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Comparison between Minimally Invasive and Open Esophagectomy in Cancer Esophagus- Experience at a Tertiary Cancer Centre in India.

Oncology

KEYWORDS: Esophagectomy, open, minimally invasive.

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ABSTRACT

Traditional open oesophagectomy constitutes the mainstay of treatment for resectable oesophageal carcinomas. The procedure is being performed by either abdominal or thoracic approaches. Associated mortality and morbidity ranges from 2 to 10% and 30 to 50% respectively, for both the abdominal and thoracic approaches. Laparoscopic technique is an emerging technique with various advantages over traditional methods such as reduced intra operative trauma, better recovery and lower postoperative morbidity. Both techniques are associated with their specific advantages and disadvantages. A comparative study may be helpful to decide the appropriate method of surgery. We conducted a Retrospective study to highlight the comparison between minimal invasive esophagectomy and open esophagectomy with respect to surgeon's preference/ comfort, oncological safety and post-operative morbidity & mortality.

Introduction

Mainstay of curative treatment of esophageal cancer is Esophagectomy. The procedure itself is associated with significant morbidity and mortality. Reported morbidity and mortality are up to 70% and 14% respectively. Various measures including advanced surgical procedures, anesthesia techniques, postoperative analgesia techniques etc. have been taken to improve the outcome [1,2].

Various approaches for resection during Surgery are two and three phase procedures which include abdominal, chest and/or neck incisions. Trans hiatal approach includes abdominal and cervical incision. Traditional technique of Esophagectomy open esophagectomy (OE) includes Ivor Lewis operation or the open cervico-thoracoabdominal approach [3]. Minimally invasive esophagectomy (MIE) is evolving as a safe and effective technique of surgery for esophageal cancer. Among various advantages the main advantage in Esophagectomy is less tissue trauma, shorter duration of surgery, better recovery and hence improved outcome [4,5].

Common steps in all laparoscopic Esophagectomy include thoracoscopic mobilization of the esophagus, followed by laparoscopic- assisted mobilization of the stomach and anastomosis in the neck [6]. Transhiatal approach is another alternative of laparoscopic Esophagectomy which also includes anastomosis in the neck [7]. MIE is may be considered as a safer technique as compared with OE as it shortens the operative time, causes less tissue trauma and less blood loss, shortens the intensive care time, decreases hospital stay without any detrimental effect on survival [8, 9].

Through this article we would like to highlight the comparison between MIE and OE with respect to oncological safety and post-operative morbidity & mortality

Aim

Comparison of outcomes between Minimal Invasive Esophagectomy (MIE) and Open Esophagectomy (OE) in terms of oncological safety, post-operative morbidity & mortality.

Patients and Methods

This is a Retrospective study conducted in the department of Oncosurgery at Kidwai memorial institute of oncology, a Regional Cancer Centre of south India. All patients of carcinoma oesophagus who were operated from June 2013 to May 2015 were included in the study. Total 47 patients underwent surgery during this period. 17 patients were operated by Minimally Invasive Esophagectomy while 30 patients were operated by Open Esophagectomy. Diagnosis of ca esophagus was established using upper GI endoscopy & Biopsy followed by Pre-operative staging by CECT thorax and abdomen. Patients with history of neoadjuvant chemotherapy were excluded from the study while patients with resectable esophageal carcinoma were considered for surgery after adequate Pre-operative work up and evaluation as per hospital protocol.

Minimally invasive procedure included both Laparoscopic Transhiatal esophagectomy (THE) and (VATS) Esophagectomy, while open procedure included THE and Transthoracic esophagectomy (TTE).

All surgeries were performed by experienced Surgeons of the institute as per hospital protocol, while comparison and evaluation was done by different surgeon in a blinded manner using hospital records.

