

# Laparoscopic-Assisted Transhiatal Esophagectomy (LATE) for Carcinoma of the Esophagus

Vageesh B G<sup>1</sup> · Hirdaya H. Nag<sup>1</sup> · Vaibhav Varshney<sup>1</sup>

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**Abstract** Total laparoscopic approach for the management of carcinoma of the esophagus has not gained much popularity due to its complexity. The aim of this study was to evaluate safety, feasibility, and outcome of laparoscopic-assisted transhiatal esophagectomy (LATE) for patients with carcinoma of the esophagus. This retrospective study involves a total of 26 patients with carcinoma of the esophagus who were considered for LATE by a single surgical team from January 2010 to September 2014. The median (range) age was 55 years (35–72), and male to female ratio was 20:6. The median (range) operative time, blood loss, and hospital stay were 300 min (180–660), 300 ml (100–500), and 11.5 days (8–25), respectively. Pulmonary complications and cervical anastomotic leak (including one patient with conduit necrosis) occurred in eight (30.7 %) and three (11.5 %) patients, respectively. AJCC stage (7th ed.) was IIA in 12 (46.15 %), IIB in 10 (38.46 %), IIIA in 3 (11.53 %), and IIIB in 1 (3.84 %) patient. Surgical resection margin was negative in all but one patient (3.8 %). The median (range) number of lymph nodes (LN) retrieved was 13 (8–28). During a median follow-up 19 months (8–39), five patients (19.23 %) developed recurrence and three (11.5 %) of them died. LATE is a safe and feasible for the management of selected patients with carcinoma of the lower thoracic esophagus.

**Keywords** Esophagus · Carcinoma · Laparoscopy · Esophagectomy · Transhiatal

✉ Hirdaya H. Nag  
hirdayanag@gmail.com

<sup>1</sup> Department of G I Surgery, Govind Ballabh Pant Institute of Postgraduate Medical Education and Research (GIPMER), Room No. 220, Academic Block, GIPMER, New Delhi 110002, India

## Introduction

Transhiatal esophagectomy (THE) is the most widely performed surgery for carcinoma of the esophagus [1, 2]. It has been found to be technically easier, oncologically adequate, and with less mediastinal complications as compared to trans-thoracic esophagectomy (TTE) [2]. However, it is associated with a risk of iatrogenic injury during blind transhiatal dissection and non-systematic lymphadenectomy. Laparoscopic-assisted transhiatal esophagectomy (LATE) is a hybrid technique which is believed to have better visualization of the infracarinal esophagus, improved lymphadenectomy, and lowers the risk of iatrogenic injury. Despite a sound technique, LATE is scarcely reported in literature. Hence, we reviewed our initial experience with LATE in patients with carcinoma of the esophagus.

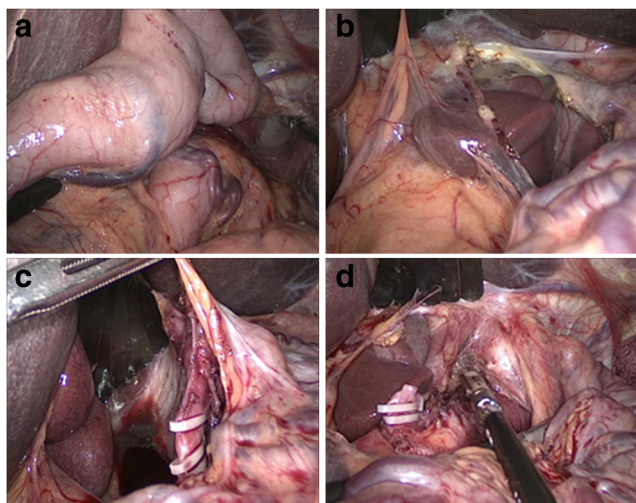
## Methods

The total 26 patients with carcinoma involving the lower thoracic esophagus (infracarinal) and/or gastroesophageal junction were considered for LATE from January 2010 to September 2014. All operations were performed by a single surgical team working at a tertiary care centre in the north India. Written informed consent was obtained from all the patients. As per prevailing guidelines, permission from the ethics committee was not necessary. All patients had confirmed diagnosis of carcinoma (endoscopic biopsy) at the time of surgery. Contrast-enhanced computed tomography (CECT) of the neck, chest, and abdomen was used for preoperative staging and surgical planning. Routine preoperative work up included blood investigation, chest X-ray, electrocardiogram and pulmonary function test. Patients with metastatic or locally advanced disease were excluded from the study. Seventh

edition of AJCC staging system was used for the disease stratification.

