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Manual and mechanical cervical esophagogastric anastomosis after esophageal Resection: A comparison

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Abstract
Anastomotic complications after esophagectomy continue to be a burden jeopardizing the quality of life and of swallowing. However, incidence, mortality and morbidity of anastomotic complications have substantially decreased in recent years. It seems that this is not so much related to the use of a particular conduit, approach or route for reconstruction, but rather related to refinement in anastomotic techniques and perhaps even more to progress in modern perioperative management. Knowledge of surgical anatomy and meticulous technique are of paramount importance and obviously related to individual expertise.

Aims

1. To compare the rates of anastomotic leaks after cervical esophagogastric anastomosis (CEGA) done by hand-sewn (end-to-side) technique and by linear stapled anastomosis (side-to-side) technique.
2. To compare the rates of postoperative anastomotic stricture after cervical esophagogastric anastomosis (CEGA) done by hand-sewn (end-to-side) technique and by linear stapled anastomosis (side-to-side) technique.

Index terms: Cervical Esophagogastric Anastomosis (CEGA), Esophagectomy, Esophageal Resection, Anastomotic leaks, Hand sewn anastomosis, Stapled anastomosis, gastrostomy.

Keywords: Manual, mechanical, cervical, esophagogastric, anastomosis

Introduction

Esophagectomy is increasingly performed for a wide spectrum of conditions but mostly for carcinoma. Improvement of preoperative management and surgical techniques has resulted in a steady decrease in postoperative mortality. Overall 5-year survival rates as high as 30-40% have been reported after resection with curative intent [1]. It is widely accepted that surgery offers the best form of palliation but the quality of palliation is commonly jeopardised by anastomotic complications eg., anastomotic leaks.

Following esophagectomy or oesophageal bypass, restoration of continuity by gastric interposition with cervical esophagogastric anastomosis (CEGA) can be done either by a hand-sewn or stapled anastomosis. Though early complications of cervical esophagogastric anastomosis are less, the long-term sequelae such as anastomotic stricture occur in nearly half the patients with an anastomotic leak. As the oesophagus has no serosa, its longitudinal muscles hold sutures poorly, thus surgical techniques is more likely to play an important role. The incidence of cervical esophagogastric anastomosis leakage with hand-sewn anastomosis has been reported from 15% to 25%. Meanwhile, side to side anastomosis with linear staplers the leak rates have been reported to be less than 5%, with lower incidence of anastomotic stricture after leak and improved satisfaction in swallowing compared to hand sewn technique.

This study was designed to compare two methods of esophagogastric anastomosis, one with hand-sewn anastomosis and the other with mechanical stapled anastomosis.

Methods

All the patients who attended Out-Patient Department of GI Surgery, Kanyakumari Government Medical College, from September 2008 to December 2020 with complaints of dysphagia were evaluated for oesophageal disorder. 28 patients were included in this study on the following bases: (i) any patient with resectable carcinoma of the mid or lower thoracic oesophagus and gastro-oesophageal junction; (ii) any patient with benign esophageal lesion where esophageal resection was beneficial and feasible.

There were a total of 17 patients in the hand-sewn group and 11 patients in the semi-mechanical stapler group.

The exclusion criteria were as follows: (i) patients who had upper thoracic or cervical oesophageal carcinoma; (ii) patients with unresectable lesions (T4/M1); (iii)patients with prior gastric surgery; (iv)patients with poor performance status (ECOG 3,4).

Procedure

Preoperative Preparation

1. Preoperative nutrition maintained and if required Ryle tube insertion or feeding jejunostomy was done.
2. Incentive spirometry, steam inhalation, bronchodilators and antibiotics were used to improve the pulmonary status as required.

