

## Original Research Article

# Morbidity and mortality in minimally invasive esophagectomy: where do we stand

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## ABSTRACT

**Background:** The objective of the study was to study morbidity and mortality patterns in patients with carcinoma oesophagus who underwent minimally invasive esophagectomy (MIE) in a tertiary centre for oncology in South India.

**Methods:** This was a retrospective observational study of 20 patients with carcinoma esophagus who underwent minimally invasive esophagectomy in center for oncology, Government Royapettah Hospital. Medical records of all these patients treated from September 2016 to August 2019 were collected from medical records department and details regarding the type of lesion, site of the lesion, preoperative chemoradiotherapy, type of surgery performed and post-operative complications were analyzed.

**Results:** Out of 20 patients who underwent minimally invasive esophagectomy 13 were female and 7 were male. Among these 18 had squamous cell carcinoma, 2 had adenocarcinoma. Thirteen patients had lesion in middle third oesophagus and 7 patients had lesion in lower third oesophagus. Nineteen patients underwent surgery after chemoradiation and one patient underwent upfront surgery. Twelve patients underwent thoracoscopic esophagectomy and 8 patients underwent trans hiatal esophagectomy. Perioperative complications were seen in 8 patients of whom pulmonary complications seen in 6 were most common. Anastomotic leaks occurred in 4 patients of which 2 patients were reoperated. One patient died within 30 days of surgery. Voice change and ECG abnormalities occurred in 2 patients each.

**Conclusions:** Minimally invasive esophagectomy is safe and associated with comparable morbidity. Though the initial learning curve is steep, it helps in faster recovery of the patient. Also, the peri-operative outcome tends to improve with experience.

**Keywords:** Esophagectomy, Minimally invasive, Morbidity, Mortality

## INTRODUCTION

Oesophageal cancer is the fourth most common cause of cancer-related deaths in India. Squamous cell carcinoma (SCC) accounts for up to 80% of oesophageal cancers, although adenocarcinoma is on rise due to changing lifestyles.<sup>1</sup>

Radical surgery currently offers the most realistic chance of cure from cancer of the oesophagus or gastroesophageal junction when spread beyond the most superficial epithelial layers but not extending beyond loco regional lymph nodes.<sup>2,3</sup> Nowadays, experienced centres can consistently perform such radical surgery with mortality rates of 3-5% and consistently obtain 5 year overall survival rates of at least 35-40%.<sup>2-4</sup>

Minimally invasive esophagectomy (MIE) was described in 1990s in an endeavour to reduce operative morbidity.<sup>5</sup> Luketich et al in 1998 demonstrated the potential feasibility of the procedure by publishing their results on 8 MIEs using either laparoscopic and/or thoracoscopic techniques with no perioperative mortalities and one anastomotic leak.<sup>6,7</sup> MIE since then is becoming the routine procedure for resectable oesophageal cancer with apparently similar peri-operative short and long-term outcomes.<sup>8,9</sup> In the absence of strong evidence confirming to the efficacy of the technique with a single published randomised controlled trial and another in process,<sup>10,11</sup> most of the evidence from literature comes from various large retrospective case series and their meta-analysis.<sup>12-15</sup>

The objective of this study was to assess mortality and morbidity results of minimally invasive esophagectomy and compare them to results published in international literature.

## METHODS

This was a retrospective observational study of 20 patients with carcinoma esophagus who underwent minimally invasive esophagectomy in center for oncology, Government Royapettah Hospital. Medical records of all these patients treated from September 2016 to August 2019 were collected from medical records department and details regarding the type of lesion, site of the lesion, preoperative chemoradiotherapy, type of surgery performed and post-operative complications were analyzed.

### Procedure

In our hospital with patient in prone position, we do thoracoscopic mobilization of the esophagus from manubrium sternum to diaphragm preserving the azygous vein and laparoscopic gastric mobilization done with patient in supine position, with mini laparotomy gastric conduit is made using staplers and cervical esophago-gastric anastomosis done with neck incision.

