



Hybrid Minimally Invasive Esophagectomy for Esophageal Cancer: 14 cases. Single Center Experience Short Term Results

Özofagus Kanserinde Hibrit Minimal İnvaziv Özofajektomi: 14 olgu. Tek Merkez Deneyimi Kısa Dönem Sonuçları

Dursun Burak ÖZDEMİR¹, Serdar ŞENOL²

ABSTRACT

AIM: To perform a retrospective evaluation of morbidity, early postoperative mortality rates, and the safety of the procedure in patients who underwent hybrid minimally invasive esophagectomy in our clinic.

MATERIAL AND METHOD: The records of 14 patients with esophageal cancer operated using the minimally invasive esophagectomy technique in the General Surgery Department of Samsun Education and Research Hospital between November 2015 and November 2022 were analyzed retrospectively.

RESULTS: The mean age of the 14 cases was 55 ± 11.96 years (32-71). Ten patients (71%) were men and four (29%) were women. The tumor was located in the lower esophagus in 12 cases, in the middle esophagus in one, and in the upper esophagus in one. Near total esophagectomy – cervical anastomosis was performed in 13 cases. Pharyngogastric anastomosis was performed after total esophagectomy, bilateral total thyroidectomy, and laryngectomy in one patient with upper esophageal tumor. The mean operative time was 319.64 ± 76.28 (188-452) min. Mean intraoperative bleeding was 109.64 ± 58.58 (40-220) ml, and the mean length of hospital stay was 13.71 ± 3.72 (7-21) days. No early postoperative mortality was observed in any case.

CONCLUSION: Our early postoperative results in cases in which we performed hybrid minimally invasive esophagectomy are consistent with the previous literature.

Keywords: Hybrid minimal invasive esophagectomy, Esophageal cancer, Thoracoscopy

ÖZET

GİRİŞ: Kliniğimizde hibrit minimal invaziv özofajektomi uygulanan hastalarda morbidite, erken postoperatif mortalite oranları ve işlemin güvenliğinin retrospektif olarak değerlendirilmesi.

GEREÇ VE YÖNTEM: Kasım 2015 ile Kasım 2022 tarihleri arasında Samsun Eğitim ve Araştırma Hastanesi Genel Cerrahi Kliniğinde minimal invaziv özofajektomi tekniği kullanılarak opere edilen özofagus kanserli 14 hastanın kayıtları retrospektif olarak incelendi.

BULGULAR: 14 olgunun ortalama yaşı 55 ± 11,96 yıl (32-71) idi. On hasta (%71) erkek ve dört hasta (%29) kadındı. Tümör 12 olguda alt özofagusta, bir olguda orta özofagusta ve bir olguda ise üst özofagusta yerleşmişti. Olguların 13'üne totale yakın özofajektomi - servikal anastomoz uygulandı. Üst özofagus tümörü olan bir hastada total özofajektomi, bilateral total tiroidektomi ve larenjektomi sonrası farengogastrik anastomoz yapıldı. Ortalama ameliyat süresi 319.64 ± 76.28 (188-452) dakikaydı. Ortalama intraoperatif kanama 109.64 ± 58.58 (40-220) ml ve ortalama hastanede kalış süresi 13.71 ± 3.72 (7-21) gündü. Hiçbir olguda erken postoperatif mortalite gözlenmedi.

SONUÇ: Hibrit minimal invaziv özofajektomi uyguladığımız olgularda erken postoperatif sonuçlarımız literatür verileri ile uyumludur.

Anahtar Kelimeler: Hibrit minimal invaziv özofajektomi, Özofagus kanseri, Torakoskopi

¹Samsun Training and Research Hospital, Department of Surgical Oncology, Samsun, Türkiye

²Samsun Training and Research Hospital, Department of Gastroenterology Surgery, Samsun, Türkiye

Makale geliş tarihi / Submitted: Ağustos 2023 / August 2023

Sorumlu Yazar / Corresponding Author:

Dursun Burak ÖZDEMİR

Adres: Kışla, Barış Bulvarı No:199, zip code: 55090 İlkadım, Samsun, Türkiye

Tel +90 533 431 0682

E-posta: dursun_burak@yahoo.com

Makale kabul tarihi / Accepted: Nisan 2024 / April 2024

Yazar bilgileri:

Dursun Burak ÖZDEMİR: dursun_burak@yahoo.com, ORCID: 0000-0002-3672-5738

Serdar ŞENOL: serdarardaduru@gmail.com, ORCID: 0000-0002-6084-2491

INTRODUCTION

The majority of esophageal cancers are squamous cell or adenocarcinomas. Although the incidence of squamous cell carcinoma (SCC) is decreasing in the United States, the incidence of adenocarcinoma (AC) arising out of Barrett's esophagus (BE) is rising dramatically, although less so in the last few years.¹ The type of surgery to be selected depends on the location of the tumor, the performance of the patient, the extent of the planned lymph node dissection, and especially the experience of surgeon. However, the randomized, controlled TIME study revealed that thoraco-laparoscopic total minimally invasive esophagectomy caused fewer pulmonary and cardiovascular complications than open surgery.² Laparoscopic preparation of the gastric reservoir and performing the esophagectomy with thoracotomy is known as hybrid minimal invasive esophagectomy (HMIE). The thoracoscopic method of thoracic surgery is also becoming increasingly common in total or near-total esophagectomies performed with abdominal, thoracic, and cervical incisions.

This study discusses cases of esophageal cancer subjected to thoracoscopic intervention with a minimally invasive method in our clinic, in the light of the current literature.

MATERIAL AND METHOD

Fourteen patients with esophageal cancer operated using a minimally invasive esophagectomy technique in the General Surgery Department of Samsun Education and Research Hospital between November 2015 and November 2022 were included in the study. All patients underwent preoperative esophagogastroduodenoscopy. Siewert type 2 patients were not included in the study because they were considered esophagogastric junction tumors. Demographic and clinic characteristics were recorded for all patients. Statistical analyses were performed on SPSS version 25.0 software (SPSS Inc., Chicago, IL, USA). Data are presented as mean \pm standard deviation, and as frequency values for categorical variables. All procedures were carried out in accordance with the ethical rules and principles of the Declaration of Helsinki. The study was carried out with the permission of the Samsun Education and Research Hospital Non-interventional Clinical Research Ethics Committee (Date: 23/11/2022 Decision no: 2022/12/9). Since the study was planned retrospectively, written informed consent was not obtained from the patients.

Thoracoabdominal computed tomography (CT) was used as a standard method during preoperative staging. Abdominal magnetic resonance imaging (MRI) and positron emission tomography (PET) were also used in some cases. Patients who received neoadjuvant treatment were re-evaluated with contrast-enhanced thoracoabdominal CT after waiting at least 6 weeks post-treatment. Pathological staging was performed using the American Joint Committee on Cancer (AJCC) 8th edition TNM staging system.³

Surgical Technique:

The operation was performed in three areas and in the following order;

Thoracoscopy: The patient was placed in the prone position, and the right lung was collapsed. Three trocars were inserted from the right hemithorax. The first 10-mm trocar was entered into the right hemithorax with open technique just inferior to the inferior type of the right scapula. One 10mm trocar was entered through the 7th intercostal space and one 12mm trocar was entered through the 9th intercostal space. The middle port was used as the optical port. CO₂ insufflation was performed during thoracoscopy. Intrathoracic pressure was maintained between 5-8 mmHg. 30-degree camera was employed. The thoracic esophagus was exposed by opening the mediastinal pleura over the esophagus. The esophagus was mobilized from the hiatus to the thoracic inlet and dissected together with the paraesophageal lymph nodes. The ductus was clipped in 1 case in which thoracic duct injury was noticed during dissection. The azygos vein was dissected, closed, and cut with an endoscopic gastrointestinal (GIA) stapler. A 32F thoracic drain was inserted for postoperative drainage.

Laparotomy: The patient was placed in the supine position. The abdomen was entered with a median incision above the umbilicus.

In 13 cases, the stomach was prepared for gastric pull-up, celiac lymphadenectomy, extensive Kocher maneuver and pyloroplasty were performed. Right gastric artery and vein, right gastroepiploic artery and vein were preserved. The vascular arch was preserved in the great curvature. A wide gastric tube was created using linear staplers. An ileocolic segment was prepared for interposition in one case. The blood supply was based on the middle colic vessels without preservation of the right colic vessels.

