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Pulmonary Complications due to Esophagectomy

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ABSTRACT

Introduction: Esophageal carcinoma is the scourge of human beings. Pulmonary complications in patients who have undergone operation are common (20-30% of cases) and there are no suitable tools and ways to predict these complications. ***Methods***: During a period of 10 years, from March 1998 to February 2007, 200 patients (150 male and 50 female) underwent Esophagectomy due to esophageal carcinoma in thoracic surgery ward retrospectively. Complications include the length of hospitalization, mechanical ventilation, morbidity and mortality. Patients' risk factors include age, preoperative chemo-radiotherapy, stage of the disease and preoperative spirometry condition. ***Results***: We grouped our patients into three categories: Normal (FEV1 ≥ 80% predicted), mildly impaired (FEV1 65% to 79% predicted), more severely impaired (FEV1 < 65% predicted).Although almost all patients had radiographic pulmonary abnormalities, significant pulmonary complications occurred in 40 patients (20%) which underwent Esophagectomy. Pleural effusion and atelectasia in 160 patients (80%). 24 patients needed chest-tube insertion. 20 patients (10%) developed ARDS. 14 patients (7%) developed chylothorax. 20 patients (10%) of patients died during their postoperative hospital stay. 30 patients (15%) required mechanical ventilation for greater than 48 hours. ***Conclusion***: We reviewed a number of preoperative clinical variables to determine whether they contributed to postoperative pulmonary complications as well as other outcomes. In general, age, impaired pulmonary function especially in those patients with FEV1 less than 65% predicted was associated with prolonged hospital length of stay (LOS). In fact pulmonary complications rate after Esophagectomy are high and there was associated mortality and morbidity.

Introduction

Esophageal carcinoma is the scourge of human beings and its operation has many pulmonary complications such as pneumonia and respiratory insufficiency. Pneumonia and respiratory insufficiency are the most frequent complications that develop after esophagectomy. These complications associated with prolongation of hospital stay increase cost of care, and substantial operative mortality. In 1940 Oschner and DeBakey reviewed the world literature and collected reports of 191 esophageal resections with a 72% mortality.[1] Much progress has since been made, but even in recent reports, a hospital mortality rate of around 10% is still encountered.[2,3] Nowadays the 30-days mortality rate is about 10%. Chronic diseases, smoking, and consume much alcohol have close relationship with Esophageal squamous cell carcinoma. Anastomotic leakage helps to substantial morbidity.[4,5] As surgical technique and perioperative care improves the incidence of leakage and its related morbidity and mortality is reduced. In despite of perioperation and post-operation care and management, perioperative mortality range from 3% to 10%.[6,7]

Post-operative pulmonary complications occur frequently. In approximately 30% of cases and include pleural effusions, atelectasis, chylothorax, pneumonia, pulmonary embolism, and respiratory failure.[8,9] Pulmonary complications are the most common serious morbidity after esophagectomy.[10,11] The purpose of this study is the identification of factors that predict which patients are at excess risk for pulmonary complications and what the surgeon must do for preventing such complications during preoperative, operative and postoperative phase.

Materials and methods

During a period of 10 years, from March 1998 to February 2007, two hundred patients (150 male and 50 female) underwent esophagectomy due to esophageal carcinoma in the thoracic surgery ward of Emam

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Khomeini and Amir al-Momenin hospitals, Tabriz, Iran. We retrospectively assessed and analyzed all data that had correlation between pulmonary complications and patients risk factors. Complications were divided into surgical or medical. Surgical complications were recorded as anastomotic leakage, non-anastomotic leakage, gangrene of the conduit, recurrent laryngeal nerve palsy, intra-abdominal sepsis, chylothorax, hemorrhage and gastric outlet obstruction. Medical complications include major pulmonary complications such as bronchopneumonia, aspiration, pneumonia, respiratory failure (diagnosed with blood gas criteria), renal failure, hepatic failure and cardiac complication (myocardial infarction, heart failure, and arrhythmia. 30-day mortality was defined as death within 30 days of esophageal resection, whereas any death in the hospital after surgery was recorded as a hospital death.

Perioperative variables that were examined included patient's age, gender, pre-existent cardiac or pulmonary diseases, diabetes, abnormal electrocardiogram, abnormal chest radiograph, serum albumin, serum hemoglubolin level, Pco2, arterial oxygenation, FEV1, percent of predicted forced vital capacity(FVC). Operative factors, included type of resection (transthoracic, non-transthoracic), site of anastomosis, organ used for esophageal substitution, amount of blood loss, duration of operation and the use of epidural analgesia postoperative pain control.

Tumor specific factors included the level of tumor (an upper third tumor defined as tumor located between the thoracic inlet and the tracheal bifurcation) the completeness of resection, roversus R1/R2. All statistical analyses were performed by statistician and P-value of less than 0.05 was chosen as indicating a difference.

Results

We retrospectively analyzed 200 patients during 10 years from March 1998 to February 2007. These patients underwent esophagectomy for esophageal cancer. We grouped our patients into three categories: Normal pulmonary function (FEV1 $\geq$ 80% predicted), Mild pulmonary function impaired (FEV1between 65% to 79%), and More severely impaired pulmonary function (FEV1< 65% predicted).