In trans hiatal esophagectomy laparoscopic mobilization of stomach and part of esophagus is done, gastric conduit made using staplers with mini laparotomy and cervical esophago-gastric anastomosis using neck incision.

### Statistical method

This was a descriptive study where the frequency of events (complications) in our study is compared with available literature. No statistical tool used for this study.

### Inclusion criteria

All patients who underwent minimally invasive esophagectomy in Government Royapettah hospital from September 2016 to August 2019.

### Exclusion criteria

Patients unfit for surgery. Those patient with carcinoma upper third oesophagus. Patients who underwent open surgery.

## RESULTS

Patient characteristics are tabulated in Table 1. Out of 20 patients who underwent minimally invasive esophagectomy 7 were male and 13 were female. Out of 20 patients 2 belong to performance status 2, remaining belong to status 1. Among these 18 had squamous cell carcinoma and 2 had adenocarcinoma. 13 patients had lesion in middle third esophagus and 7 patients had lesion in lower third esophagus. Out of 20 patients 19 patients underwent surgery after chemoradiation and one patient had upfront surgery. 12 patients underwent thoracoscopic esophagectomy and 8 patients underwent trans hiatal esophagectomy. In all cases stomach was used as conduit.

**Table 1: Patient characteristics (n=20).**

Variables	N (%)
<b>Sex</b>	
Male	7 (35)
Female	13 (65)
<b>Performance status</b>	
I	18 (90)
II	2 (10)
<b>Type of the lesion</b>	
Squamous cell carcinoma	18 (90)
Adenocarcinoma	2 (10)
<b>Site of the lesion</b>	
Middle third	13 (65)
Lower third	7 (35)
<b>Upfront surgery</b>	1 (5)
<b>Post chemo radiotherapy</b>	19 (95)
<b>Type of surgery</b>	
Thoracoscopic	12 (60)
Transhiatal	8 (40)
<b>Conduit for reconstruction</b>	Stomach in all cases

**Table 2: Perioperative complications.**

Complication	No (%)
<b>Pulmonary</b>	8 (40)
<b>Anastomotic leak</b>	4 (20)
<b>Major bleed</b>	1 (5)
<b>Reoperations</b>	2 (10)
<b>Voice change</b>	2 (10)
<b>ECG abnormalities</b>	2 (10)
<b>Mortality*</b>	1 (5)

\*Within 30 days of surgery.

Pulmonary complications are the most common after surgery (Table 2), seen in 8 out of 20 patients; anastomotic leaks occurred in 4 out of 20 patients of

which 2 patients were reoperated. One patient died within 30 days of surgery.

Complications according to Clavien-Dindo classification were summarized in Table 3.

**Table 3: Perioperative complications according to Clavien-Dindo standardized classification (the most serious complication for each patient is described).**

Stage	N (%)
I	3 (15)
II	5 (25)
IIIA	-
IIIB	2 (10)
IV	-
V	1 (5)

Type I: Seroma, nausea and/or vomiting; Type II: Low flow leak, stenosis, pneumonia, atelectasis, pleural effusion, collections, vocal fold paralysis, deep vein thrombosis, atrial fibrillation, urinary infection, paralytic ileus, delirium, high blood pressure crisis, acute kidney failure; Type IIIA: Severe stenosis, gastric dilation, hydro pneumothorax; Type IIIB: High flow leak, pleural empyema, paraesophageal abscess, evisceration, airway injury, azygos vein injury, chylothorax; Type IV: Septic shock, respiratory and/or urinary foci, multiple organ dysfunction syndrome, septic embolism, mediastinitis; Type V: Death.

One patient had loculated collection for which image guided pigtail catheter insertion was done. One patient had esophageal bed recurrence which was found when second surgery was done for hiatus hernia.

One patient developed prerenal acute kidney injury with cervical anastomosis leak which subsided with wound care and conservative management.

One patient had cervical anastomosis leak with right pyothorax for which right side decortication was done and anastomotic leak managed conservatively.

