



Review

Failure to rescue patients from early critical complications of oesophagogastric cancer surgery

Elroy P. Weledji^{a,*}, Vincent Verla^b^a Department of Surgery, Faculty of Health Sciences, University of Buea, Buea, Cameroon^b Department of Anaesthesia, Faculty of Health Sciences, University of Buea, Cameroon

HIGHLIGHTS

- Major oesophagogastric surgery has inherent risks and complications.
- In-hospital mortality involves patient, tumour, and surgeon-related factors.
- Failure to rescue and not complication rate is the significant cause of in-hospital mortality.
- Early non-operative or re-operative intervention is the key.
- Improved multidisciplinary approach would decrease in-hospital mortality.

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ABSTRACT

'Failure to rescue' is a significant cause of mortality in gastrointestinal surgery. Differences in mortality between high and low-volume hospitals are not associated with large difference in complication rates but to the ability of the hospital to effectively rescue patients from the complications. We reviewed the critical complications following surgery for oesophageal and gastric cancer, their prevention and reasons for failure to rescue. Strategies focussing on perioperative optimization, the timely recognition and management of complications may be essential to improving outcome in low-volume hospitals.

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* Corresponding author. PO Box 126, Limbe, S.W. Region, Cameroon.

E-mail address: elroypat@yahoo.co.uk (E.P. Weledji).

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1. Introduction

'Failure-to-rescue' refers to failure to prevent a clinically important deterioration resulting from a complication of an underlying illness or complication of medical care such as oesophago-gastric cancer surgery [1]. Rates of failure to rescue are a measure of hospital quality of care [2,3]. In 2011, there were 462,000 new cases of oesophageal cancer and 988,000 new cases of gastric cancer diagnosed worldwide [4]. The increasing incidence of oesophageal cancer particularly adenocarcinoma near the oesophago-gastric junction parallels the increase in adenocarcinoma of gastric cardia. The epidemiological profile suggests a similar aetiology and is consistent with the two cancers having a similar phenotype and *p53* gene mutation [4]. The lethality of oesophageal cancer is corroborated by the epidemiology of 7000 new diagnoses and 6700 deaths per year in the UK with a 5-year overall survival rate of 8% [4,5]. Surgical resection offers a chance of long-term survival in a proportion of patients with oesophageal cancer. However, even after careful staging, survival remains disappointing with less than 25% of patients surviving at 5 years after oesophagectomy. In addition, the curative potential of surgery is associated with considerable perioperative risks [6]. The surgical risk in the short-term and the potential loss in quality of life have to be weighed against the long-term benefit, such as a longer survival. Gastrointestinal (GI) surgery is associated with a strong systemic inflammatory response both during and after surgery and the patient requires an adequate cardiopulmonary reserve to be able to meet the metabolic demands of surgery [7,8]. This is compounded by the fact that respiratory complications are the most common cause of morbidity and mortality following upper gastrointestinal surgery [9]. Oesophagectomy, in particular, has one of the highest perioperative mortality rate of all elective procedures (5%), and over 30% of patients suffer a major complication [10]. Although in-hospital mortality involves patient, tumour, and surgeon-related factors, the wide variations in mortality after major surgery are due to differences in the failure to rescue rates [11]. Lower mortality units (LMUs) are more likely to re-intervene and rescue patients from complications although the impact on survival is unclear [12]. Therefore, reducing the variations in mortality will require strategies to improve the ability of high-mortality hospitals to manage post-operative complications [11]. This paper discussed the reasons for failure to rescue patients from the critical complications of elective oesophago-gastric surgery for cancer.

2. The oesophagectomy complications consensus

Gastroesophageal cancer resections are associated with significant re-intervention and perioperative mortality rates. The critical general surgical post-operative complications would include the Clavien - Dindo grade III complications that require surgical, endoscopic or radiological interventions and the grade IV (life-threatening) complications. The Clavien-Dindo grade III complications represent surgical technical quality and anastomotic complications which have important implications in perioperative survival following gastro-oesophageal cancer surgery [13]. However, the complications in previous studies are not particularly comparable and a new consensus syllabus by the *oesophagectomy complications consensus group* (ECCG) has defined complications, severity and recommended quality measures. These include specific definitions for anastomotic leak, conduit necrosis, chyle leak, and recurrent nerve palsy. The critical quality parameters for routine inclusion in databases were documentation on mortality, comorbidities, completeness of data collection, blood transfusion, grading of complication severity, changes in level of care, discharge location, and readmission rates [14].