## Operative Procedure

Patients were operated in French position. Hassan's technique was used to create pneumoperitoneum, and total four ports were utilized to complete laparoscopic part. Laparoscopic camera set (Karl Storz), ligaclips (Ethicon), hem-o-lock clips, and ultrasonic shear (Harmonic Gen 4, Johnson & Johnson) were utilized for dissection and division of the vessels. The mobilization of the stomach was completed after the assessment of resectability. The right gastroepiploic artery was preserved, and the left gastric artery was divided between the clips [Fig. 1c]. The esophagus was mobilized through widened hiatus under direct vision. Mediastinal dissection was carried out carefully to ensure adequate lymphadenectomy as well as preservation of all the vital structures [Fig. 1D]. After the completion of laparoscopic part of dissection, a cervical incision was made along the lower part of the left sternocleidomastoid muscle which extended across the midline. The deep fascia and muscles were dissected to expose the esophagus. The esophagus was encircled with great care to avoid injury to the left recurrent laryngeal nerve. A small (5–6 cm) upper midline incision was made to complete transhiatal mobilization as described by Orringer et al. [1]. The esophagus was divided about 4–5 cm distal to crico-esophageal junction, and specimen was delivered through abdominal wound. Endo GIA stapler (75 mm, green cartridge, Ethicon) was utilized for the creation of gastric conduit and excision specimen [Fig. 1D]. Gastric conduit was brought to the neck through orthotopic route, and cervical-esophago-gastric anastomosis (CEGA) was completed with interrupted



**Fig. 1** Intraoperative pictures showing LATE. **a** Dissection along greater curvature. **b** Dissection along lesser curvature. **c** Clipping of the left gastric artery. **d** Hiatal dissection

**Table 1** Demographic and clinical characteristics

Parameter	Details ( <i>n</i> = 26)
Age in years, median (range)	55 (35–72)
Sex	
Male <i>n</i> (%)	20 (76.92)
Female <i>n</i> (%)	06 (23.07)
History of smoking, <i>n</i> (%)	17 (65.38)
Comorbid conditions	
Hypertension, <i>n</i> (%)	04 (15.38)
Diabetes mellitus, <i>n</i> (%)	03 (11.53)
Cardiac disease, <i>n</i> (%)	01 (03.84)
COPD, <i>n</i> (%)	03 (11.53)
Symptomatology	
Progressive dysphagia	26 (100)
Hematemesis	01 (3.84)
Weight loss	17 (65.38)
Reflux esophagitis	09 (34.61)
Preoperative lab values	
Hemoglobin mg/dl, median (IQR)	12.85 (10.35–12.85)
Albumin mg/dl, median (IQR)	3.3 (3.2–3.6)

3–0 silk sutures (Ethicon). A feeding jejunostomy was fashioned by Stamm's method. An abdomen wound was closed after placement of drains in the right pleural space and left sub-hepatic space. A cervical wound was closed after placement of a 18 FG suction drain (Romsons) near CEGA.

**Table 2** Operative details and complications

Operative parameter	Value
Operative time (min), median (range)	311.6 (180–660)
Operative blood loss (ml) , median (range)	300 (100–500)
Blood transfusion, <i>n</i> (%)	5 (19.23)
Reoperation, <i>n</i> (%)	1 (03.84)
Postoperative stay ( days)	12 (8–25)
ICU stay (days)	3 (2–4)
Respiratory complications <i>n</i> (%)	08 (30.76)
Pleural effusion	05 (19.23)
Empyema	02 (07.69)
ARDS	01 (03.84)
Cardiac complications	03 (11.53)
Arrhythmias	03 (11.53)
Vocal cord paralysis	0
Anastomotic leak	3 (11.53)
Conduit necrosis	1 (03.84)
Chylous leak	1 (03.84)
Wound infection	5 (19.23)
Mortality in 30 days	0