Operative techniques

Open Transhiatal Esophagectomy (TE)

Patient was positioned supine on O.T table with neck extended and head rotated towards right side. Abdomen was opened through an upper midline incision and operability assessed. Mobilization of the duodenum was done by Kocher Maneuver. Blunt dissection done in the avascular plane between the duodenum, the head of the pancreas, and the retroperitoneal vessels until the anterior wall of the inferior vena cava was exposed. Skeletonization of the greater curvature was done sparing left and right gastro-epiploic vessels. Left gastroepiploic artery was transected at its origin, preserving the existing anastomosis between left and right gastroepiploic arteries. Dissection of the lymph nodes of the hepatic artery up to the celiac trunk, of the portal vein as well as around common bile duct was performed. After transection and ligature of short gastric vessels, the parietal peritoneum was incised at the upper pancreatic margin and transection of left gastric vein was done. Lymph nodes along the left gastric artery, splenic artery, common hepatic artery, celiac trunk, and paraaortic lymph nodes were removed. Left gastric artery was ligated. Sharp transection of the phrenicoesophageal ligament at the margin of the esophageal hiatus was done followed by blunt mobilization of the esophagus with the index finger. As a rule the dissection was continued anteriorly under vision up to the tracheal bifurcation with two fingers initially and finally using the whole hand. Above the tracheal bifurcation the dissection was done. In the same way mobilization of the region posterior to the esophagus including paraesophageal lymphatic tissue from aorta and prevertebral fascia up to the tracheal bifurcation was done sharply and under vision. Lateral esophageal ligaments consisting of branches of the vagal nerves, pulmonary ligaments and esophageal branches were transected sharply between clamps. Isoperistaltic

gastric tube was fashioned. Sutures at the top of the gastric tube were left long for transthoracic transposition. Pylorotomy was done in all cases

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Cervical stage- Oblique incision taken from the jugular notch to the level of the thyroid cartilage along the anterior rim of the sternocleidomastoid muscle. Blunt dissection of the space between the straight muscles and the sternocleidomastoid muscle was done. Sternocleidomastoid muscle retracted laterally. Sharp transection of the omohyoid muscle exposed the lateral edge of the thyroid, the jugular vein, and the carotid artery and the carotid sheath. Left laryngeal recurrent nerve was identified in tracheoesophageal groove. The cervical esophagus was dissected with right angle clamp. After removal of the naso-gastric tube, the esophagus was divided. The gastric tube was pulled up in the original esophageal bed into the cervical position. Esophagogastric anastomosis was performed. One penrose drain was placed beside the cervical anastomosis. The wound was closed with cursory platysma sutures and skin closure .Bilateral chest tubes placed was placed in all patients.

LAPROSCOPIC THE-

Port positons-(as shown in figure 1)-

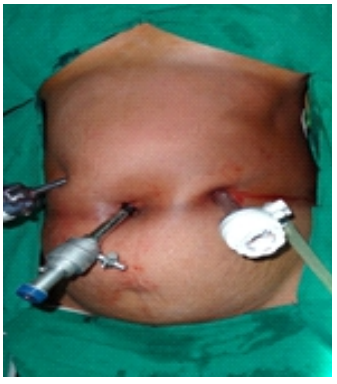

Figure 1

Steps are same as that of open THE. Specimen is delivered through a 5cm upper midline incision and stomach conduit is made through same incision.

TRANSTHORASIC ESOPHAGECTOMY-

Right-sided anterolateral thoracotomy through 5th Intercostal was done. Mediastinal pleura was incised along the hilum of the right lung. Dissection of the vagus nerve distal to the recurrent laryngeal nerve was done followed by dissection between esophagus, aorta, and trachea and resection of paratracheal, parabronchial, paracarinal, and infracarinal lymph nodes. Thoracic drainage and closure of the thoracotomy completed. Abdominal and cervical part of procedure was same as that of THE.

