] was low 11% and was statistically not significant between the two groups. PEG site excision biopsy was positive in two cases, one in each group, one was adenocarcinomas and other squamous in morphology, both of them were mid to lower oesophageal tumours not involving GEJ.

Table 1: Distribution of clinical and demographic variables among two groups

Clinical and Demographic variables	Conventional 31 (31%)	Study group 69 (69%)	*P* value
Mean (Standard deviation) range			
Age; years	49.5 (10.7), 25–72	52.3 (10.5), 22–75	0.212
BMI	21.4 (4.2), 15.3–31.1	22.5 (4.6), 11.6–35	0.288
Serum albumin (g/dl)	4.1 (0.3), 3.3–4.7	4.1 (0.4), 2.8–4.9	0.781
n (%)			
Tumour morphology			
Squamous	26 (83.9)	57 (82.6)	0.876
Adeno	5 (16.1)	12 (17.4)	
Gender; female	16 (51.6)	30 (43.5)	0.45
PEG insertion complications			
No	16 (51.6)	46 (66.7)	0.322
Class 1	12 (38.7)	17 (24.6)	
Class 2	3 (9.7)	6 (8.7)	
pT stage			
T0	22 (71)	36 (52.2)	0.190
T1,2,3	9 (29)	32 (46.4)	
T4	0 (0)	1 (1.4)	
Minimally invasive esophagectomy technique			
3-stage	25 (80.6)	47 (68.1)	0.00
2-stage	6 (19.4)	1 (1.4)	
Transhiatal	0 (0)	21 (30.4)	

BMI: Body mass index, pT: Pathological tumour stage

Table 2: Distribution of procedure specific complications in two groups (%)

Complications	Conventional group	Study group	Total
Wound infection class 1	2 (6.45)	6 (8.7)	8 (8)
Wound infection class 2	0	2 (2.9)	2 (2)
Wound dehiscence	0	1 (1.4)	1 (1)
Incisional hernia	0	1 (1.4)	1 (1)
Conduit failure	1 (3.2)	1 (1.4)	2 (2)

Median operative time was less in the study group, but the difference was statistically insignificant. Overall mean operative time was 363 min (SD + 113.8) for all patients (median 362.5), and it was taken as a reference to dichotomize this outcome variable for multivariate analysis.

After controlling for the type of minimally oesophagectomy procedure performed the conventional group had a statistically significant longer operative time (>363 min) as compared to the study group (OR = 1.71, CI = 1.17–8.92, $P = 0.024$), on multivariate analysis for this specific outcome measure.

Discussion

The benefits of PEG placement are a high mean body mass index (BMI) and serum albumin level before surgery in both groups and a low PEG-related complications rate.[1-7] The mean BMI in all of our patients was >20 for both groups. PEG site, during stomach mobilisation, has an additional benefit that it acts as an additional port by keeping the stomach retracted to the abdominal wall [Figure 1].

The early complications related to PEG insertion in this series were minor Clavien class 1 including pain abdomen,

Table 3: Distribution of outcome variables between two groups

Outcome variables	Conventional group (%)	Study group (%)	*P* value
Complications			
No	28 (90.3)	59 (85.5)	0.538
Class 1,2	2 (6.5)	9 (13.0)	
Class 3	1 (3.2)	1 (1.4)	
Operative time in min			
Median	405	330	0.06
Range	215-570	195-750	
IQR	320-450	255-415	
Peg site histopathology			
Positive for tumour cells	1 (3.2)	1 (1.4)	0.523

peri-PEG pain or discharge, postprocedure hypotension, and diarrhoea managed with mild analgesics, proton pump inhibitor and hydration and class 2 complications; peri-PEG infection and cellulitis, hypotension requiring management with I/V antibiotics and admission. There were no re-operations or mortalities. In terms of benefits of laparoscopic versus open conduit formation, we failed to show any procedure specific low complication rate but operative time was less in the study group. A number of studies have described the technique of extracorporeal gastric conduit formation with a paramedian incision for the purpose of minimizing conduit failure rate.[8-10] These series have used an additional incision for the specific purpose, without any added nutritional benefits of PEG tube during preoperative downstaging in the setting of disease associated dysphagia.

Wajed *et al*. analysed their results and compared them with their intracorporeal approach with a conduit failure or necrosis rate of 2.5% for extracorporeal versus 4.5% with the intracorporeal approach. In the present study, there was one conduit failure in each group, requiring re-exploration. One proximal gastric necrosis in the open gastric tube group requiring proximal gastric excision and reanastomosis, and one anastomotic leak followed by gastric excision and colon pull up in the total laparoscopic group [Table 3].

