

Could hybrid minimally invasive esophagectomy improve the treatment results of esophageal cancer?



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Abstract

Aim: To assess the effectiveness of hybrid minimally invasive esophagectomy (hMIE) in comparison with open esophagectomy (OE) in esophageal cancer treatment.

Methods: The single center prospective nonrandom cohort study included a total of 88 patients in convenience sample, who underwent the Ivor-Lewis procedure with a curative intention for the middle- and lower-third esophageal cancer between January 2009 and February 2015. All patients were operated by the one surgical team. Out of 88 patients, 44 underwent OE and 44 hMIE laparoscopic approach (laparoscopic gastric mobilization). Primary endpoints were significant early postoperative complications, including major postoperative pulmonary complications (MPPCs). Secondary endpoints were perioperative characteristics, 30-day mortality and oncological outcomes.

Results: The total number of complications was 21 in the OE group vs. 13 in the hMIE group ($p > 0.05$). Higher prevalence of major postoperative pulmonary complications (MPPCs) was observed in the OE group compared to the hMIE group.

Mean intensive care unit (ICU) stay was 3.8 (1–21) days; there was a statistically significant difference in favor of the hMIE group. Mean number of harvested lymph nodes was 26.3 in the OE group compared to 31.9 in the hMIE group ($p < 0.05$). There was no statistically significant difference regarding 30-day mortality between the groups. Overall median survival rate was 807 days; 824 days in the OE group vs. 778 days in the hMIE group ($p > 0.05$).

Conclusion: Perioperative and oncologic results after hMIE are not inferior but are even better in some aspects of treatment when compared to OE.

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Keywords: Esophageal cancer; Surgery; Minimally invasive esophagectomy; Laparoscopy; Postoperative complications

Introduction

The era of video-assisted and minimally invasive surgery began over three decades ago when laparoscopic

cholecystectomy was introduced. Laparoscopic cholecystectomy served as the spark ignition in the laparoscopic surgery explosion and paved the way for the more complex laparoscopic procedures. Indeed, in 1992 Sir Alfred Cuschieri published a paper about the first thoracoscopic mobilization of the esophagus.¹ Soon afterwards, a minimally invasive esophagectomy (MIE) has been increasingly performed to treat loco-regional esophageal cancer worldwide. According to the data from a population-based UK national study, there has been a steady increase in the uptake of the concept of MIE from 6.2% in 2005 to 24.7% in 2009.²

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Utilization of the concept of MIE is a strategic change, and the implementation of the new and demanding surgical technique which had to be thoroughly well planned and implemented. In change management from OE to a total minimally invasive esophagectomy (tMIE), hMIE (laparoscopic or thoracoscopic procedure) is an intermediate, albeit a huge step. Indeed, according to the systematic review of MIE cases published in the English language up to June 2012, hMIE or video-assisted transhiatal esophagectomy was performed in at least 40% centers worldwide.³

At the Department of Minimally Invasive Upper Digestive Surgery of the Hospital for Digestive Surgery in Belgrade, hMIE was standard of care for patients with a resectable esophageal cancer from 2009. As the next and final step in the change management, since January 2015 we have utilized tMIE as standard of care.

The aim of the study was to summarize a single center experience in hMIE (laparoscopic approach) and assess the effectiveness of the procedure in comparison with OE in the treatment of esophageal cancer.

Materials and methods

The single center prospective nonrandom cohort study included a total of 88 patients in convenience sample, who underwent the Ivor-Lewis procedure with a curative intention for the middle- and lower-third esophageal cancer between January 2009 and February 2015. All patients were operated by the one surgical team. Out of 88 patients, 44 underwent OE and 44 hMIE laparoscopic approach (laparoscopic gastric mobilization). Through strategic change management, we have gradually increased proportion of patients operated using hMIE, and decreased the proportion of patients operated using OE. Preoperative data did not influence operative approach. Subsequent comparative analysis of the preoperative data did not indicate selection bias or potential confounding (Table 1). Two different surgical techniques were evaluated in respect to perioperative, as well as postoperative course details (Tables 1 and 2). All subjects gave informed consent prior to study enrollment. The study was reviewed and approved by Clinical Center of Serbia Institutional Review Board. This study adhered to the Strengthening the Reporting of observational Studies in Epidemiology (STROBE) statement.⁴

Preoperative work-up included symptom evaluation, barium swallow radiography, upper flexible endoscopy with biopsy, computed tomography (CT) of thorax and abdomen, pulmonary evaluation (flexible bronchoscopy and pulmonary function tests) and in some cases endoscopic ultrasound (EUS) and positron emission tomography (PET). In cases of resectable esophageal cancer, surgical procedure was the first treatment option. Patients with locally advanced squamocellular cancer received neoadjuvant concomitant chemoradiation therapy (CRT) followed by surgery.⁵

The standard surgical technique has been previously described in details.⁶ Surgical procedure included laparoscopic or open gastrotomy, lymph node dissection in the coeliac region and tubulization of the stomach. Pyloromyotomy or pyloroplasty was performed routinely in the majority of cases. After repositioning of the patient in the left lateral decubitus, open thoracotomy was performed. In case of distal thoracic cancer, two-field standard lymph node dissection was performed. In respect to the Japanese Classification of Esophageal Cancer, tenth edition it means lymph node dissection of the station numbers 1, 2, 3, 7, 20, 112, 111, 110, 109, 108 and 107. In the case of the middle thoracic carcinoma, lymph node dissection was extended to the tracheobronchial (106tb) and upper thoracic paraesophageal (105) lymph node.⁷ After subtotal esophagectomy and gastric pull-up, mechanic end to side esophagogastric anastomosis was performed in the upper mediastinum and wrapped with the part of the omentum preserved along the greater curvature of the stomach. In the case of hMIE, minimally invasive surgical procedure was a part of early recovery after surgery (ERAS) concept. Thus, instead of decompressive tube jejunogastrostomy performed as a part of OE, nasogastric (NG) tube was placed during the hMIE and removed within 36 h after surgery.⁸ In addition, feeding jejunostomy was not standard part of hMIE because early NG tube removal and preserved peristaltic activity after laparoscopic procedure allow early postoperative sip feeding.

After the procedure, the operating surgeon dissected all lymph nodes separately from the specimen. Histopathological examination and staging were based on the revised TNM tumor classification including tumor stage grouping.⁹

After hospital discharge the first check-up was performed a month after surgery and then periodically according to the European Society for Medical Oncology (ESMO).¹⁰ Data were collected from prospectively developed data base.

The study objective was to assess the effectiveness of hMIE by comparing it to OE. Primary endpoints were significant early postoperative complications (defined as grade II and over according to the Dindo-Clavien classification,¹¹ including major postoperative pulmonary complications (MPPCs)). Secondary endpoints were perioperative characteristics (duration of the operation, blood loss, ICU and overall hospital stay) 30-day mortality and oncological outcomes (based on the number of harvested lymph nodes and short- to mid-term survival).

Statistical analysis

The descriptive statistics, including the numbers and percentages of categorical data or mean, median and range of numerical data were used to summarize sample data. The Pearson chi-square test or the Fisher exact probability test were used to compare categorical variables between OE and hMIE procedures, and independent samples *t*-test or

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