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Original Article

Oncology Section

Analysis of Postoperative Complications of Minimally Invasive Surgery for Carcinoma of Oesophagus: A Single Centre Retrospective Cohort Study

SONAI DATTA KAKATI[1], DOKNE CHINTEY[2], GAURAV DAS[3], MARIE NINU[4]

ABSTRACT

Introduction: Traditional transthoracic oesophagectomy is associated with high perioperative morbidity. Minimally Invasive Oesophagectomy (MIE) techniques have been shown to have a decreased incidence of respiratory complications and an improvement in perioperative outcomes, such as length of hospital stay and wound infection rates.

Aim: To evaluate the incidence of postoperative respiratory complications, 30-day mortality, and length of hospital stay among patients with carcinoma of the oesophagus undergoing, Video-Assisted Thoracoscopic Surgery (VATS) oesophagectomy.

Materials and Methods: A cross-sectional study was conducted in the Department of Anaesthesiology in a new thoracic oncology unit at a Tertiary Cancer care centre, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India. A total of 67 patients with resectable oesophageal cancer who underwent VATS oesophagectomy from September 2019 to December 2021 were included. Patients who had surgery by open thoracotomy and inoperable cases were excluded. The patients' clinicodemographic profile, intra- and postoperative variables, and complications were studied. Descriptive statistics were used for analysis. A p-value ≤0.05 was considered statistically significant at a 5% level of significance.

Results: Out of 67 patients, 45 (67.2%) were male, and 22 (32.8%) were female. The age ranged from 33 to 78 years with a median age of 55 years (IQR 47-61). The median body weight was 45 kg (IQR 42-53). Nineteen (28.4%) patients developed postoperative complications, including respiratory distress in 7 (10.4%) and anastomotic leakage in 5 (7.5%) patients. Other complications included symptomatic Coronavirus Disease 2019 (COVID-19) infection, pneumonia, mediastinitis, Multiorgan Dysfunction Syndrome (MODS) with sepsis, seizure and cardiac arrest, and surgical re-exploration. The 30-day mortality was 2.98%. The median length of hospital stay was 19 days (Interquantile Range (IQR) 16-22), which was higher in those with complications (p<0.001). One-lung ventilation was associated with a higher risk of postoperative respiratory complications (p=0.077).

Conclusion: VATS oesophagectomy, even in a new thoracic oncology unit, was associated with lower perioperative complications, a shorter hospital length of stay, and decreased mortality compared to historical controls.

Keywords: Morbidity, Mortality, Postoperative period, Thoracic surgical procedure

INTRODUCTION

Carcinoma of the oesophagus is the seventh most common cancer globally. In 2020, it accounted for 3.1% of all diagnosed cancers and 5.5% of all cancer related deaths, meaning one in every 18 deaths [1]. Carcinoma of the oesophagus is a debilitating disease, often diagnosed at locally advanced or advanced metastatic stages, with high rates of morbidity and mortality. Without treatment, carcinoma of the oesophagus is highly aggressive, with an overall 5-year survival rate of 17% [2].

The treatment of oesophageal cancer involves a multimodal approach, typically starting with neoadjuvant chemotherapy or combined chemoradiotherapy followed by surgery [3,4]. Transthoracic oesophagectomy is the standard surgical approach for treating carcinoma of the oesophagus. However, it carries a high risk of perioperative morbidity. Major complications include respiratory issues, postoperative bleeding, anastomotic leakage, mediastinitis, and the need for reoperations during the hospital stay. Respiratory complications encompass initial respiratory distress after the operation, postoperative respiratory infections such as pneumonia, and thoracic infections like empyema [5]. Additionally, this procedure often requires a prolonged stay in the Intensive Care Unit (ICU), an extended recovery period, and an increased length of hospital stay. Survival rates are generally poor, with a high recurrence rate and metastatic disease spread.