Surgical technique

1. Either trans-hiatal or trans-thoracic esophagectomy was performed.
2. When a three-incisional esophagectomy was performed, a standard right lateral thoracotomy through the sixth intercostal space was used. This approach was primarily chosen to resect mid-oesophageal lesions and in conditions with dilated oesophagus where injury to distal trachea, azygos vein was greater.
3. Standard intra-thoracic dissections of the oesophagus and peri-oesophageal lymphatics were undertaken. Closure of the thoracotomy was accomplished and the patient was positioned for the laparotomy and cervical aspects of the oesophagectomy.
4. The laparotomy aspect of the esophagectomy was standardised.
5. The midline upper abdominal incision was created.
6. The stomach was completely mobilised by ligation and division of the left gastric vessels at its origin from the celiac axis and ligation of all short gastric vessels distal to their communication with the right gastroepiploic arcade.
7. The gastric conduit was prepared based on the right gastric and the right gastroepiploic vessels and pyloromyotomy and pyloroplasty were not performed.
8. Finger dilatation of pylorus was done when required.
9. The conduit was prepared using 75-mm linear cutter.
10. The stomach was brought up into the neck through either the retrosternal or posterior mediastinal route.
11. 4 to 6 cm of the stomach was brought into the neck wound more from pushing below in the chest than from pulling from above in the neck.
12. The CEGA was done by a side-to-side stapled or end-to-side hand-sewn method.
13. Chest tubes (32F) were inserted bilaterally to take care of any breach in the pleura.
14. Feeding jejunostomy (Witzel's type) with 12F suction catheter was done in all patients.
15. The neck wound will be closed loosely with interrupted sutures over a drain.

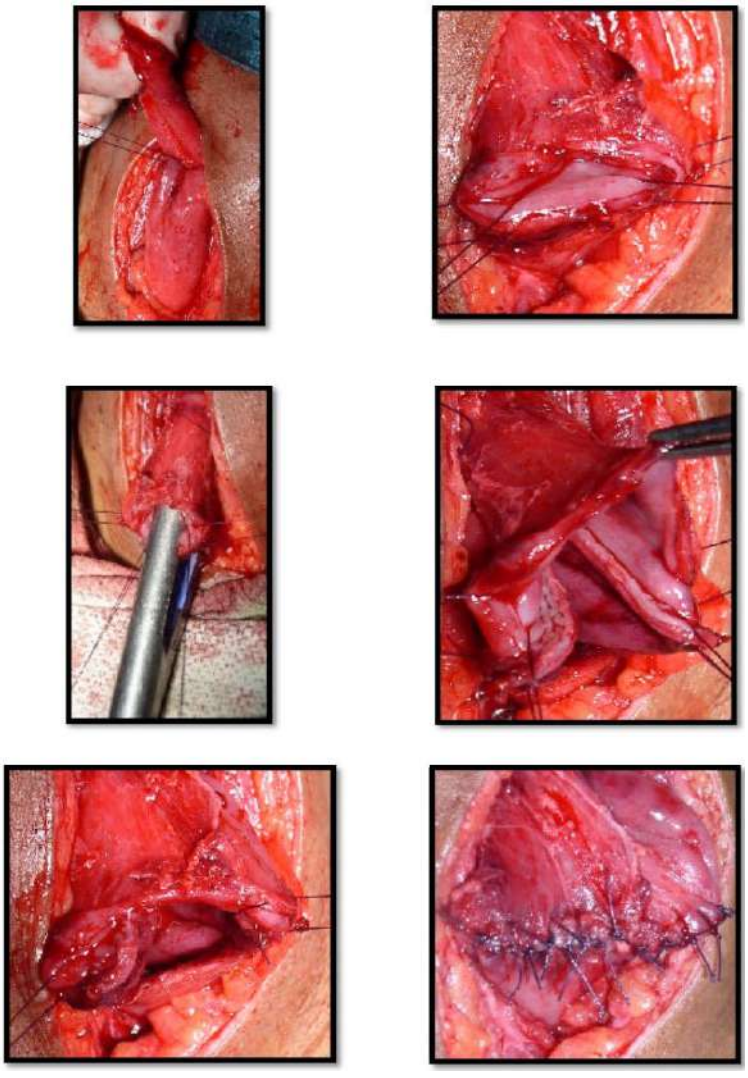

Fig 1: Steps of cervical esophago gastric anastomosis with stapler

Hand sewn anastomosis

1. A proper site on the anterior wall of stomach away from the stapled line approximately 2 cm below the highest point of the gastric conduit was anastomosed to oesophagus.
2. The stomach was then opened transversely (2.5 to 3 cm long)
3. Interrupted stitches with full thickness of the stomach and oesophagus using 2-0 Polyglactin were placed to achieve mucosa to mucosa approximation.
4. A 16F nasogastric tube was placed across the anastomosis into the intra-thoracic stomach.
5. The anterior wall of the anastomosis was completed in a manner similar to posterior wall.