**Table 3** Pathological findings

Tumor specific variables	<i>n</i> (%)
Tumor location <i>n</i> (%)	
Lower 1/3 esophagus	24 (92.30)
GE junction	02 (07.69)
T stage, <i>n</i> (%)	
T1	0
T2	20 (76.9)
T3	06 (23.07)
T4	0
N stage, <i>n</i> (%)	
N0	12 (46.15)
N1	12 (46.15)
N2	02 (07.69)
AJCC stage <i>n</i> (%)	
1	0
2A	12 (46.15)
2B	10 (38.46)
3A	02 (07.69)
3B	01 (03.84)
4	0
Histological type, <i>n</i> (%)	
Squamous cell carcinoma	3 (11.53)
Adenocarcinoma	23 (88.46)
Lymph node status, median (range)	
Total number of LN resected	13 (8–28)
Positive number of LN	2 (0–6)
Resection, <i>n</i> (%)	
R0	25 (96.15)
R1	1 (03.84)
R2	0

## Results

Median age was 55 years and most patients were male (77 %). Majority of the patients were from semi-urban areas and had poor socioeconomic status. Seventeen patients (65 %) were

chronic smokers, and 3–15 % patients had associated comorbid illnesses. Progressive dysphagia and weight loss were the most common symptoms (Table 1). Median operative time was 311(180–660) min, median blood loss was 300 ml (100–500), and five patients (19.23 %) required blood transfusion. Mean postoperative hospital stay was 12 (8–17) days, and mean ICU stay was 3 (2–4) days. Three (11.53 %) patients had anastomotic leak and one (3.8 %) of them required re-exploration and replacement gastric conduit by colonic conduit (Table 2).

Twenty-three (88 %) patients had adenocarcinoma, and three (12 %) patients had squamous cell carcinoma. AJCC stage was II in 22 patients (85 %) and III in four (15 %) patients. Minimum number of lymph nodes were six; maximum number was 23; and 14 patients had LN positive disease. Resection margins were negative in all but one patient (Table 3). Thirty-day mortality was 0. Patients with stage 3 disease received cisplatin-based adjuvant chemotherapy. With a median follow-up of 19 months, three patients expired. Among them, one patient who had margin positive disease received adjuvant chemotherapy and survived for 13 months after surgery.

## Discussion

This study describing a novel modification in esophagectomy has shown that LATE can be performed safely with no postoperative mortality, minimum hospital stay including short ICU stay, comparable in postoperative morbidity, and oncological adequacy.

While thoracoscopic approach is fastly replacing open thoracoscopic approach in mid-thoracic esophageal tumors, the application of minimally invasive techniques to transhiatal approach in lower thoracic esophageal tumors has been slow. DePaula et al. [3] first reported the technique of laparoscopic approach to THE in 1995. In 2005, Avital et al. [4] presented a series on LATE with 22 patients, 19 among which had esophageal cancer.

**Table 4** Comparison of our study with THE and MIE

Features	THE (Orringer et al)	MIE (Luketich et al)	LATE (present series)
Number of patients	2000	960	26
Stage included	0 to 4	0 to 4	2 and 3
Mean intraoperative blood loss (ml)	368	NM	300
Mean operative time (in min)	NM	NM	311
Post operative hospital stay (days)	10	8(6–14)	12(8–25)
Major complications	Low	Low	Low
Median number of LN resected	NM	21(15–29)	13(8–28)

\*NM not mentioned

We accomplished zero 30-day mortality in 26 patients who underwent LATE. Since LATE is ideal for lower thoracic esophageal tumors, majority (88.46 %) were adenocarcinoma. It was around 60 % in Orringer [1] series, 96 % in Hulschers [5] series, and 76 % were adenocarcinoma in Luketich's [6] largest MIE series.

Mean intraoperative blood loss is 300 ml in our series and is less when compared to open THE series (368 ml) and it was 220 ml in Avital et al. [4] series. This can be attributed to mediastinal dissection done under vision in LATE. Mean duration of surgery is 311 min and is in tune with literature range. In all the 26 cases, we could successfully complete the transhiatal dissection laparoscopically.

