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The first postesophagectomy chest X-ray predicts respiratory failure and the need for tracheostomy

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ABSTRACT

Background: Esophagectomy is a major surgical procedure associated with high rates of morbidity. The purpose of this study was to determine if the immediate first post-esophagectomy chest X-ray (pCXR) is associated with morbidity or mortality.

Methods: This was a single-institution analysis of patients undergoing esophagectomy, 2005-2015. A pCXR was routinely performed. A pCXR score was developed based on the number of objective abnormal findings. A statistical analysis was performed using patient/tumor variables and the pCXR score to derive adjusted odds ratios (ORs) on short-term outcomes.

Results: One hundred eighty-two patients had pCXRs. Scores ranged from 0 (normal) to 4 depending on the number of abnormalities, with a mean score of 1.6. The mean patient age was 60.7 y. Within the cohort, 92.9% had adenocarcinoma, 39.6% had T3/T4 tumors, and 48.4% were node positive. Open surgeries were performed in 51.6%, and 74.2% had chest anastomoses. The 30- and 90-d mortality rates were 2.2% and 3.9%, respectively. Increasing pCXR scores were associated with increased risk of prolonged intubation (OR: 1.67, 95% confidence interval [CI]: 1.21-2.36, $P = 0.002$) and tracheostomy (OR: 2.12, 95% CI: 1.08-4.16, $P = 0.029$). Multivariable analysis adjusting for age, comorbidities and performance status, histology, pathologic stage, surgical approach, and operative time confirmed a statistically significant association with the pCXR score and respiratory failure requiring tracheostomy (OR: 2.13, 95% CI: 1.03-4.39, $P = 0.041$).

Conclusions: This is the first study to show an association between the first pCXR and respiratory failure, providing new evidence that the first pCXR has important implications for pulmonary care after esophagectomy.

Introduction

Esophageal resection for cancer, either adenocarcinoma or squamous cell carcinoma, is a major oncologic surgical procedure that in conjunction with neoadjuvant chemotherapy and radiation offers a potential for cure.[1-3] However, esophagectomy is associated with high rates of morbidity.[4,5] These include anastomotic leak, chyle leak, pneumonia,

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respiratory failure, atrial fibrillation, myocardial infarction, and other complications. Many patients with esophageal cancer present in the seventh and eighth decades of life have a significant history of smoking and/or alcohol use. Pulmonary complications are particularly prone to occur when single-lung ventilation is used and part of the dissection occurs within the thoracic cavity. Patients may require prolonged intubation or an extended hospitalization after this surgery. Although minimally invasive surgery (MIS) and hybrid approaches (using both open and MIS techniques) have decreased morbidity after esophagectomy as compared to the open approach,[6-8] significant postoperative complications still occur.[9-11]

At our institution and others, a large proportion of esophagectomies are performed by surgical oncologists as well as general and thoracic surgeons. After surgery, it is a routine practice to obtain an immediate postesophagectomy chest X-ray (pCXR) to ensure that there is no pneumothorax, collapsed lung, significant atelectasis, or distention of the gastric conduit that requires immediate intervention. Anecdotally, our surgeons have noted that the findings on this first pCXR have correlated with postoperative morbidity. However, based on an extensive literature review, there is currently no information validating this suspicion. Therefore, the purpose of this study was to investigate the association of the first pCXR after esophagectomy and short-term outcomes, including morbidity and mortality. We hypothesized that an increased number of pCXR findings (including atelectasis, effusion, pneumothorax, and gastric conduit distention) would be associated with increased morbidity and 30- and 90-d mortalities.

Methods

Patients

This was a single-institution study of all patients who had esophageal cancer (either adenocarcinoma or squamous cell carcinoma) and underwent neoadjuvant chemoradiation followed by esophagectomy from January 1, 2005, to December 31, 2015. It is a routine practice at our institution for all patients to be considered for neoadjuvant chemoradiation before surgery. Patients were identified from a retrospective review of a prospectively maintained database at Roswell Park Cancer Institute. This study received appropriate approval from the institutional review board at Roswell Park Cancer Institute. As a retrospective study, this analysis was deemed minimal risk by the institutional review board, and therefore, the need for informed consent was waived.

All patients had biopsy-confirmed esophageal tumors. Surgery was performed by the members of the Departments of Surgical Oncology or Thoracic Oncology. Surgical approaches during the study period included open, MIS, and hybrid techniques. Anastomoses occurred in the chest (Ivor Lewis) or left neck (transhiatal or McKeown). There were no cases identified that were performed through the left chest. For the purpose of this study, only cases where the stomach was used in the reconstruction were included. Patients who underwent a colonic interposition were excluded. All patients who underwent Ivor Lewis or McKeown esophagectomies received anesthesia through single-lung ventilation. This was not necessary for patients who had transhiatal surgery. After resection, all patients had an immediate postoperative CXR either in the postanesthesia care unit or in the intensive care unit (ICU). Patients are routinely admitted postoperatively to the ICU or the intermediate medical care unit (step-down). Placement of a feeding jejunostomy tube is routinely performed with the esophagectomy. Postoperatively, a low basal rate (10 mL per hour) of high calorie tube feeds is started on postoperative day (POD) 2 and advanced per gastrointestinal function. The nasogastric tube is typically removed on POD 3 as long as there is no evidence of conduit distention. For anastomoses in the chest, a gastrografin swallow study is performed on POD 4, and if negative for leak, then a clear liquid diet is initiated. For anastomoses in the neck, a bedside swallow evaluation is performed by a certified speech pathologist, and if the patient passes (indicated by no aspiration or per oral contents within the neck drain aided by a liquid dyed with food coloring), then a clear liquid diet is initiated. Tube feeds are often continued to supplement nutrition as the patient transitions to a full-liquid diet, typically providing additional calories during the night for 12 h. Within 2 wk, the patient is advanced to a soft, low-residue diet. When the patient is able to maintain appropriate caloric intake, the feeding tube is removed.

Pertinent demographic data including age; gender; American Society of Anesthesiologists status; Eastern Cooperative Oncology Group performance status; history of smoking or alcohol use; pulmonary disease including chronic obstructive pulmonary disease; cardiac disease including previous myocardial infarction, coronary artery disease, and arrhythmia; and diabetes were recorded. Clinical data included histology, pathologic T stage, and pathologic N stage. Surgical approach was recorded so that any patient who had a portion of the surgery (either abdominal or thoracic components) performed using an open approach was considered "open." To have an MIS approach, both the thoracic and abdominal components were performed minimally and invasively. For this study, the neck dissection or a transhiatal or McKeown esophagectomy was not factored into the definition of open surgery or MIS as this component of the surgery always occurs in an open fashion and is a relatively short part of the procedure. Operative time and administration of intraoperative transfusion were also recorded, as these factors are known to be associated with short-term outcomes.

Short-term outcomes included postoperative total hospital length of stay, ICU length of stay, prolonged intubation, reoperation, anastomotic leak, pneumonia, sepsis, respiratory failure requiring reintubation and need for tracheostomy, chyle leak, myocardial infarction, atrial fibrillation, postoperative bleeding, renal failure, and 30- and 90-d mortality. A prolonged hospital length of stay was defined as being greater than 2 wk. A prolonged ICU length of stay was defined as over 4 d. Prolonged intubation was met if the patient was intubated for 6 or more days after surgery. This included days following reintubation, if this was performed. Patients without complete data for a specific variable within the medical record (e.g., ICU length of stay) were excluded from the respective analysis.