VATS ESOPHAGECTOMY-

In VATS esophagectomy first thoracic mobilization of esophagus was done with patient in prone position and using three ports as shown in figure 2-

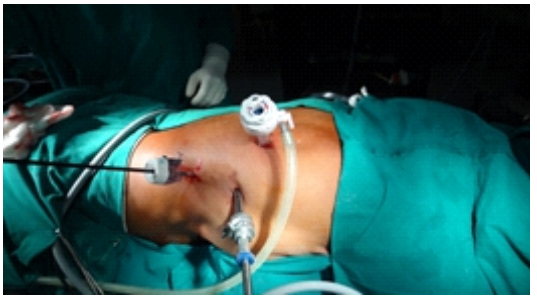

Figure 2 Rests of the steps were same as open procedure.

Post-operative management-

- Post-operatively patients were put on ventilator in ICU & extubated when haemodynamically & respiratory stable.
- Extubated patients were shifted to step down ICU & from there to ward.
- FJ feeds started on POD-1 or 2.
- On POD-5, oral test feed given & if no leak oral feeds started.
- Patients were discharged when completely mobile & able to take orally.

Statistical analysis-

Statistical analysis will be performed with the help of SPSS version 22 software (SPSS Inc., Chicago, IL) and STATA 11 software. Proportions will be compared using the Chi-square test. Survival data will be generated using life table methods. Differences in survival estimates will be compared using log-rank test. Prognostic factors in the treatment groups will be analyzed with the aid of Cox proportionate univariate and multivariate regression analysis.

RESULTS-

From June 2013 to May 2015, 17 patients who underwent minimally invasive Esophagectomy are compared to 30 patients who underwent open Esophagectomy. The two groups were comparable in terms of patient related factors like gender, age and American society of anesthesiologists (ASA) distribution (table1). None of the patients received neoadjuvant chemotherapy in either group. Patients in whom laparoscopy was converted to open has been excluded from study.

	MIE (n=17)	OPEN (n=30)	p
Gender Male Female	 10 (55%) 7 (45%)	 12 (40%) 18 (60%)	0.071
Age-median (interquartile range)	61.5 (52-69)	63.5 (55-68)	0.621
ASA(%) I II III	 2 (10%) 11 (66%) 4 (24%)	 6 (20%) 18 (62%) 6 (18%)	

Table 1

Two groups were also comparable in terms of tumor related factors like histologic type of tumor, TNM stage of tumor, and tumor localization (table 2). Laparoscopic THE was carried out in 2 of 17 patients (12%) in minimally invasive group and VATS Esophagectomy in 15 out of 17 patients (88%) (table 3).

	MIE (n=17)	OPEN (n=30)	p
Histologic type Sq. cell carcinoma Adenocarcinoma	 14 (77%) 3 (23%)	 27(90%) 3(10%)	0.232
TNM stage I IIa IIb III	 1 (6%) 3 (17%) 2 (12%) 11 (65%)	 3 (10%) 6 (20%) 3 (10%) 18 (60%)	0.764
Tumor location Middle third Lower third	 1 (6%) 16(94%)	 3 (10%) 27 (90%)	0.754

Table 2

MIE (n=17)	OPEN (n =30)
Laproscopic THE 2 (12%)	THE 28 (94%)
VATS Esophagectomy 15 (88%)	TTE 2 (6%)

Table 3

The median operating time was more (188 minutes) in MIE group compared to 171 minutes in open group but was not found to be

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statistically significant (p= 0.052). ICU stay and total hospital stay was on an average 4 days and 8 days respectively in MIE group and 6 days and 11 days respectively in open group. Both ICU and hospital stay was found to be significantly less in MIE group. Blood loss in MIE group was on an average 111 ml as compared to 241ml in open group and was found to be significantly less in MIE group (table 4).

