

## Case Report

# Minimally Invasive Three Stage Esophagectomy: How we do it!

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## Abstract

**Background:** Esophageal cancer ranks 8<sup>th</sup> among the most common malignancies. Management of esophageal cancer is complex and involves multidisciplinary team approach. Esophagectomy is a complex procedure with significant morbidity. Surgical approach to esophagus depends on a lot of factors like the anatomical location of the disease in the esophagus, histopathology, desired lymphadenectomy and surgeon preferences. Historically the approach to esophageal resection was via open surgery. Minimally invasive surgery has revolutionized the management of esophageal surgery. Concept of Minimally Invasive Esophagectomy (MIE) was introduced to lessen the morbidity associated with open surgery. Less surgical trauma and hence less injury and inflammation are thought to play vital part in reducing the surgical stress and associated morbidity. Minimally invasive three stage esophagectomy is carried out for tumors of upper and middle esophagus, hence mostly for squamous cell carcinomas as they predominate in this region.

**Materials and Methods:** At our institute, Shaukat Khanum Memorial Cancer Hospital and Research Center (SKMCH&RC) we routinely perform minimally invasive esophagectomy. The source of work that is described in this article and accompanying video is a cancer patient presenting to SKMCH&RC, who underwent minimally invasive three stage esophagectomy. We performed the thoracic part first in left lateral position via Video Assisted Thoracoscopic Surgery (VATS) approach, then the patient was placed in modified Lloyd Davis position and the abdominal part was performed via laparoscopic approach and simultaneously neck was dissected and later anastomosis was fashioned in the neck and operation was concluded.

**Result:** The patient was discharged on post-operative day six and he had uneventful recovery. He had R0 resection with adequate lymph node harvest. He is alive and is on regular follow up.

**Conclusion:** Three Stage minimally invasive esophagectomy is a technically safe procedure with less morbidity and at least equal oncological outcomes. It can be safely carried out in high volume centers.

**Keywords:** Esophageal Cancer; Esophagectomy; Minimally Invasive Esophagectomy; Video Assisted Thoracoscopic Surgery; Laparoscopy

## Introduction

Esophageal cancer ranks eighth among the most common cancers worldwide [1]. The incidence of esophageal cancer is highest in China in the world with an incidence of 22.14 per 100000 persons-year [2]. Management of esophageal cancer is complex and involves multidisciplinary team approach. The management has continuously evolved over the previous few years. Surgery is still the cornerstone for the management of esophageal cancers. Esophagectomy is a complex procedure with morbidity and mortality in range of 25-30% and 2-8%. High volume centers report better figures with morbidity and mortality specially in China.

Esophagectomy requires two or three-field access depending on preoperative staging, location and histology of the lesion and most importantly the fitness of the patient. The concept of three field excess was introduced by McKeown [3]. In order to decrease overall morbidity and better patient recovery several centers have introduced

the concept of minimally invasive three stage esophagectomy which aims at decreasing the surgical trauma and inflammation and hence better surgical outcomes [4,5]. Law and colleagues reported series of thoracoscopic mobilization for esophageal cancer [6]. First reported by Cusher et al. in 1992 minimally invasive esophagectomy has undergone significant advancements [7,8]. The major advantage is less post-operative pulmonary infection [9]. This is of paramount importance as respiratory infections are most common morbidity after three stage esophagectomies and cause significant morbidity and mortality [10,11]. In this article we present the procedure of minimally invasive three stage esophagectomy that is undertaken at our institute.

## Materials and Methods

### Patient Selection and Workup

Our patient, a 35-year-old male, resident of Afghanistan

presented to the outpatient department of Shaukat Khanam Memorial Cancer Hospital and Research Center (SKMH&RC) with complains of dysphagia and weight loss for six months. He underwent upper gastrointestinal endoscopy and biopsy which conformed the diagnosis of squamous cell carcinoma middle third of esophagus, simultaneously Percutaneous Endoscopic Gastrostomy (PEG) tube was passed for future nutritional support. It was followed by CT scan that concluded a T3N1 mid esophageal tumor (AJCC classification eighth edition). Endoscopic Ultrasound (EUS) was performed that complimented the findings of the CT scan Positron Emission Tomography (PET) scan was performed. Workup revealed non metastatic disease. The patient was discussed in multi-disciplinary tumor board meeting and decision for neoadjuvant chemoradiotherapy followed by assessment for surgery was made. The patient completed neoadjuvant chemoradiotherapy was again staged with CT scan and was referred for surgical assessment.