Minimally Invasive Oesophagectomy (MIE) is a surgical technique that utilises minimally invasive approaches. This typically involves Video-Assisted Thoracoscopic Surgery (VATS) for thoracic mobilisation of the oesophagus and laparoscopic mobilisation of the stomach for the formation of the gastric conduit (neoesophagus). When both procedures are performed using minimally invasive techniques, it is referred to as total MIE. If one procedure is done using minimally invasive techniques and the other using an open technique, it is called hybrid MIE. Studies have shown that MIE techniques have a decreased incidence of respiratory complications and improved perioperative outcomes, such as reduced length of hospital stay and lower rates of wound infections [2,6-8]. Currently, pulmonary complications occur in 57% of cases undergoing open transthoracic oesophagectomy and 29% of those undergoing minimally invasive transthoracic oesophagectomy [5]. Minimally invasive procedures may require longer operative times but are associated with less blood loss and potentially fewer respiratory complications, leading to a reduced length of hospital stay, as observed in the Traditional Invasive vs MIE (TIME) trial [5].

The present study was aimed to evaluate the short term postoperative outcomes following VATS oesophagectomy. The primary objective was to determine the incidence of short-term postoperative respiratory complications. Secondary objectives included assessing the length of hospital and ICU stay, as well as the 30-day mortality rate.

MATERIALS AND METHODS

A retrospective study was conducted in the Department of Anaesthesiology in a new thoracic oncology unit at a Teritary Cancer care centre, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India over a three-year period. Data was collected for the period of September 2019 to December 2021 and the data was analysed in January 2022.

Inclusion and Exclusion criteria: Patients with resectable oesophageal cancer who underwent MIE were included in the study. Patients who had open surgery or were deemed inoperable were excluded from the study.

Sample size calculation: The sample size was estimated to be 67 patients using Fisher's formula, with a confidence level of 95%, a margin of error of 12%, and a population proportion of 50%. Data was collected from electronic medical records and patients' logs.

Study Procedure

The variables studied included the clinicodemographic profiles of the patients, preoperative laboratory reports, adjuvant treatments received (chemotherapy/chemoradiation), co-morbidities, American Society of Anaesthesiologists (ASA) status, blood work, imaging findings, intraoperative factors such as the type and duration of surgery, anaesthesia administered, use of one-lung ventilation, patient position, blood loss, and blood transfusion. Postoperative factors included extubation status, surgical re-explorations, other postoperative complications, and ICU stay. Postoperative complications encompassed anastomotic leak, pneumonia, mediastinitis, cardiac arrhythmias, sepsis, Multiorgan Dysfunction Syndrome (MODS), and Acute Respiratory Distress Syndrome (ARDS). Deaths were calculated during the immediate postoperative period, specifically within 30 days after surgery. The length of hospital stay was calculated from the day of admission for surgery until the date of discharge or death.

STATISTICAL ANALYSIS

Descriptive statistics were used for the analysis. The Chi-square test was used to evaluate the association between categorical variables, and the Independent T-test was used for continuous variables. Univariate and multivariate analyses of clinical, laboratory, and therapeutic variables associated with outcomes were calculated using logistic regression models. For the multivariate analysis, only variables with parameter estimates showing a p-value ≤0.10 in the univariate analysis were finally included. Two-sided exact p-values were reported, and p-value <0.05 were considered statistically significant at a 5% level of significance. The Kaplan-Meier method was used to evaluate survival, and the hazard ratio was estimated using Cox regression. All data were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

A total of 67 patients with carcinoma of the oesophagus underwent VATS oesophagectomy procedure at the institute during the study period. The majority of the patients were male (n=45), middle-aged (median age 55 years), and of average build (median body weight 45 kg). Most patients had normal clinical and laboratory investigations, except for one patient with uncontrolled diabetes and severe Chronic Obstructive Pulmonary Disease (COPD) [Table/Fig-1].