	MIE (n=17)	OPEN (n=30)	p
Operation time (minutes)*	188 (175-230)	171 (160-230)	0.052
ICU stay (days)*	4 (3-6)	6 (4-8)	0.000
Hospital stay (days)*	8 (5-11)	11 (7-15)	0.000
Blood loss (ml)*	111 (90-140)	241 (210-300)	0.000

* Median (interquartile range)

Table 4

Microscopically negative margin resection (R0 resection) was achieved in 88% in MIE group and 86% in open group. R1 resection was done in 12% and 14 % in MIE and open groups respectively. None of the patients underwent R2 resection in both groups. No statistically significant difference was present between two groups in terms of radicality of resection (p = 0.87). The median number of harvested lymph none yield was 13 in MIE group and 11 in open group. This came out to be a significant difference (p= 0.17)with more L.N yield favoring MIE group(table 5).

	MIE (n=17)	OPEN (n=30)	p
Number of L.N's*	13 (4-26)	11 (3-21)	0.17
Ro resection	15 (88%)	26 (86%)	0.87

* Median (interquartile range)

Table 5

In-hospital mortality and morbidity

One patient died in each MIE and open group and both patient died due to respiratory complications. Anastomotic leak was 11% and 13% in MIE and open groups respectively and was not significantly different between the two groups (p=0.875). Morbidities in terms of pulmonary, cardiac complications, recurrent laryngeal nerve palsy and chylous leak were significantly less in MIE groups (table 6).

	MIE (n=17)	OPEN (n=30)	p
In hospital mortality	1 (6%)	1 (3.3%)	
Morbidity-no(%)			
Pulmonary & cardiac complications	3(17%)	8(26%)	0.021
Anastomotic leak	2(11%)	4(13%)	0.875
RLN palsy	1(6%)	4(13%)	0.034
Chylous leak	1(6%)	2(6.6%)	0.045

Table 6

Discussion

Surgery for cancer resection of esophagus is one of the most known extensive surgical procedures. Open method of surgical resection is associated with complications of large incision, relatively more tissue trauma hence more chances of bleeding, prolonged operation time and its consequences, higher post-operative morbidity. Minimal invasive esophagectomy is an alternative for reducing morbidity associated with open esophagectomy, especially pulmonary complications.

A study done by Hulscher et al. on traditional three-stage transthoracic esophagectomy showed 57% pulmonary complications [10].

A study conducted by Palanivelu et al. on 130 patients of minimally invasive esophagectomy showed significantly lower complications of respiratory system. The surgery was done in prone position and pulmonary complication rate was 2.3% while mean ICU stay was 1 day [6].

Another study was conducted by Luketich et al. on 222 patient, they performed the surgery in left lateral position while the pulmonary complication rate was 18% with mean hospital stay of 6 days [11].

However a comparative study of by Mu J et al. on 176 patients of MIE and 142 patients of OE. Age, sex, tumor location, Charlson score, number of harvested lymph nodes, duration of surgery, the rate of leak, pulmonary morbidity rate, morbidity rate, mortality rate, and hospital length of stay were variables of their study. The result of their study showed that early oncological outcomes were equivalent among MIE and OE groups while Length of Stay and hospital stay was reduced in MIE group [12].

Zingg U et al performed a study on Fifty-six patients underwent MIE and 98 OE. They concluded that neoadjuvant treatment increased the relative risk of surgical morbidity in MIE group, Thoracic epidural analgesia reduced the risk of mortality in MIE group and MIE should be considered for all patients undergoing esophagectomy [13].

Our article highlights the comparison between MIE and OE with special reference to median number of lymph nodes, intra operative complications, bleeding, RLN palsy, operating time, ICU stay, in-hospital stay, post-operative recovery and post-operative morbidities like pulmonary and cardiac events, and chylous leak etc.

Conclusion

Minimally invasive esophagectomies are associated with faster post-operative recovery with less ICU and in-hospital stay, less blood loss, without any significantly longer operating time with less post-operative morbidities like pulmonary and cardiac events, RLN palsy and chylous leak. This study shows that minimally invasive esophagectomy is safe alternative and has same oncologic outcome to open esophagectomy. However a large sample sized randomized trial would be helpful to establish the effectiveness of procedure.

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