One patient had intraoperative left bronchus injury which was identified intraoperatively in time and laparoscopic intracorporeal suturing done with no postoperative complications.

One patient had port site hernia with cervical anastomotic leak, for which he was reoperated, died within 30-day post-operative period.

One patient had severe bleeding due to left inferior bronchial artery injury during thoracoscopic mobilization of esophagus which was controlled by doing thoracotomy; further procedure was deferred for that day and completed next day.

## DISCUSSION

Oesophageal cancer is the fourth most common cause of cancer-related deaths in India and newer modalities like minimally invasive techniques have been developed for the overall decrease in morbidity and mortality.

Esophagectomy for cancer is a formidable undertaking and its inherent risks for morbidity and mortality remain reliable criteria for outcome assessment. Pulmonary complications are the most frequent source of complications and mortality after an esophagectomy. Their reduction seems to be the primary aim of any MIE technique. Considerable variations in the very definition of a pulmonary complication, may however explain the unusually wide range of pulmonary complication rates found by this review (0-76% of patients; median 20). Some centres defined pulmonary complications as any unexpected pulmonary event (atelectasis, need for bronchoscopy) and reported pulmonary complications in 30-76% of patients. Others reported only the most severe pulmonary complications (e.g., reintubation, ARDS, need for tracheostomy) and consequently found much lower rates of 0-6%. Some of the reasons for this might be long operative times and inherent need for prolonged single lung ventilation during thoracoscopic oesophageal mobilization.<sup>16</sup>

In present study among 20 patients 8 (40) patients had pulmonary complications. All the patients were treated with antibiotics, chest physiotherapy and additional broncho-alveolar lavage was done. One patient underwent decortication for pyothorax and one patient underwent image guided pigtail catheter insertion. In Khan et al study pulmonary complication rate was 28.4%.<sup>17</sup> In other studies pulmonary complications ranges from 5% to 36% as mentioned in Table 4.

**Table 4: Comparison of complications in various studies.**

Study	Year	N	Pulmonary	Anastomotic leak	Mortality	Voice change
Lei chen e al <sup>19</sup>	2017	51	15.7	7.8	2	5.9
Nguyen et al <sup>20</sup>	1999	18	11	11	0	0
Fabian et al <sup>21</sup>	2008	22	5	14	4.5	5
Zingg et al <sup>22</sup>	2009	56	3.6	20	3.6	-
Parameswaran et al <sup>23</sup>	2009	50	8	18	2	12
Gao et al <sup>24</sup>	2011	96	13.5	7.3	2.1	2.1
Sundaram et al <sup>25</sup>	2012	47	10.6	8.5	4.2	2.1
Bakhos et al <sup>26</sup>	2012	99	36	6	3	9
Present study	2019	20	40	20	5	10

\*N=number of patients.

In present study anastomotic leak was seen in 4 (20) patients which was managed conservatively. All the cases of anastomotic leak were managed conservatively with jejunostomy feeding and total parenteral nutrition. In other studies anastomotic leak ranges from 6% to 20% as mentioned in Table 4.

In present study overall mortality rate was 5% whereas in braghetto et al study it was 2.8% and 2.1% in Khan et al study.<sup>17,18</sup> In other studies it ranges from 0% to 4.5% as mentioned in Table 4.

In present study voice change was seen in 2 (10) out of 20 patients. In other studies it ranges from 0% to 12% as mentioned in Table 4.

In present study reoperations and ECG abnormalities were seen in 2 (10) out of 20 patients. In Chen et al study reoperations and ECG abnormalities were seen in 3.9% each.<sup>19</sup>

### Learning curve

Undoubtedly MIE is technically complex surgery and therefore issues related to training and learning curves should be addressed before any widespread application.

## CONCLUSION

Minimally invasive esophagectomy is safe and associated with comparable morbidity. Though the initial learning curve is steep, it helps in faster recovery of the patient. Also, the peri-operative outcome tends to improve with experience.

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