3. Management in high-volume specialized centres

Although surgery is the mainstay for a cure, the associated significant postoperative mortality from oesophageal and gastric cancer resections with notable variability among centres has led the drive to centralization of services [2,3,5,6]. In these centres, the treatment of cancer is arranged and planned by a multidisciplinary team (MDT) in which the decision is made for surgery with or without neo-adjuvant chemotherapy for resectable cancer in fit patients with early lesions (T1-3/N0/M0), chemoradiotherapy (if not fit for or refused surgery) although adenocarcinoma tends to be resistant to radiotherapy, and for palliative procedures in advanced or metastatic disease. It is, however, worth noting the recent findings that neoadjuvant chemoradiotherapy nearly doubled mortality compared with no neoadjuvant treatment or neo-adjuvant chemotherapy alone although these results may have been confounded by selection of patients with more advanced tumours for neoadjuvant treatment [15].

The European Registration of Cancer Care (EURECCA 2015) reported a mean R0 resection rate of 86% for oesophageal and junctional resection and 88% for gastric resection over a twelve month period in high-volume specialized centres. Postoperative mortality varied from 1% to 7% [16]. The volume-outcome relationship demonstrated that critical complications are recognized early and

managed proactively in these centres with more patients surviving in low mortality units (LMUs) than in high mortality units HMUs (failure to rescue rate, 7.0% vs. 12.5%) [12]. Patients were more likely to survive following both reoperations and nonsurgical interventions in LMUs. As technical complications have a large negative impact on survival after oesophagogastrectomy for cancer, strategies to optimize surgical technique and minimize complications should improve outcome. Individual surgeon experience should be greater than 20 cases/year [1–3,5]. In addition to surgeon-related factors, there is an association between low levels of nurse staffing and high levels of failure to rescue [17].

4. Rescuing patients from general complications of surgery

Approximately 25% of patients can suffer pulmonary complications following oesophagectomy, and it is the leading cause of mortality [18]. Thus, the suitability of a patient for oesophagogastric surgery requires careful pre-operative assessment and optimization of their physiological status (patient factor) in order to prevent post-operative complications. Old age is not a contraindication to surgery per se, but increased post-operative complications are associated with co-morbidities [19]. Post-operative complications will also depend on the severity of the underlying disease process (i.e. tumour factor) [20].

4.1. Perioperative optimization

Requirement for one-lung ventilation (OLV) in oesophageal surgery makes assessment of pulmonary function of particular importance. Patients with significantly impaired preoperative pulmonary function will have difficulties maintaining oxygenation during OLV and in the post-operative period. However, the risk of developing pulmonary complications cannot be predicted by pulmonary function tests alone and is considered along with clinical findings and other investigations [21]. Where results from cardiopulmonary exercise testing (CPET) suggest a higher risk, omitting neoadjuvant chemoradiation and proceeding straight to surgery may be of benefit [22]. A history of rapid onset weight loss may be evidence of advanced disease but malnutrition should be sought as it is associated with increased risk of post-operative infectious complications. Hypoalbuminaemia as a marker of malnutrition is a predictor of adverse surgical outcome [23]. Feeding jejunostomy inserted during staging laparoscopy procedure prior to surgical resection can be of benefit in the severely malnourished patient [8]. In absence of disorders of gastric emptying or diabetes i.e. minimal or reversible co-morbidity, preoperative administration of carbohydrate-rich beverages 2–3 h before induction of anaesthesia may attenuate preoperative thirst, anxiety, and postoperative nausea and vomiting. It also substantially reduces post-operative insulin resistance, thereby improving efficacy of post-operative nutritional support [24,25].