Preoperative patient characteristics	Values
Age (years), median (IQR)	55 (47-61)
Sex, male, n (%)	45 (67.2)
Weight (wt), median (IQR)	45 (42-53)
ASA* I, n (%)	40 (59.7)
ASA II, n (%)	26 (38.8)
ASA III, n (%)	1 (1.5)
Preoperative albumin, g/dL, median (IQR)	4.1 (3.9-4.4)
Preoperative haemoglobin, g/dL, median (IQR)	12 (10.9-13)
Postoperative haemoglobin, g/dL, median (IQR)	11.4 (10.4-12.9)
Comorbid conditions, yes, n (%)	28 (41.8)
Diabetes mellitus, n (%)	3 (4.5)
Hypertension, n (%)	7 (10.4)
Epilepsy, n (%)	1 (1.5)
COPD†, n (%)	4 (5.9)
Asthma, n (%)	1 (1.5)
Hypothyroidism, n (%)	2 (2.9)
COVID-19, n (%)	1 (1.5)
Old severe LAFB§, n (%)	1 (1.5)
Chemotherapy/chemoradiation, yes, n (%)	67 (100)

[Table/Fig-1]: Demographic profile (N=67).
*ASA: American society of anaesthesiologists; †COPD: Chronic obstructive pulmonary disease; COVID-19: Coronavirus disease 2019; §LAFB: Left anterior fascicular block; IQR: Interquartile range

All patients underwent surgery under general anaesthesia supplemented by a thoracic epidural. Patients were premedicated with intravenous injection of glycopyrrolate 0.2 mg, palonosetron 0.075 mg, and fentanyl 2 mcg/kg. Induction was done with intravenous injection of propofol 1.5 mg/kg body weight and vecuronium 0.1 mg/kg, and anaesthesia was maintained with isoflurane 0.2 to 0.6%. A thoracic epidural was inserted at levels T8-T9 using an 18 G Tuohy needle in the sitting position. Analgesia was provided with intravenous injection of paracetamol 1 g and epidural infusion with ropivacaine 0.25%. The surgical steps included VATS for the thoracic mobilisation of the oesophagus and laparoscopic mobilisation of the stomach for the formation of the gastric conduit (neoesophagus). The patient's position varied between supine, prone, and lateral, with the most common being the prone position (n=44). One-lung ventilation was used in 18 (26.9%) patients using a double-lumen endobronchial tube. The average duration of surgery was 7.5 hours (IQR 6.5-8.5), and the estimated blood loss was around 500 mL.

Postoperatively, 50 patients (74.6%) were not extubated on the table due to various factors such as the choice of elective mechanical ventilation, inadequate breathing efforts, inadequate reversal, or the patient having respiratory distress or unstable hemodynamics [Table/Fig-2]. Most of the patients stayed on mechanical ventilation for one day (median, IQR 1-2), with the longest stay of 15 days noted in one patient due to unexplained seizures, which ultimately resulted in sepsis, pneumonia, and death [Table/Fig-2]. Postoperative haemoglobin levels did not vary significantly from the preoperative values.

Operative variables	Values
Duration of surgery (hours), median (IQR)	7.5 (6.5-8.5)
Blood loss (mL), median (IQR)	500 (400-500)
Duration of MV (days), median (IQR)	1 (1-2)
One lung ventilation, yes, n (%)	18 (26.9)
Extubation on table, yes, n (%)	17 (25.4)
In-hospital mortality, n (%)	2 (2.98)
30-day mortality, n (%)	2 (2.98)
Postoperative stay (days), median (IQR)	19 (16-22)
ICU stay (days), median (IQR)	4 (3-6)

[Table/Fig-2]: Operative variables (N=67).
*MV: Mechanical ventilation; ICU: Incentive care unit

Out of the total, 19 patients (28.4%) developed postoperative complications, with the most frequent being respiratory distress requiring reintubation after extubation in seven patients (10.4%) and anastomotic leak in five patients (7.5%). One patient developed symptomatic COVID-19 infection in the postoperative period, necessitating COVID-19 protocol treatment. Two patients (3%) underwent re-exploration due to surgical complications. One patient developed pneumonia and mediastinitis confirmed by culture reports, another had MODS and ultimately sepsis, and yet another patient had seizures and cardiac arrest. The 30-day mortality rate was 2.98%.