Stapled anastomosis

- The mobilised stomach is gently manipulated by one hand through the diaphragmatic hiatus upward beneath the aortic arch into the superior mediastinum until the tip of the gastric fundus can be grasped with a Babcock clamp inserted through the cervical incision. The clamp is applied gently, not completely ratcheting the handle, and is used to deliver the gastric fundus into the neck wound until it can be grasped with the fingertips
- At least 5 cm of the mobilised stomach was placed in the neck.
- The oversewn gastric staple line along the lesser curvature side of stomach is toward the patient's right.
- A Babcock clamp is used to grasp the anterior wall of the stomach low in the neck wound where it emerges from the posterior mediastinum at the thoracic inlet, and the gastric staple line was rotated more medially. The stomach was elevated several more centimetres into the wound, and a seromuscular 3-0 silk traction suture is placed distal to the clamp.
- A 1.5 cm gastrotomy was made. The gastrotomy must be located far enough inferior to the tip of the gastric fundus to allow subsequent full insertion of the 3 cm long staple cartridge. Placement of the gastrotomy also must take into consideration the remaining length of cervical oesophagus and should be performed with the realisation that when the traction suture on the stomach is eventually removed, the stomach will partially retract downwards into the thoracic inlet. Therefore, some redundancy in the length of the cervical oesophagus should be allowed as the anastomosis is constructed.
- An atraumatic vascular forceps serves as a guide for amputation of the cervical esophageal staple suture line, which is sent to the pathology department as the proximal oesophageal margin. The cervical oesophagus was divided with the stapler by placing it obliquely because the anterior tip of the oesophagus should be longer than the posterior corner in construction of the anastomosis.
- Two stay sutures were taken, one at the anterior corner of the oesophagus and another between the posterior corner of the oesophagus and the middle of the gastrotomy.
- These stay sutures were retracted downwards as the stapler device (Endoscopic linear cutter) was introduced the thinner portion into the stomach and the thicker staple-bearing portion into the oesophagus.
- The staple cartridge was then rotated so that the posterior wall of the oesophagus and the anterior wall of the stomach were aligned in a parallel manner, keeping the site of the anastomosis well away from the gastric staple suture line.
- The stapler is closed, thereby approximating the jaws, but before firing it, two suspension sutures between the anterior stomach and the adjacent oesophagus are placed on either side.
- When the knife assembly of the stapler is advanced, the common wall between the oesophagus and stomach is cut, and a 5-6 cm long side-to-side anastomosis is created.
- Corner sutures are then placed at either side of the gastrotomy.
- A 16F nasogastric tube was placed across the anastomosis into the intra-thoracic stomach
- The anterior edges of the gastrotomy and open oesophagus were approximated in a single layered suture with interrupted 2-0 polyglactin.

C. Postoperative management

a. Jejunostomy trial feed was started when the intestinal activity appeared.
b. A contrast study using water-soluble contrast medium was done on the 7th postoperative day.
c. The neck drain was removed after the contrast study
d. If no leakage were observed and the nasogastric tube delivered <200 mL, the patients started to drink fluids, followed by a soft diet. On the ninth postoperative day, a regular diet was served. No form of supporting enteral nutrition was provided.
e. If a leak was identified, the cervical wound was opened to establish external drainage of any cervical abscess and anastomotic fistulae.
f. Regular dressing with normal saline soaked gauze was done.

Statistical analysis

- Continuous variables were reported as Mean with Standard Error of Mean (SEM).
- Categorical variables were reported as proportions
- Student's t test, Chi-square tests and Fischer's exact test, where possible, were used for comparison between groups.
- A p-value of 0.05 or less was regarded as significant.

Results

The pertinent characteristics of the 28 patients are listed in Table 1. One patient (3.6%) died in the hospital, and the remaining 27 were available for follow-up.