4.2. Risk stratification

Although it is not a sensitive predictor of morbidity and mortality, the American Society of Anaesthesiologists (ASA) classification of the perioperative risks of surgery has a reasonable correlation with outcome [26]. The quantitative evaluation using the Physiological and Operative Severity score for the enumeration of Mortality and Morbidity (POSSUM) and the modified P-POSSUM is a widely used classification [27]. However, it tends to overestimate risk in low risk groups but becomes increasingly more accurate as risk increases. A simple risk score combining clinical characteristics along with hospital volume to predict surgical mortality after oesophagectomy from administrative data may

form a basis for risk adjustment in quality of care assessment. Predictive patient characteristics included age, comorbidity (cardiac, pulmonary, renal, hepatic, and diabetes), preoperative radiotherapy or combined chemoradiotherapy, and a relatively low hospital volume [15]. Thus, patients at higher risk may most appropriately undergo surgery at high volume centres [1–3,12].

4.3. Operative anaesthetic management

The management of one-lung anaesthesia (OLV) requires good communication between the anaesthetist and surgeon to prevent and/or manage hypoxia (i.e. arterial oxygenation <90%). OLV is commenced in the thoracotomy stage of oesophagectomy. Surgical manipulation of the mediastinum causes mechanical obstruction and further diverts blood towards the dependent ventilated lung. Hypovolaemia and low cardiac output states, will worsen hypoxia because of decrease in mixed venous saturation of blood passing through the shunt. Haemodynamic optimization is concerned with adequate perioperative perfusion of organs and thus goal-directed therapy (GDT) with fluid and inotropes would improve post-operative surgical outcome but requires preoperative admission to intensive care unit (ICU) [28]. Unfortunately, the use of oesophageal doppler in oesophagectomy is limited but the advantage of the other cardiac output monitors (thoracic electrical bioimpedance, lithium dilution, arterial pulse contour, transpulmonary thermodilution) is that they are easier for awake patients to tolerate post-operatively. However, when flow-based measurement is not available, fluid therapy will be guided by pulse, peripheral perfusion, capillary refill, central venous pressure (CVP), measured blood loss, acid-base, lactate, and haemoglobin measurements [29,30]. Most fluid is required at beginning of surgery, when anaesthesia and epidural analgesia is established. Vasopressors, either intermittently or as an infusion, is given where hypotension is not fluid responsive. Balanced salt solutions, such as Ringer's lactate, Hartmann's solution, or balanced colloid solutions are used as 0.9% (normal) saline carries the risk of inducing hyperchloraemic acidosis when used routinely for fluid replacement or resuscitation [30]. Adequate haemoglobin concentration must be maintained at a haematocrit of 30% for adequate tissue oxygenation and coexisting cardiopulmonary disease may raise threshold for transfusion [31]. However, the serious early and late complications of blood transfusion should be noted. A multivariate analysis demonstrated that in addition to nodal status, > 4 units transfusion was an independent poor prognostic indicator. Transfusion-related immune suppression is manifest as increased risk of post-operative infections and increased tumour recurrence after surgical resection [32].

4.4. Postoperative care

As post-operative hypoxia is common after upper GI surgery, high dependency unit (HDU) facilities that offer basic respiratory and cardiovascular support must be available prior to commencing surgery. In some cases, where a period of post-operative ventilation is anticipated, an ICU will be required [29]. A protective ventilatory strategy decreases the pro-inflammatory systemic response after oesophagectomy, improves lung function, and results in earlier extubation [33]. Although there is some recent evidence that treatment with corticosteroids can potentially mitigate the SIRS response with no increase in infections or hyperglycaemia a larger randomized controlled trial is required [34].

Post-operative ventilation, however, may be associated with an increased risk of barotrauma, acute respiratory distress syndrome (ARDS) and ventilator-assisted pneumonia. With improvements in patient selection, operative technique and anaesthetic

management most patients can now be safely extubated immediately post-operatively. Other operative and preoperative factors, may lead to re-ventilation or to a decision for elective post-operative ventilation such as massive blood transfusion, prolonged duration of surgery particularly with one-lung anaesthesia, low preoperative force expiratory volume in 1s- FEV1 (<70%), low preoperative FEV1/force vital capacity (FVC) ratio (<75%) and extenuating comorbidities [29,35]. Post-operative chest X-ray would exclude pneumothorax, haemothorax, lung collapse and a misplaced chest drain.