The median length of stay in the hospital was 19 days (IQR 16-22), and the ICU stay was four days (IQR 3-6) [Table/Fig-2,3]. The mean age, weight, preoperative albumin, and haemoglobin levels in patients who developed complications did not vary significantly from those who did not develop complications [Table/Fig-3]. The total number of days in the hospital was significantly higher in patients who developed complications (p<0.001) [Table/Fig-4a].

Postoperative complications	n (%)
Anastomotic leak	5 (7.5%)
Mediastinitis	1 (1.5)
Pneumonia	1 (1.5)
Immediate postoperative respiratory distress	7 (10.4)
Seizure	1 (1.5)
Cardiac arrhythmia	1 (1.5)
Sepsis, MODS†	1 (1.5)
Re-exploration	2 (2.98)
Total	19 (28.4)

[Table/Fig-3]: Postoperative complications.
†MODS: Multiorgan dysfunction syndrome

Variables	Postoperative complications (n=19)	Mean±SD	p-value
Age (years)	No	53.17±8.88	0.358
	Yes	55.52±10.62	
Weight (kg)	No	46.64±6.68	0.597
	Yes	47.57±5.88	
Preoperative albumin (g/dL)	No	4.11±0.45	0.978
	Yes	4.11±0.39	
Preoperative Hb* (g/dL)	No	12.02±1.28	0.314
	Yes	11.63±1.44	
Duration of surgery (hours)	No	7.36±1.43	0.857
	Yes	7.28±1.75	
Blood loss (mL)	No	491.25±140.57	0.757
	Yes	502.63±120.73	
IVF† (mL)	No	3064.58±623.49	0.631
	Yes	3147.36±655.20	
Postoperative Hb* (g/dL)	No	11.65±1.79	0.505
	Yes	11.34±1.37	
Hospital stay (days)	No	17.95±3.97	<0.001
	Yes	29.84±15.08	

[Table/Fig-4a]: Association of different variables with postoperative complications.
*Hb: Haemoglobin; †IVF: Intravenous fluid

Postoperative complications occurred in both sexes with equal frequency. ASA status did not significantly influence the occurrence of complications (p=0.848). Patients with co-morbidities had a higher risk of developing postoperative complications (p=0.093). Intraoperative factors such as patient position (p=0.526), blood transfusion (p=0.195), and extubation status (p=0.911) were not associated with postoperative complications. However, the use of one-lung ventilation was related to a higher risk of developing postoperative respiratory complications (p=0.077) [Table/Fig-4b].

The median length of ICU stay was four days (IQR 3-6), with the longest stay of 28 days seen due to an anastomotic leak [Table/Fig-5]. The median hospital length of stay was 19 days (IQR 16-22) [Table/Fig-2]. One patient stayed for 64 days in the hospital due to the development of a surgical complication (anastomotic leak), though he ultimately survived.

Variables		Postoperative complications		p-value
		No	Yes	
Sex	Male	32 (71.1%)	13 (28.9%)	0.89
	Female	16 (72.7%)	6 (27.3%)	
ASA* status	I	29 (72.5%)	11 (27.5%)	0.848
	II	18 (69.2%)	8 (30.8%)	
	III	1 (100%)	0	
Co-morbidities	No	31 (79.5%)	8 (20.5%)	0.093
	Yes	17 (60.7%)	11 (39.3%)	
Patient position	Left lateral	6 (75%)	2 (25%)	0.526
	Prone	33 (75%)	11 (25%)	
	Right lateral	3 (75%)	1 (25%)	
	Semiprone	6 (60%)	4 (40%)	
	Supine	0	1 (100%)	
One lung ventilation	No	38 (77.6%)	11 (22.4%)	0.077
	Yes	10 (55.6%)	8 (44.4%)	
Blood transfusion	No	29 (80.6%)	7 (19.4%)	0.195
	1 unit	18 (62.1%)	11 (37.9%)	
	More than 1 unit	1 (50%)	1 (50%)	
Extubation on table	No	36 (72%)	14 (28%)	0.911
	Yes	12 (70.6%)	5 (29.4%)	
In-hospital mortality	No	48 (73.8%)	17 (26.2%)	0.077
	Yes	0	2 (100%)	

[Table/Fig-4b]: Response of study participants with Postoperative complications.