### Pre-Operative Preparation

Patient had pre-operative nutritional assessment by nutritionist before admission to the surgical floor and routine medical workup. He was admitted on surgical one day prior to surgery and Incentive Spirometry (ISM) was started by respiratory therapist. Blood arrangements made and operative technique explained with the aid of a diagram and models. Informed consent was obtained.

### Equipment Preference Card

We use dedicated high definition laparoscopy suite with two screens. For access we use 5mm,11mm and 12 mm ports with insufflation cuffs. Ligasure™ Maryland dissector, Enseal

device and L hook cautery for dissection. Alexis TM wound protector for specimen extraction and conduit formation via small upper midline incision.

Echelon staplers and Hem-O-lock clips are used.

### Procedure

After induction of general anesthesia with double lumen tube and invasive monitoring lines such as arterial lines and thoracic epidural catheters left lateral position was being made and table breaking was adequately done for thoracoscopy. Right lung was deflated and flexible bronchoscopy was performed by the anesthetist to check the position of the double lumen endotracheal tube.

Four port thoracoscopy was performed. Two × 5mm ports, 1× 10mm and 1 ×11mm ports were utilized. A10mm camera port was placed in the 7<sup>th</sup> intercostal space anterior to the midaxillary line. A 5mm working port was placed in the 8<sup>th</sup> intercostal space two finger breadths posterior to the first camera port. Another 10mm port was placed in the fourth intercostal space adjacent to nipple. Last 5mm port was being placed in the sixth intercostal space just beneath the tip of the scapula that helped in retraction and manipulation for the operating surgeon. The surgeon stood on the right side whereas the camera assistant and first assistant to surgeon stood on the left side. Scrub nurse stood on right side with the equipment trolley.

After post placements, the deflated lung was retracted and the area of the tumor was visualized and general resectability was assessed. Inferior pulmonary ligament was mobilized up to the azygos vein and the esophagus was exposed. Medial dissection was performed

first, followed by careful lateral dissection from adjacent aorta. Direct branches from aorta to esophagus were individually clipped to avoid troublesome hemorrhage. Azygos vein was divided by vascular stapler and later dissection above azygos vein was performed. It is critical that one needs to stay on esophagus to avoid injury to closely placed membranous trachea. The esophagus was mobilized up to the root of the neck, taking care to avoid injury to nearby major vessels. Adequate lymphadenectomy was performed at this stage, avoiding injury to carina and pericardium. Inferiorly the esophagus was mobilized to hiatus after retracting the diaphragm with a sponge on stick. We clip the thoracic duct if there is suspicion of injury to thoracic duct during the lateral mobilization of the esophagus. Hemostasis was ascertained and chest drain was placed to suction followed by closure of chest cavity and the patient was moved to supine position.

Abdominal cavity was approached by 4×5mm ports and 1×11mm camera port that was placed in infra umbilical manner. Abdominal cavity was inspected for any metastasis and mobilization of the stomach was started. Pedicle of Right Gastroepiploic artery was identified and at all times it was carefully preserved during the mobilization. Lesser sac was opened at the gastro colic ligament and mobilization was progressed towards the spleen. Short gastric arteries were carefully taken care of with ligasure device staying midway between stomach wall and spleen as to prevent gastric injury or splenic infarction.