4.5. Failure to rescue respiratory complications

Failure to rescue may occur in cases of respiratory complications, smokers, bacteria colonization of airways, ineffective anti-biophylaxis or respiratory physiotherapy and early extubation. Atelectasis secondary to pain is common and can lead to pneumonia and respiratory failure. Pneumonia has a negative impact on overall survival after oesophagectomy. Strategies to prevent pneumonia after oesophagectomy should improve outcome [18,29]. Post-operative epidural analgesia is associated with lower cardiopulmonary complications and minimal systemic side effects. By attenuating the stress response and reducing insulin resistance, post-operative morbidity and mortality is decreased [18,25]. Hypovolaemia will exaggerate any hypotension secondary to epidural or opiate analgesia, whereas, hypervolaemia will lead to third space fluid shifts in pulmonary and gastrointestinal tissue. Following oesophagectomy there is increase in pulmonary vascular permeability, making lung increasingly susceptible to fluid overload [18,28]. Early mobilization is the key to prevent deep vein thrombosis (DVT) and pulmonary embolism (PE), although the rates of DVT, PE and death from pulmonary embolism can all be significantly reduced by the use of subcutaneous heparin peri-operatively [36]. In a recent study over a period on postoperative general surgical patients, venous thromboembolism increased in frequency but mortality decreased due to improved detection guidelines and management [37].

5. Failure to rescue patients from specific procedure-related complications

This is important as the longer-term survival of cancer patients are outside the control of the oncological surgeon, being dependent on the presence or absence of micrometastases [20]. Thus hastening the death of these patients from surgical complications is insensible. Reoperations, especially for leaks are associated with poor long-term survival in some studies [38–40]. High volume upper gastrointestinal cancer hospitals demonstrate improved postoperative mortality rates, but the impact on survival is unclear. A large, population-based cohort study showed that reoperation within 30 days after primary oesophageal resection was associated with a 28% increased mortality in high volume centres compared to those not re-operated [39]. These findings stress the need to consider any actions that might prevent complications and re-operation after oesophageal cancer resection.

5.1. Rescuing patients from specific complications in oesophageal surgery

5.1.1. Anastomotic leak

Anastomotic leak is an independent predictor of mortality and is associated with 20% mortality [40,41]. Although the oesophagus has no serosa (except upon the abdominal segment) that may form fibrinous adhesions and seals small leaks the leak rate should not exceed 5% in high-volume centres, and there is no evidence for

difference in leak rates between hand-sewn and stapled anastomoses [5,10,42,43]. Anastomotic leak is diagnosed by clinical suspicion and confirmation with water-soluble contrast studies, CT or upper GI endoscopy [44,45].

Post-operative mortality from major cancer surgery-related sepsis is due to significant disparities that exist in patient and hospital characteristics [45,46]. In one study, the most prevalent cause of death following hiatal oesophagectomy for advanced oesophageal cancer was anastomotic leak (43%), mediastinitis (3.6%), respiratory insufficiency from acute respiratory distress syndrome (ARDS) (2.9%), bronchopleural fistula (1.4%), sepsis (2.15%) and myocardial infarction (1.4%) [47]. The enhanced clinical experience of staff in a high volume hospital would lessen the failure to rescue rate and prevent death in hospital [1–3,12]. Overt signs of sepsis, failure to progress as expected, or subtle signs, such as new onset cardiac arrhythmias would heighten suspicion of complication and require rapid investigation in the first instance such as contrast enhanced computer tomography (CT) with oral contrast or laparoscopy in these major cancer surgery centres [12]. Systemic inflammatory response syndrome (SIRS) measured as the acute phase C-reactive protein (CRP) is a useful criterion for the recognition of postoperative complications and early recovery of SIRS may arrest the progression of organ dysfunction [7,34].