Variables	Postoperative complications	n	Mean±SD	Median (IQR)	p-value
ICU stay (days)	No	48	3.2917±1.27092	3 (2-4)	
	Yes	19	11.3684±7.66094	9 (6-16)	<0.001
Total days	No	48	287.5833±256.5767	218.5 (104.5-402.75)	
	Yes	19	256.0526±249.9546	125 (34-545)	0.432
Months	No	48	9.5861±8.55256	7.28 (3.48-13.43)	
	Yes	19	8.5351±8.33182	4.17 (1.13-18.17)	0.432

[Table/Fig-5]: ICU stay and postoperative complications.
ICU: Intensive care unit

Two patients died during the study period, with the cause of death being cardiac arrest and sepsis. Both deaths were associated with postoperative complications (p=0.022). Both patients died within the 30-day in-hospital period, bringing the mortality rate to 2.98% [Table/Fig-2]. Patients with complications had a longer hospital stay (p<0.001) and longer ICU stay (p<0.001) than those without complications [Table/Fig-4a,5].

DISCUSSION

Oesophageal cancer is one of the most common causes of cancer related mortality. It is a highly malignant tumor and carries a poor prognosis [1]. The postoperative five-year survival rate in patients with American Joint Committee on stage I oesophageal cancer is approximately 90%. The survival rate decreases with increasing invasiveness of the tumor [2]. Along with neoadjuvant chemotherapy and radiotherapy, surgery is also found to be a very effective option for treatment [3]. However, due to the age of presentation, co-morbidities, surgical site, and high invasiveness of the tumor, Open Oesophagectomy (OE) is associated with several postoperative complications. Though there is swift progress in extended lymph node dissection and superior perioperative care, oesophagectomy remains an exceedingly invasive procedure that has consequences like increased complications [4].

Complications of VATS procedures are rare and are estimated to be 3-4%, out of which prolonged postoperative air leak is the most frequent. Other significant complications include bleeding, infections, postoperative pain, and recurrence at the port site [5,8].

In present study, 67 patients with carcinoma of the esophagus underwent VATS oesophagectomy surgery between September 2019 to December 2021. The most frequent presentation was male, middle-aged, and average build. In a nationwide database of 5,354 patients in Japan, the mean age of presentation for carcinoma of the esophagus was 65.9 years, and 84.3% of patients were male [9].

The immediate 30-day mortality in present study was 2.98%. This mortality rate is similar to that reported in a systematic review (2.0%) [8]. The aforementioned database from Japan had a slightly lower 30-day mortality of 1.2% [9]. In a nationwide retrospective analysis of 14,880 patients in Japan, the in-hospital mortality was 1.1% in the minimally invasive esophagectomy (MIE) group versus 1.9% in the open esophagectomy (OE) group [10]. The cause of death in present study was determined to be cardiac arrest and sepsis following prolonged respiratory complications. In the aforementioned meta-analysis, the causes of death were sepsis in seven patients, respiratory insufficiency in four, progression of malignancy in three, pneumonia in two, renal failure in two; and hepatic failure, cardiac arrest, pulmonary embolus, and stroke each in one patient. Postoperative respiratory complications, such as pneumonia, have been found to be one of the most common causes of increased morbidity and mortality after oesophagectomy and affect the prognosis and survival [7].

