

Robotic Esophagectomy Modified McKeown Approach

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KEYWORDS

• Esophageal cancer • Robotics • Minimally invasive surgery • Esophagectomy

KEY POINTS

- Robotic esophagectomy for esophageal carcinoma offers excellent visibility, complex maneuvers, and unprecedented precision during minimally invasive esophagectomy and may ultimately lead to improved outcomes for this difficult disease with profound mortality.
- Further advances in robotics and clinical management comparing robotic resection versus traditional approaches are needed to define the role of robotics in the surgical management of esophageal cancer.

INTRODUCTION

Esophageal carcinoma is a highly lethal disease; untreated, over 95% of symptomatic patients die in less than 12 to 14 months. The incidence of esophageal adenocarcinoma of the esophagus in the United States has demonstrated startling growth in recent years: from 3.6 cases per million population in 1973 to 25.6 cases per million population in 2006.¹ Increases in adenocarcinoma incidence are in part due to growth of the known risk factors gastroesophageal reflux disease and obesity. However, the incidence of squamous cell carcinoma of the esophagus has been steadily decreasing in the western world because of long-term reductions in tobacco abuse and excessive alcohol consumption.

Cure is the ultimate goal for surgical management of esophageal carcinoma. For early stage disease, less than T2, surgery alone has been shown to provide survival benefit as well as prognostic information. For patients with locally advanced disease, 2 randomized trials comparing chemoradiotherapy alone to chemoradiotherapy followed by surgery have failed to demonstrate improved survival with surgery; however, both showed better locoregional control and a lesser

need for palliative procedures when surgery was a component of treatment.^{2,3} Surgically-related mortality was excessive, diluting the true impact of surgical resection. More recent randomized trials have demonstrated survival benefit, especially in patients resected by means of an optimal minimally invasive approach. Therefore, surgery remains the preferred treatment approach for clinically resectable esophageal cancer.

Esophagectomy is a technically challenging operation. Open esophagectomy has been documented to be effective in providing good oncologic control but often is associated with significant morbidity and postoperative hospital stay. Minimally invasive esophagectomy offers several advantages over the traditional open approach: fewer postoperative complications, less intraoperative blood loss, smaller incisions, shorter hospital and intensive care unit stays, and better preservation of postoperative pulmonary function.^{4,5} The surgical optimal approach, open technique versus laparoscopic/thoracoscopic; modified McKeown versus Ivor Lewis versus transhiatal; and various different resection techniques have yet to be determined as to effectiveness. Criticism of minimally invasive esophagectomy has included the uncertainty of adequate lymph node dissection

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and the steep learning curve for mastering the procedure. The computer-assisted technology of the robotic approach to the minimally invasive esophagectomy has the potential to increase lymph node dissection in difficult-to-reach areas and shorten the learning curve. This article will review the technical aspects of the modified McKeown approach to robotic esophagectomy and review the existing literature with respect to indications and outcomes.

SURGICAL TECHNIQUE

Preoperative Planning

Standard workup of esophageal cancers and esophagogastric junction cancers is described by NCCN Clinical Practice Guidelines In Oncology (NCCN Guidelines[®]) and is shown in **Table 1**.

Patients with T1 or T2 lesions without evidence of nodal disease or metastasis are candidates for esophagectomy as the initial therapeutic approach. Patients with full-thickness lesions or invasion of local structures even with evidence of nodal disease may be candidates for esophagectomy following response to chemotherapy or chemoradiotherapy. The relative contraindication for esophagectomy with advanced age is severe comorbid illness. The presence of lung, bone, adrenal, brain, liver, or peritoneal metastasis precludes

resectability. Celiac, mediastinal, and supraclavicular nodes are considered regional nodal disease in the 2010 update for the TNM staging system.

Utilization of robot assistance for esophagectomy requires additional preoperative preparation. Robotic surgery can be performed in patients with history of prior thoracic surgery, but extensive pleural adhesions may preclude a reasonable dissection. Preoperative computed tomography (CT) is beneficial to determine operability and for planning port placement. Generally, port placement should be at least 10 to 15 cm away from pathology, a challenge for small adults and children.

Pulmonary function testing and preoperative cardiac testing will determine if the patient is physiologically fit to undergo esophagectomy. Preoperative evaluation will need to demonstrate that the patient will tolerate CO₂ insufflation and single lung ventilation. A retrospective cohort study demonstrated that patients undergoing an esophagectomy had fewer postoperative complications (6% vs 24%) with preoperative respiratory rehabilitation.⁶

PREPARATION AND PATIENT POSITIONING

Thoracic Phase

At the outset of the procedure, the patient is intubated with a double-lumen endotracheal tube,

Table 1
NCCN Guidelines[®] for Esophageal and Esophagogastric Junction Cancers

Workup

- H&P
- Upper GI endoscopy and biopsy
- Chest/abdominal CT with oral and IV contrast
- Pelvic CT as clinically indicated
- PET/CT evaluation if no evidence of M1 disease
- CBC and chemistry profile
- Endoscopic ultrasound (EUS), if no evidence of M1 disease
- Endoscopic mucosal resection (EMR) may contribute to accurate staging of early stage cancers
- Nutritional assessment and counseling
- Biopsy of metastatic disease as clinically indicated
- HER-2-neu testing if metastatic adenocarcinoma is documented/suspected
- Bronchoscopy, if tumor is at or above the carina with no evidence of M1 disease
- Assign Siewert category
- Smoking cessation advice, counseling, and pharmacotherapy

Additional Evaluation

- Laparoscopy (optional) if no evidence of M1 disease, recommended only for patients with adenocarcinoma if the tumor is at the esophagogastric junction (EGJ)

Abbreviations: H&P, History and Physical Examination; HER, human epidermal growth factor receptor.

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