Although almost all patients had radiographic pulmonary abnormalities, significant pulmonary complication occurred in 40 patients (20%) which underwent esophagectomy. Pleural effusion and atelectasis in 160 patients (80%). 24 patients (12%) needed chest-tube insertion in addition to those placed at the time of operation. Pneumonia was the most common clinically important pulmonary complication occurring in 60 cases (30%). 20 patients (10%) developed ARDS (Acute Respiratory Distress Syndrome). 14 patients (7%) developed chylothorax. 20 patients (10%) died during their post operative hospital stay. 30 patients (15%) required mechanical ventilation for more than 48 hours. All of the 10% patients who died post-operatively developed pneumonia. The location of tumors (upper, middle, lower) was very important for pulmonary complications after esophagectomy.

In a study the chance of having pulmonary complications for patients with upper, middle and lower third tumors were 29%, 16% and 8% respectively. Age is another factor that is important in outcomes. The mean age was 71±9 years. For patients who died, compared with 63±9 years for the survivors, p value<0.01.hospital mortality rate was 10% in patients older than 70 years and was 3% in the younger patients, p=0.002. The median blood loss during operation is important in patients' mortality. Elderly patients had lower preoperative albumin and hemoglobin levels, lower percent predicted FVC (forced vital capacity) values and had a higher prevalence of preexisting cardiopulmonary diseases. Other factors also tested included alcohol intake, smoking, cirrhosis, diabetes, po2 and pco2 levels, percent of predicted FEV1 value, location of primary tumor, the use of thoracotomy for resection, route of placement of the esophageal substituted organ, site of anastomosis, use of epidural analgesia, stage of tumor, blood loss and duration of operation. Preoperative variables and patients demographics are shown in Table 1 and Table 2.

Table 1. Preoperative variables and patients demographics

Age	71±9
Age (range)	25-81
Male	150
Female	50
FVC (%predicted)	160
FEV_1 (%predicted)	160
FEV_1>80% predicted	111
FEV_1 between 65%-79% predicted	23
FEV_1<65% predicted	25
Pco_2(mmHg)	128
Po_2(mmHg)	128

Table 2. Preoperative variables and patients demographics

Tumor histology	
Squamous cell	69
Adenocarcinoma	121
Other	10
Pathologic Stage	
Stage O	39
Stage I	26
Stage IIA	29
Stage IIB	29
Stage III	53
Stage IV	54
Level of Tumor	
Upper third	48
Middle	126
Lower Third	26

Discussion

Pulmonary complications after esophagectomy are very high rate. In this study, we reviewed a number of preoperative clinical variables to determine whether they contributed to post operative pulmonary complications as well as other outcomes. Pulmonary complications after esophagectomy are the most and serious complications. Some of them are not significant. Major pulmonary complications in our patients occurred about 20% and were reasonable for many hospital deaths. The rate of pulmonary morbidity is similar to that reported in the literature.[3,12-14] Various factors could predispose the patients to pulmonary complication.

These factors include diabetes, lung disease, FEV1< 65% predict, low serum protein, blood loss, and volume transfused, advanced age, history of smoking, general performance status, in adequate postoperative analgesia and stage of disease.[10,12-15] After esophagectomy, the chance of developing significant pulmonary complications and higher rate of death in elderly patients (≥ 70 years) is high and it may be rated to the more prevalence of pre existing cardiopulmonary diseases, so surgeons must pay close attention to patient's selection. The location of tumor is very important. In our study patients who had upper third esophageal carcinoma were at high risk of developing major pulmonary complication. In one study, patients who had upper third esophageal tumor had a 3.5 times risk of developing pulmonary complications compared to those with lower third esophageal carcinoma. The reason of these high risk and worse outcome are the more extensive upper mediastinal dissection behind the trachea and possibly more recurrent laryngeal nerve (RNL) injury for tumors above the tracheal bifurcation, azygos vein tear and more blood loss.[16] Longer operation duration and more blood loss during operation were associated with more pulmonary complications and hospital deaths respectively. Both factors may be associated with more advanced and upper third located esophageal carcinoma, because dissection and resection of tumor in this part of esophagus are associated with more blood loss and laryngeal nerve injury. Fortunately decreased blood loss intraoperative and decreased transfusion has been shown to correlate with reduced hospital death rate and long-term survival after major cancer surgery, such as heptatectomy.[17] In this field the surgeon can play an active role in patient selection, refining technique of operation and preoperative management of patient. Another point that the surgeon must pay close attention is that indirect lyth amount of blood loss may be related to T-stage, because the difficulty of dissection and resection (hence blood loss) is more dictated by the locally advanced tumor rather than distant metastases. One of the obvious changes in surgical technique is the advent of thoracoscopic esophagectomy. Thoracoscopic esophagectomy was introduced in 1994. No significant differences in blood loss, post-operative mortality and morbidity were found between transhiatal and transthoracic esophagectomy.[18] In our study transthoracic esophagectomy and, FEV1< 65% predicted were associated with prolonged mechanical ventilation and length of stay (LOS) in the ICU and hospital. Epidural analgesia, which was introduced in 1990 for perioperative care in esophagectomy, was shown to reduce complications and death rate.[15] Pulmonary complications after esophagectomy were high. Pleural effusion and atelectasis were the most common pulmonary complications occurring in 90% of patients, but were of little clinical importance. Pneumonia was the most common clinically important pulmonary complication, occurring in nearly 30% of our patients, which is slightly higher than what has been previously reported (15% to 25%).[6,19,20] The overall mortality rate in our series was 10% nearly consistent with other series.[7,19-21] Fan and colleagues suggested that a pre-operative peak expiration flow rate (PEFR) of less than 65% predicted correlated well with the incidence of pulmonary complication.[17] Nagawa and coworkers reported that a significant difference in vital capacity between patients who developed pulmonary complications and those who did not.[22]

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Ethical issues: Not applicable in this research.

Conflict of interests: No conflict of interest to be declared.

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