Mean postoperative hospital stay was 12 days (range 8–25 days) with one patient needing re-exploratory surgery for conduit necrosis diagnosed on postoperative day 1 and was managed with colon pull-up. Three patients had neck leak and was managed with conservative measures.

Hulscher et al. [5] conducted the largest RCT comparing THE and TTE. Eventhough the open TTE showed a trend towards better survival and nodal clearance, there was an increased respiratory complications, wound infections, and early postoperative mortality associated with this procedure as compared to THE [7, 8]. Orringers [1] series including 2000 THE has shown that several refinements in the procedure have reduced the historic mortality and morbidity associated with THE. In a recent revision, they have shown mortality rate of 1 %, minimal postoperative morbidity, and better survival. In parallel with these results, (Table 4) present series that has shown better oncological clearance, less postoperative morbidity, and minimal hospital stay. In terms of technicality, our results are comparable with largest MIE series by Luketich et al. [6], reflecting the positive side of the application of minimally invasive technique to one of the well-established open approach.

The extent of nodal clearance plays an important role in staging and oncological outcome [9, 10]. TTE holds an upper hand in this regard with better exposure and detailed mediastinal nodal dissection. In our current series, the average number of lymph nodes cleared was 13(8–28) with mean positive nodes being 2 (0–6) which was comparable to most of the minimal invasive series.

Most of the minimally invasive procedures have a steep learning curve while LATE is relatively easy to perform. Literature on LATE is scarce, and this is the largest series till date reported in English medical literature to the best of our

knowledge. A small sample size and a lack of comparable arm are the limitations of our study.

## Conclusions

LATE is a safe and feasible alternative to THE in the selected group of lower thoracic esophageal cancers. However, long-term follow-up results are awaited.

**Compliance with Ethical Standards** Written informed consent was obtained from all the patients. As per prevailing guidelines, permission from the ethics committee was not necessary.

**Conflict of Interest** The authors declare that they have no conflict of interest.

## References

- Orringer MB, Marshall B, Iannettoni MD (1999) Transhiatal esophagectomy: clinical experience and refinements. *Ann Surg* 230:392–400
- Pennathur A, Zhang J, Chen H, et al. (2010) The “best operation” for esophageal cancer? *Ann Thorac Surg* 89:S2163–S2167
- DePaula AL, Hashiba K, Ferriera EA, et al. (1995) Laparoscopic transhiatal esophagectomy with esophagogastroplasty. *Surg Laparosc Endosc* 5:1–5
- Avital S, Zundel N, Szomstein S, Rosenthal R (2005 jul) Laparoscopic transhiatal esophagectomy for esophageal cancer. *Am J Surg* 190(1):69–74
- Hulscher JBF, van Sandick J, de Boer AGEM, et al. (2002) Extended transthoracic resection compared with limited transhiatal resection for adenocarcinoma of the esophagus. *N Engl J Med* 347:1662–1669
- Luketich JD, Alvelo-Rivera M, Buenaventura PO, et al. (2003) Minimally invasive esophagectomy: outcomes in 222 patients. *Ann Surg* 238:486–494
- Boshier PR, Anderson O, Hanna GB. Transthoracic versus transhiatal esophagectomy for the treatment of esophagogastric cancer: a meta-analysis. *Ann Surg*. 2011; Dec 254(6):894–906
- Chu KM, Law SY, Fok M, et al. (1997) A prospective randomized comparison of transhiatal and transthoracic resection for lower-third esophageal carcinoma. *Am J Surg* 174:320–324
- Lerut T, Nafteux P, Moons J, et al. (2004) Three-field lymphadenectomy for carcinoma of the esophagus and gastroesophageal junction in 174 R0 resections: impact on staging, disease-free survival, and outcome: a plea for adaptation of TNM classification in upper-half esophageal carcinoma. *Ann Surg* 240:962–972
- Rizk N, Venkatraman E, Park B, et al. (2006) American joint committee on cancer staging system. The prognostic importance of the number of involved lymph nodes in esophageal cancer: implications for revisions of the American Joint Committee on Cancer staging system. *J Thorac Cardiovasc Surg* 132:1374–1381