Adequate mobilization up to the Left crus was being performed and then later mobilization was done along hepatoduodenal ligament. At this stage it is critical to identify any aberrant or replaced left hepatic artery. Right crus were approached and mobilized. However, it shall not be opened as at this stage pneumoperitoneum can be lost. Left gastric artery and vein were clipped at their origin and lymph nodes harvested. Both the crura were opened. At this stage the abdominal cavity is in communication with the chest cavity and suction of chest drain is made off. Second team at this stage started the neck dissection. We use an oblique incision on left side of the neck, after dividing the platysma and dissection along anterior border of sternocleidomastoid. Middle thyroid vein was clipped to avoid traction injury near its communication with internal jugular. Strap muscles were divided and thyroid was retracted medially. Esophagus was exposed and delivered in wound. It was transected after stay sutures were taken and transection was made such that the mucosa was around 1 cm below the adventitia for adequate anastomosis. The distal transected end was tagged to a soft nasogastric tube. The abdominal team by then had opened the abdomen via a small upper midline incision just enough to accommodate small Alexis wound retractor. The specimen was delivered with ease in the abdominal wound as it was fully mobilized. Gastric conduit was created by resecting gastroesophageal junction, cardia, part of fundus and part of lesser curvature with green Echelon reloads. Staple lines were re enforced. We routinely do not perform kockerization of the duodenum. Mechanical pyloromyotomy was done and the gastric conduit was tagged to the previously passed soft nasogastric tube from neck. Gastric conduit was delivered in neck under laparoscopic assistance to prevent twists. At this point it is paramount that the vascular supply of the conduit shall not be under tension.

In neck a single layer end to side anastomosis was fashioned using PDS 4/0 in interrupted fashion.

Nasogastric and nasojejunal tubes were passed. Nasojejunal tube was manipulated post duodenojejunal junction. Abdominal and neck drains were placed.

Wounds of neck and abdomen were closed.

Operating time: 300 minutes.

Blood loss: 50 ml.

Histopathology: yPT0N0, 0/26 Lymph nodes positive.

### The Detailed Video with Audio Commentary is Being Attached with the Manuscript

**Post-Operative Management:** Postoperatively, patient was managed in Post Anesthesia Care Unit (PACU) for six hours and then later shifted to High Dependency Unit (HDU) for overnight observation and later stepped to Surgical Extended Care Unit (SECU). Diet was started on day one via nasojejunal tubes. Patient was mobilized on day one. Nasogastric tube, abdominal and neck drains were removed on day one. On day two Foley's catheter and epidural were removed and patient was given full diet of isocal via nasojejunal tube. Patient was transferred to room on day three and central venous line was removed. Full diet was continued. On day 4 chest drain was removed according to output, we remove chest drain if output is less than 100 ml in one shift of eight hours. Neck clips are also removed. Patient was discharged on post-operative day 6. Nasojejunal feeding was continued till day 12 and nasojejunal tube was removed in the outpatient clinic after giving water trial orally. We have abandoned the practice of getting post-operative oral contrast studies for evaluation of anastomosis.

**Tips, Tricks and Pitfalls:** Proper positioning of patient for VATS, improper positioning leads to difficult in operation.

- Early assessment of the tumor before embarking on mobilization, only to find after mobilization that the initial tumor was not resectable!
- Avoiding injury to pericardium during medial dissection of esophagus.
- Avoid injury to carina during lymphadenectomy.
- Avoiding lateral injury of aorta.
- Staying close to esophagus above the azygos vein to prevent injury of the membranous trachea.
- Avoiding injury of opposite pleura.
- During abdominal dissection at all times see the Right Gastroepiploic pedicle, sole option for making gastric conduit.
- Transfer of gastric conduit under vision to neck as to avoid twisting.
- Meticulous anastomotic technique.
- In the post-operative phase keep a close eye on vitals and biochemical markers.
- Early CT scan to detect leaks in case of suspicion.

- Early intervention, most of the times only draining abscess in neck and drain placement is sufficient.
- Early diaphragmatic hernia is a possibility!

## Result

The patient was discharged on post-operative day six and he had uneventful recovery. He had R0 resection with adequate lymph node harvest. He is alive and is on regular follow up.

## Conclusion

Minimally invasive three stage esophagectomy is a safe procedure with minimal morbidity and equal oncological outcomes if it is being carried out in high volume centers that are dedicated to esophageal surgery. Team approach is of paramount importance in these complex procedures.

## Disclosures

The author and co-authors declare no conflict of interest.

## Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-chief of this journal.

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