Timing of intervention: The chance of a leak is less if the C-reactive protein (CRP) is less than 140 on the 4th postoperative day [12,14]. Upper GI endoscopy within 1 week of oesophagectomy is a safe and highly accurate method of diagnosing leaks and provides unique information on the condition of the stomach. It allows a more targeted approach to patient care in the context of anastomotic healing and in the treatment of leaks [48,49]. If leak occurs within 72 h, it usually represents technical failure and if the general condition of the patient is good, exploration and repair is advisable [50]. The majority of leaks, however, occur at 2 weeks and probably represent anastomotic tension ± local ischaemia [51].

Severity and intervention: The majority of leaks are minor and can be managed conservatively with nasogastric (NG) suction, local drainage, antibiotics, and jejunal feeding [50]. Major thoracic leaks require early recognition (may present with atrial fibrillation), volume resuscitation, antibiotics and pleural drainage. If there is continuing or worsening sepsis (haemodynamic instability, hypoxemia, respiratory distress), early operation is necessary for a good outcome. This entails pleural/mediastinal debridement and resection of the necrotic stomach. If the remaining gastric tube is healthy, immediate reanastomosis is safe. If there is extensive gastric necrosis, a cervical end-oesophagostomy and the insertion of a feeding gastrostomy is the best option prior to a delayed (colonic) reconstruction. If there is minimal gastric necrosis of the remaining gastric tube it could be brought out as a double-barrelled cervical oesophago-gastric stoma for later closure during convalescence [50]. Neck leaks are more common than thoracic, but have less severe consequences [14]. Recently, endoscopic interventions such as oesophageal stenting have been successfully used for the management of intrathoracic leak [50]. Rescue manoeuvre with the combination of an endo-sponge-assisted device covered by a self-expanding metallic stent successfully treated complex uncontained leaks refractory to stenting alone [52]. Reoperations for leaks are associated with poor long-term survival (median overall 35.8 vs 54.8 months; disease-free 34 vs 47.9 months) probably because of the impact of a severe anastomotic leak on local cancer recurrence [53–55].

Minimally Invasive Oesophagectomy shows superiority over the open procedure in reducing In-hospital mortality of patients with resectable oesophageal cancer [56–59].

5.1.1.1. Chylothorax. Chylothorax occurs in 2–3% of thoracic

oesophagectomies, and may be higher with transhiatal techniques and recognized by milky discharge from the chest drain [60]. The diagnosis is based on the presence of chylomicrons (lipoproteins synthesized in the jejunum and transported via the thoracic duct) in the circulation post-prandially with a peak 3 h after eating. Short and medium chain fatty acid feed/total parenteral nutrition (TPN) and the somatostatin analogue, octreotide are the conservative treatment [61,62]. However, prolonged conservative treatment has high mortality due to hypo-albuminaemia and leucocyte depletion. The indication for re-operation and ligation of the thoracic duct is if chyle production is >10 ml/kg/day on the fifth post-operative day [62]. Perioperative lipid feed can assist identification of the leaking thoracic duct.

5.1.1.2. Conduit necrosis. Conduit necrosis is very rare with open procedures but reported in 13% laparoscopic cases in some series [63]. It presents with devastating chest sepsis that requires thoracotomy excision of conduit, proximal diversion with oesophagotomy, distal conduit closure, drainage and a feeding jejunostomy. Prolonged ITU support is required in most cases and prolonged nutritional support and sepsis control is followed by reconstruction using colon or jejunum.

5.1.2. Acute diaphragmatic herniation

Post-oesophagectomy diaphragmatic hernia (DH) is an uncommon problem but an important one to recognize and treat because of the risk of significant complications such as incarceration and strangulation. Diaphragmatic hernia appears to occur more frequently following transhiatal esophagectomy (THE) than after transthoracic procedures, likely because of the enlargement of the diaphragmatic hiatus required to perform THE [64]. Repair by plugging the diaphragmatic hiatus with a biologic mesh is a safe and effective method for closing the defect and results in few complications.