Patients with co-morbidities had a higher risk of developing postoperative complications (p=0.093) in present study. In the Japanese database, morbidity arising from oesophagectomy was 41.9% [10], which was higher in the MIE group than in the OE group (44.3% vs 40.8%, p=0.016) [10]. Risk factors for mortality after surgery included a history of smoking within one year before surgery, weight loss of more than 10% within six months before surgery, requiring preoperative assistance in Activities of Daily Living (ADL), metastasis/relapse, male patients, and COPD [10]. In a comparative study between total MIE, hybrid MIE, and total open group, the presence of cardiac comorbidity, lung comorbidity, and anastomotic leakage were independent risk factors for postoperative complications after oesophagectomy [11].

Total 19 (28.4%) patients (28.4%) developed postoperative complications in the present study. Complications were seen in as high as 43% of treated cases in one review study [9]. In a comparison between open versus video-assisted thoracoscopic oesophagectomy, the overall incidence of postoperative complications was found to be 38.1% in the video-assisted group, compared to 57.1% in the open group [7]. Another review reported a 41.5% complication rate for MIE cases versus 48.2% for the OE group [12]. In a meta-analysis of VATS versus open thoracotomy, it was noted that the total complication rates were 20.2% versus 24.9% [13]. In a three-way comparative study, postoperative complications were significantly less in the total MIE group (p=0.015) compared to the total open group but not to the hybrid MIE group (p=0.19) [11]. In the Japan database, morbidity rates ranged from 40.7% in the MIE group to 47.7% in the OE group [10].

Respiratory complications were most commonly noted (11.9%). The most frequent respiratory complication seen was respiratory distress needing reintubation after extubation (seven patients). Pneumonia and mediastinitis were seen in one patient each. Five patients developed anastomotic leak, two patients underwent surgical re-exploration, and one patient each developed COVID-19 infection, sepsis, seizure, and cardiac arrhythmia leading to arrest. In a systematic review, pulmonary complications occurred in 12% to 23% of treated patients [9], out of which pneumonia and atelectasis were the most common. Recurrent laryngeal nerve paralysis occurred in 3% to 9% of patients, and anastomotic leak in 6% to 9% [9].

In the Japan study, the MIE group had more favorable outcomes than the OE group in terms of surgical site infection (1.9% vs 2.7%, p=0.004) and anastomotic leakage (12.9% vs 16.9%, p<0.001), although vocal cord dysfunction was more likely to occur in the MIE group than the OE group (9.3% vs 6.2%, p<0.001) [10]. In a meta-analysis of VATS versus open thoracotomy, the anastomotic leak ranged from 0% to 12%. Cardiovascular complications such as arrhythmia, heart failure, acute myocardial infarction, deep vein thrombosis, and pulmonary embolism were less apparent in MIE. The recurrent laryngeal nerve injury rate was 3.6% to 7% [12]. In a meta-analysis comparing video-assisted thoracic surgery versus open thoracotomy for non-small cell lung cancer, there were significantly lower incidences of prolonged air leak (8.1% vs 10.4%), pneumonia (3.2% vs 5.0%), atrial arrhythmia (7.3% vs 11.7%), and renal failure (0.9% vs 3.0%) for patients who underwent VATS when compared to open thoracotomy. The incidences of pulmonary embolism (0.3% vs 0.4%), myocardial infarction (0.2% vs 0.1%), significant bleeding (1.0% vs 0.8%), empyema (0.3% vs 0.6%), and sepsis (0.5% vs 1.0%) were not significantly different between the two treatment groups [13]. In another retrospective study, the complication rates were 22.5% for pneumonia, 19.4% for anastomotic leakage, and 15.8% for recurrent laryngeal nerve paralysis, which were comparable to most similar studies [14].

The major cause of perioperative morbidity and mortality after thoracic surgery is respiratory complications, with atelectasis, pneumonia, and respiratory failure occurring most commonly. 15-20% of patients develop these complications [9]. The rate of respiratory complications noted in this study was 11.9%, which was similar to that seen in one randomised controlled trial between MIE and OE, which was 12% in the MIE group [4]. Another comparative study showed pulmonary complications in the VATS group to be 9.5% compared to the open group (40.5%, p=0.004) [7]. In the above-cited review, the pulmonary infection rate was 29% [12]. Respiratory complications accounted for 16.8% of the MIE cases and 18.1% of the OE cases in the Japan study [10].