There have been series from experienced centres associating a higher conduit failure rate with minimally invasive techniques,[11-14] and to minimize that extracorporeal technique has been advocated. Our series failed to show any significant difference for this specific complication between two groups. Rather we have developed and adopted the technique differently at our institute, initially for a better oncological outcome by removing a potential site of tumour recurrence along with the added advantage of nutritional support during neoadjuvant chemoradiation therapy and better nutrition parameters in terms of BMI and serum albumin at surgery. This has evolved now to add ease and safety to the minimally invasive procedure with less time by putting the conduit back into the surgeon's hands for the critical part of the operation.

Although there is no statistically significant difference in the rate of locoregional recurrence with specimen removal through abdomen, the idea is to adhere to oncological principals of minimum tumour handling and less exposure to surrounding viscera *in vivo*.

Limitations

The study does not take into account minor Class I and II anastomotic leaks due to their multifactorial association with anastomotic technique. The comparison group is quite small in size relative to the study group. An important confounding factor to the decreasing operative time could be the chronological sequence of the comparative groups in the parallel setting of the learning curve of minimally invasive technique at our centre, with a decrease in operative time-related simply to the maturation of skill and experience.

Conclusions

Benefits of the described approach are ease of gastric conduit formation along with an additional second layer

of proline with less operative time through no additional wound and avoidance of specimen and tumour removal from all the way through mediastinum to the neck.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. Kobayashi T, Oshima K, Yokobori T, *et al*. Perioperative nutriture in esophageal cancer patients undergoing esophagectomy. Hepatogastroenterology 2013;60:1311-6.
2. Löser C, Aschl G, Hébuterne X, *et al*. ESPEN guidelines on artificial enteral nutrition--percutaneous endoscopic gastrostomy (PEG). Clin Nutr 2005;24:848-61.
3. Sousa AL, Sousa D, Velasco F, *et al*. Rare complication of percutaneous endoscopic gastrostomy: Ostomy metastasis of oesophageal carcinoma. World J Gastrointest Oncol 2013; 5:204-6.
4. Kassir R, Cavaille A, Barabino G, *et al*. Metastasis of oropharyngeal carcinoma to the site of percutaneous endoscopic gastrostomy: Literature review. J Curr Surg 2014; 4:46-8.
5. Cappell MS. Risk factors and risk reduction of malignant seeding of the percutaneous endoscopic gastrostomy track from pharyngoesophageal malignancy: A review of all 44 known reported cases. Am J Gastroenterol 2007; 102:1307-11.
6. Hearn M, Trull B, Hearn J, *et al*. Percutaneous endoscopic gastrostomy tube-associated metastasis in pharyngooesophageal malignancy. R Coll Surg Irel Stud Med J 2012;5:54-7.
7. Bhatti AB, Rizvi FH, Waheed A, *et al*. Does prior percutaneous endoscopic gastrostomy alter post-operative outcome after esophagectomy. World J Surg 2015;39:441-5.
8. Berrisford RG. Minimally-invasive subtotal oesophagectomy: Three-stage thoracoscopic, laparoscopic subtotal oesophagectomy with cervical anastomosis. Multimed Man Cardiothorac Surg 2011;2011:mmcts.2008.003566.
9. Wajed SA, Veeramootoo D, Shore AC. Video. Surgical optimisation of the gastric conduit for minimally invasive oesophagectomy. Surg Endosc 2012;26:271-6.
10. Palazzo F, Evans NR 3rd, Rosato EL. Minimally invasive esophagectomy with extracorporeal gastric conduit creation-how i do it. J Gastrointest Surg 2013;17:1683-8.
11. Berrisford RG, Wajed SA, Sanders D, *et al*. Short-term outcomes following total minimally invasive oesophagectomy. Br J Surg 2008;95:602-10.
12. Luketich JD, Alvelo-Rivera M, Buenaventura PO, *et al*. Minimally invasive esophagectomy: Outcomes in 222 patients. Ann Surg 2003;238:486-94.
13. Nguyen NT, Hinojosa MW, Smith BR, *et al*. Minimally invasive esophagectomy: Lessons learned from 104 operations. Ann Surg 2008;248:1081-91.
14. Veeramootoo D, Parameswaran R, Krishnadas R, *et al*. Classification and early recognition of gastric conduit failure after minimally invasive esophagectomy. Surg Endosc 2009; 23:2110-6.