5.1.3. Recurrent laryngeal nerve injury

Recurrent laryngeal nerve palsy developed in 60% of patients after esophagectomy and the left nerve is at risk during mediastinal lymphadenectomy and cervical esophageal mobilization. Cervical anastomosis should be performed on the left side so that both nerves are not at risk. The majority are unilateral and transient and although 62% of affected nerves recovered within 12 months, great attention should be given when performing these procedures [65]. CIONM is feasible during VATS esophagectomy and can alert the surgeon of imminent injury to the RLNs, thereby preventing permanent injury [66]. Injury impairs the ability to cough and protect the airway in the early post-operative period and thus can be an important contributor to pulmonary morbidity. In most patients there should be adequate compensation from the contralateral side. Otherwise, a tracheostomy is considered to protect the airway and improve pulmonary toilet. Thyroplasty or vocal cord injections are rarely required.

5.2. Rescuing patients from specific complications following gastrectomy

Morbidity and mortality rates following gastric surgery are still high [67,68]. Total gastrectomy or distal subtotal gastric resection in cases of tumours located in the distal two-thirds of the stomach are followed by a Roux-en-Y reconstruction [68]. The life-threatening surgical complications were early, surgery-related and associated with a hospital mortality of 14% in a high volume Japanese centre [69]. The most frequent early complications were intra-abdominal bleeding (9%), anastomotic leakage (4%), duodenal stump leakage (3%), acalculous cholecystitis (3%), bowel perforation (3%) and

intraabdominal abscess (3%). The most common long-term complication requiring re-operation was intestinal obstruction from adhesions rather than technical failure [70].

5.2.1. Haemorrhage

Severe haemorrhage not responding to resuscitation with isotonic crystalloid and blood products and high-dose IV proton pump inhibitor therapy (e.g. omeprazole or pantoprazole), or radiological embolization, is managed by surgery (resuscitative laparotomy). Radiological embolization is highly useful for patients with recurrent bleeding despite medical or surgical intervention, patients unfit for re-operative surgery and for occult bleeding not visualized at upper GI endoscopy. The disadvantage is that angiography will only detect bleeding vessel if bleeding occurs at rate of more than 0.5 ml/min [71].

5.2.2. Duodenal stump leak

Duodenal stump leak is usually due to technical error, distal obstruction or ischaemia [71]. Contrast study should be considered via drain to ensure no distal obstruction at bilio-pancreatic limb of the anastomosis. The aim of management is to create a controlled fistula. For an early leak with still fresh tissue, surgical re-exploration is required. However, for a delayed leak and in the absence of overwhelming sepsis, it is possible to manage non-operatively by adequate drainage with existing drains or radiologically-guided percutaneous drains. Gentle suction can be applied to the drain [72]. TPN is often not necessary but should be considered and as a minimum an elemental diet should be recommended. Somatostatin analogues (octreotide) and high dose PPI may suppress residual acid and pancreaticobiliary secretions. As drainage volumes reduce, the drain can slowly be retracted but if the output remains >200 ml/24 h a technical problem should be sought with further contrast studies prior to surgical re-exploration [71,72].

5.2.3. Anastomotic leak

Anastomotic leak is usually a consequence of technical error, ischaemia, or tension and an independent predictor of survival. Consequently, it is recommended although without much evidence that drains are left next to high-risk anastomoses so as to create a controlled fistula in case of a leak [72]. Smoking and alcohol abuse are major risk factors for anastomotic leakage [73]. A meta-analysis showed that omentoplasty significantly reduced the rate of anastomotic leak following oesophageal anastomosis although these were not observed in colorectal anastomosis [74]. The high mortality rate was due to sepsis and the comorbidities of patients undergoing relaparotomy [75]. Conservative approach should always be considered as the treatment of choice as most leaks are minor and only demonstrated radiologically. Conservative approach entails being kept nil by mouth with distal feeding or total parenteral nutrition (TPN) until serial studies ensure resolution [75]. Re-operation may be necessary in case of wide dehiscence or when other treatments fail. Major leakage from the oesophagojejunal anastomosis following total gastrectomy for gastric malignancy is usually early (within 72 hrs of surgery) and often fatal from mediastinitis. Surgical re-exploration is warranted with either taking down of the anastomosis, primary repair if feasible (but often futile) or creation of a controlled fistula with in all cases, washout, drainage, and insertion of feeding jejunostomy [76,77].