There were no differences in age, gender distribution, distribution of disease, and the indication for operation between the two groups.

Worldwide, males of all ages were more commonly affected than females, and the male to female ratio in this study was 2:1. Fifteen (68.2%) of the patients with oesophageal carcinoma were men and 7 (31.2%) were women. Nineteen male patients (66.7%) and 9 female patients (33.3%), ranging in age from 24 to 65 years (average 50.5 years). The study comprised mostly patients in the age group 41-60 years. In general, oesophageal cancers are seen infrequently in the early adulthood. The one patient below the age of 25 had a benign pathology, corrosive oesophageal stricture.

Table 1: Characteristics and Pathological Conditions of Patients

	Hand Sewn (N=17)	Stapler (N=11)	P-value
Sex (male/female)	10/7	9/2	0.2311
Mean age (range)	24-65 (50.5)	32-62 (50.6)	0.7985
Anemia	11.612	11.373	0.8699
Malignancy	14	8	0.6525
Benign	3	3	0.6525
Esophagectomy (THE/TTE)	13/2	8/3	0.6196

Table 2: Operative and Peri-operative data

	Hand Sewn N=17	Stapler N=11	p-value
Blood loss (ml) [median range]	313 [150-600]	291 [150-450]	0.5527
Transfusions (no. of units) [median(range)]	1.6[0-4]	1.5[0-2]	0.5737
Anastomotic time (min) [median(range)]	43.6 [25-55]	32.2 [20-45]	0.0096
Conduit necrosis	0	0	-
Vocal cord palsy (%)	2	0	0.4986
Hospital stay (days)	17.25	15.28	0.6730
Hospital mortality %	0	1	0.4074

Table 3: Incidence of Anastomotic leak

	Hand Sewn	Stapler	p-value
Radiological	0	0	-
Clinical Minor	3 (18.8%)	2 (18.2%)	1.000
Clinical Major	0	0	-
Conduit Necrosis	0	0	-
Total	3 (18.8%)	2 (18.2%)	1.000

Table 4: Incidence of Anastomotic Stricture

	No. of patients	Percentage	p-value
Hand-Sewn [n=17]	5	29.41	0.3497
Stapler [n=11]	1	9.09	

Discussion

Anastomosis techniques, both the hand-sewn and mechanical stapling procedures, have been evaluated by many investigators. Although cervical esophagogastrostomies can be performed with circular stapling devices both trans orally [2] and by transitioning the stapler through the subsequent pyloroplasty site and pushing the stomach up to the cervicotomy [3], most surgeons prefer to suture cervical anastomoses. [4] The reported high failure rate of attempted circular stapled anastomoses in the neck and the fact that cervical anastomoses can be readily performed manually in a highly standardised manner made surgeons to choose hand-sewn technique for anastomosis in the neck. The high stricture rate for circular stapled intrathoracic esophagogastric anastomosis was reported by Law et al. (40%) in a prospective randomised trial [5]. The anastomotic narrowing is presumably explained by wound contraction in the annular incision effected by the circular knife of the stapler that cuts through the anastomotic tissue. The accurate mucosa-to-mucosa apposition, considered important for good anastomotic healing was achieved only in the manually sutured anastomosis.

The cost/benefit ratio of mechanical sutures is a controversial issue. To compare the cost of esophago-visceral anastomoses performed with staplers versus the cost of conventional anastomosis, not only the cost of the material, but also the economical impact of the hospital stay and operative complications needs to be evaluated. Results show a decrease in hospital stay in patients treated with mechanical sutures (15.28% vs. 17.25%, p=0.6730).

Conclusion

Construction of the cervical esophagogastric anastomosis with a side-to-side stapled anastomosis greatly reduces the frequency of anastomotic leaks and later strictures rates. The side-to-side stapled anastomosis is a major technical advance in the progression of refinements of transhiatal esophagectomy and a cervical esophagogastric anastomosis. Transhiatal esophagectomy is feasible in most patients requiring esophageal resection for malignant disease and is a safe, well-tolerated operation if performed with care and for the proper indications. The semimechanical technique for cervical esophagogastrostomy is associated with a shorter postoperative stay.

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