Cervical incision: An oblique incision was made along the 2/3 distal anterior border of the left sternocleidomastoid muscle. The middle thyroid vein and the inferior thyroid artery were ligated. The left recurrent laryngeal nerve was exposed following medial retraction of the thyroid gland. The prevertebral region was then entered. The esophagus was dissected, suspended, and subsequently skeletonized by dissection towards the mediastinum. In 13 cases, after the esophagus had been extracted through the cervical incision with the gastric tube, it was transected and a 25-mm anvil was inserted into it. This was then sutured in a purse-string fashion. An end-to-side esophagogastric anastomosis was performed with a circular stapler and a GIA stapler. Ileocolic interposition was performed in one case because the gastric conduit could not be used.

RESULTS

The mean age of the fourteen patients was 55 \pm 11.96 years (32-71). Ten patients (71%) were male and four patients (29%) were female. The female/male ratio was 0.40. The mean body mass index (BMI) was 29.35 \pm 3.38 (24-35). The tumor was located in the lower esophagus in 12 cases, in the middle esophagus in one, and in the upper esophagus in one. The tumor type was AC in 12 cases and SCC in two. All patients received neoadjuvant chemoradiotherapy (CRT). Thoracoscopy was used in all operations. Near total esophagectomy – cervical anastomosis was performed in 13 cases. Pharyngogastric anastomosis was performed after total esophagectomy, with bilateral total thyroidectomy and laryngectomy being applied in one case with upper esophageal tumor. In the case in which a gastric conduit could not be used, a ileocolic interposition flap was prepared, and interposition was applied to re-establish the continuity of the gastrointestinal tract. The mean operative time of the cases was 319.64 \pm 76.28 (188-452) minutes. Mean intraoperative bleeding was 109.64 \pm 58.58 (40-220) ml, and the mean hospital stay was 13.71 \pm 3.72 (7-21) days. Histopathological examination revealed ypTNM stage 1 disease in eight patients. Complete pathological response was observed in four of these cases (TONOMO). Of these 4 cases, 2 were AC and 2 were SCC. Two patients had ypTNM stage 2 disease, and four had ypTNM stage 3B disease. No 30-day mortality was observed in any of our patients (Table 1).

Table 1: Demographic and clinical characteristics

		N	%
Age (year)	Mean \pm standard deviation (min-max)	14	55 \pm 11.96 (32-71)
Sex	Female	4	29%
	Male	10	71%
BMI (kg/m ²)	Mean \pm standard deviation (min-max)	14	29.35 \pm 3.38 (24-35)
Tumor localization	Upper esophagus	1	7%
	Middle esophagus	1	7%
	Lower esophagus	12	86%
Histopathological type	Squamous cell carcinoma	2	14%
	Adenocarcinoma	12	86%
Reconstruction type	With gastric conduit	13	93%
	With ileocolic loop interposition	1	7%
Operative time (min)	Mean \pm standard deviation (min-max)	14	319.64 \pm 76.28 (188-452)
Intraoperative blood loss (ml)	Mean \pm standard deviation (min-max)	14	109.64 \pm 58.58 (40-220)
Length of stay (days)	Mean \pm standard deviation (min-max)	14	13.71 \pm 3.72 (7-21)
Pathological stage	ypTNM stage 1	8	58%
	ypTNM stage 2	2	14%
	ypTNM stage 3B	4	28%
Postoperative complications	Anastomotic leak and fistula	1	7%
	Pneumonia	1	7%
	Pulmonary thromboembolism	1	7%
Early mortality (\leq 30 days)	Frequency (%)	0	0%

Data are presented as mean \pm standard deviation (minimum-maximum) for continuous variables and as frequency (percentage) for categorical variables.
BMI: Body mass index.

We performed near-total esophagectomy on a patient, who had a history of distal subtotal gastrectomy surgery. We prepared an ileocolic loop preserving the middle colic vessels and performed interposition to ensure continuity of the gastrointestinal tract. In this case, fever developed on the 10th day postoperatively. Neck and chest CT and endoscopy revealed a fistula between the trachea and the neoesophagus. An intraluminal esophageal stent was subsequently installed in the esophagus. The stent was changed regularly at intervals of 4-6 weeks. However, the fistula still persisted at the 13th month of follow-up. An AMPLATZER™ ventricular septal defect occluder (St. Jude Medical, Plymouth, MN, USA) was applied to the fistula tract, and the fistula was closed mechanically. At the time of writing, the patient is in the 21th postoperative month and receiving oral nutrition. No local recurrence or distant metastasis was detected in that case. The patient gained 11 kg during the follow-up period, experienced no recurrent pneumonia, and did not require hospitalization.