In present study, 1.5% of patients developed pneumonia, and 10.4% had respiratory distress postoperatively. Pneumonia was found to have a negative impact on overall survival after oesophagectomy. Hence, strategies to prevent pneumonia after oesophagectomy should improve postoperative outcomes [14].

One-lung ventilation was associated with a higher risk of postoperative respiratory complications (p=0.077). Factors that did not influence the occurrence of complications include ASA status (p=0.848), co-morbidities (p=0.093), patient position (p=0.526), blood transfusion (p=0.195), and extubation status (p=0.911). The median duration of surgery in present study was 7.5 hours, and the average blood loss was 500 mL.

A meta-analysis of 57 studies showed that MIE had less intraoperative blood loss, a shorter hospital stay, and a longer operative time (p-value <0.05) than OE [5]. In another comparative study, MIE patients required less blood transfusion than the OE group (21.9% vs 33.8%, p<0.001). The duration of anaesthesia was significantly longer in the MIE group than the OE group (408 vs 363 minutes, p<0.001). The reoperation rate was lower in the MIE group than the OE group (8.6% vs 9.9%, p=0.03). The postoperative length of stay was shorter in the MIE group than the OE group (23 vs 26 days, p<0.001) [10].

In the Japan study, the duration of surgery was significantly longer in the MIE group than the OE group (526±149 min vs. 461±156 min, p<0.001), but there was considerably less blood loss than in the OE group (442±6121 mL vs. 608±591 mL, p<0.001). 8.9% of patients who underwent MIE required more than 48 hours of postoperative respiratory support, such as mechanical ventilation, compared to 10.9% of patients in the OE group. In contrast, 7% of MIE patients were reoperated within a 30-day period compared to 5.3% of OE patients (p=0.004) [15].

Respiratory failure that requires unplanned reintubation in the postoperative period is associated with very high morbidity, leading to a longer hospital stay and an increase in 30-day mortality. The incidence of unanticipated reintubation in the first 72 hours after surgery is low (<1%), but it is higher in older patients (up to 3%). Reintubation is associated with an increased likelihood of death (odds ratio 72). The risk of reintubation is greatest within the first six hours after primary extubation. The main causes that lead to reintubation are pulmonary oedema, atelectasis, pneumonia, airway obstruction, impaired brain function, and aspiration [16]. In present study, seven patients had respiratory distress needing reintubation after extubation. In contrast to present and the above-cited studies, a recent study comparing robot-assisted MIE with thoracoscopic or transthoracic oesophagectomy showed that the overall rate of surgical complications was higher for VATS than for OE, and VATS did not reduce the incidence of pulmonary complications compared with OE and did not demonstrate the usefulness over OE [17].

Limitation(s)

No comparison was done with the open oesophagectomy group in present study. The total number of cases was less, and the study period duration was also less. Perioperative factors were not thoroughly studied. There could also be Institutional bias.

CONCLUSION(S)

Minimally Invasive Oesophagectomy (MIE) has low mortality, a shorter duration of hospital and ICU stay, and fewer postoperative complications. A combined thoracoscopic and laparoscopic MIE could achieve even better results for the reduction of postoperative complications after oesophagectomy.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anaesthesiology, Critical Care and Pain, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India.
2. Assistant Professor, Department of Anaesthesiology, Critical Care and Pain, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India.
3. Associate Professor, Department of Surgical Oncology, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India.
4. Associate Professor, Department of Anaesthesiology, Critical Care and Pain, Dr. B. Borooah Cancer Institute, Guwahati, Assam, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Marie Ninu,
Associate Professor, Department of Anaesthesiology, Critical Care and Pain,
Dr. B. Borooah Cancer Institute, Guwahati-781016, Assam, India.
E-mail: marie.ninu@yahoo.com

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