Pulmonary embolism was detected in one of our patients (7%) who was dramatically hypoxemic on the second postoperative day. Diagnosis was established using thoracic contrast-enhanced CT. This patient was using anti-embolism stockings and taking prophylactic low molecular weight heparin. No technical difficulties were experienced during surgery, and thoracoscopy lasted 285 minutes.

DISCUSSION

EC is the eighth-most common cancer and the sixth-most common cause of death worldwide.⁴ Its global incidence is 12.9/100,000, and it is more common in men, with a reported female/male ratio of 0.38.⁵ In our series, the female/male ratio was 0.40, consistent with the previous literature. The most common histological subtype worldwide is SCC. However, in our series the incidence of AC was higher than that of SCC (86%). We attribute this to the more frequent referral of patients with lower esophageal tumors to the general surgery department (86%). Numerous surgical methods have to date been described for the curative treatment of EC, but there is no consensus on the most appropriate surgical method for esophageal resection. The search for an ideal surgical technique capable of optimally reducing mortality and morbidity rates and increasing quality of life is still ongoing.

Minimally invasive esophagectomy (MIE) was first reported by Cuschieri in 1992 in a series of five cases.⁶ In that series, the esophagus was mobilized by thoracoscopy, and the operation was combined with laparotomy. This method was later given the name hybrid esophagectomy.⁶⁻⁸ Different combinations of MIE were described in subsequent years. Total MIE (TMIE, thoracoscopy + laparoscopy) was reported in 2003 with a series of 222 patients, and significantly low morbidity and mortality were observed.⁹ We combined thoracoscopy and laparotomy in all our cases.

The first published randomized control trial comparing outcomes after minimally invasive transthoracic esophagectomy (TTE) and open TTE was the Traditional Invasive vs. Minimally Invasive (TIME) trial performed in 2012.¹⁰ That study assessed several perioperative, as well as oncological, outcomes and quality of life measurements, although it was primarily planned to assess perioperative complications.^{2,10} Including the one published randomized controlled trial (TIME), eight meta-analyses were completed between 2009 and 2017 and compared the perioperative and oncological outcomes of MIE and open esophagectomy (OE).¹¹⁻¹⁸

Studies have shown that the mean operative time is higher in MIE than in OE.^{10,15,18,19} In the TIME study, mean operative times were 329 minutes for MIE and 299 minutes for OE.¹⁰ In the present series, the mean operative time was 319.64 ± 76.28 (188-452) minutes, a figure consistent with the literature. Average intraoperative blood loss in MIE was 200 ml in the TIME study.¹⁰ In the present series this was 109.64 ± 58.58 (40-220) ml. We attribute this to improvements in camera, monitor, and electrosurgery technology and our own laparoscopy experience.

We have a lot of experience with near-total esophagectomy in our clinic. Thoracoscopic Ivor-Lewis esophagectomy and intrathoracic anastomosis are technically difficult. It is especially difficult to perform the anastomosis without mini-thoracotomy. In case of anasto-

motric leakage, intrathoracic anastomotic leakage can lead to catastrophic results. Therefore, we performed cervical anastomosis in all patients regardless of tumor localization.

One potentially lethal complication following esophageal surgery is anastomotic leak. The incidence of this complication ranges from 0 to 12% and is similar between MIE and OE.²⁰ In the present series, anastomotic leakage was determined in one case (7%), in line with the previous literature.

Pulmonary embolism was detected in one of our patients (7%). In the TIME study, the reported incidence of pulmonary complications related to MIE was 29%.²

In our case series, the mean length hospital stay after MIE was 13.71 ± 3.72 (7-21) days, consistent with the literature.²¹

CONCLUSION

In conclusion, our early postoperative results in patients who underwent HMIE are consistent with the previous literature. Further publications concerning HMIE are now needed. We believe it is important for clinics to share their results and experiences in hybrid surgery. Our treatment of persistent esophageal fistula using a ventricular septal defect occluder was successful in leak management.

ACKNOWLEDGEMENTS

Author Contributions:

DBO: Data analysis and interpretation, drafting the article, final approval of the version to be published. SS: Substantial contributions to conception and design of the study and the article.

Conflict of Interest: No potential conflict of interest was reported by the authors.

Sponsor's Role: This research received no specific grant from any funding agency

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