Best results with covered self-expanding stent can be achieved in leakages occurring after the very early postoperative phase [78]. In delayed leaks, the decision lies between radiological drainage or surgical re-exploration. If it is a small leak on contrast study and the patient not unwell, it can be managed conservatively with either distal feeding or TPN, and serial contrast studies to ensure

resolution [76].

5.2.4. Pancreatic fistula

Resection of the capsule of the pancreas is part of the radical operation proposed by oriental authors for the treatment of gastric cancer. This may be a risk factor for the development of a pancreatic fistula or metastases to the pancreas [79]. Postoperative drain amylase greater than 1949IU/L on the first postoperative day and CRP >20 mg/dl on the third postoperative day predicts CD grade III pancreatic fistula after gastrectomy [76,79]. If it is felt at time of surgery that injury to pancreatic tail could have occurred, surgical drain should be left. A controlled fistula with a drain is allowed to close spontaneously with the commencement of the somatostatin analogue (octreotide). For an uncontrolled fistula, surgical drainage and debridement of necrotic pancreatic tissue in conjunction with octreotide is required [80,81].

5.2.5. Intra-abdominal sepsis

In a ten year period, the incidence of major cancer surgery-related sepsis increased but sepsis-related mortality remained stable [45]. Consideration is given to early intensive care unit (ICU) admission for patients with significant co-morbidity and thus the specialist centre is an important modifiable risk factor associated with improved sepsis-related outcomes [44,46,82]. Intra-peritoneal abscess is suspected in any patient who develops signs of sepsis 7–10 days after surgery. It is usually as a result of complication from anastomosis, duodenal stump, or pancreatic abscess complicating a pancreatitis/pancreatic fistula, if it occurs within 2 weeks of surgery [82].

Management revolves around surgical or radiological drainage in conjunction with antibiotics and attention to nutrition. CT or ultrasound – guided percutaneous drainage of abdominal abscesses via a pigtail catheter has emerged as the procedure of choice as morbidity and mortality is lower than following operative damage [83,84,85]. Laparoscopy or laparotomy is undertaken if doubt remains despite negative radiology. Operative drainage is necessary for those abdominal abscesses which are multiple, isolated but cannot safely be approached percutaneously, and/or associated with systemic sepsis unresponsive to percutaneous drainage [85]. Preservation of abdominal wall integrity by abdominal wall closure with biological mesh if necessary would prevent enterocutaneous fistula formation [86].

The mortality from post-operative intra-abdominal abscess is greater than 50% and the mortality increases with each operation to treat recurrent or persistent sepsis [45,46]. This is due to the deteriorating septic state of the patient superimposed on the stress of surgery and, the increased dissection required by re-operative surgery with increased risk of injury and ischaemia to tissues. Therefore, the best opportunity to eradicate infection is the first operation [45,86].

5.2.6. Overwhelming post-splenectomy sepsis

Significant early morbidity and mortality follows a splenectomy incidental to a planned procedure such as the classical Japanese D2 resection or accidental as when injured by the surgeon [76]. The standard lymphadenectomy (LAD) is the D2 LAD without distal pancreatectomy and splenectomy but extended organ resections are indicated in cases where a R0 resection is possible. The early post-operative complications of splenectomy would include bleeding, thrombosis associated with thrombocytosis, left-sided pulmonary atelectasis, sympathetic pleural effusion, bronchopneumonia, subphrenic abscess and pancreatitis [87].

The post splenectomy sepsis syndrome may be encountered early despite the low risk of 1%, and carries a high mortality of greater than 60% [88]. The risk is greatest during the first 3 years

post splenectomy, greater with encapsulated organisms (*streptococcus pneumoniae*, *nesseieria meningitides*, *Escherichia coli* and *Haemophilus influenzae*) and increased in immunosuppressed or immunodeficient individuals. Preoperative *H. influenzae*, *meningococcal* and *pneumococcal* vaccines are administered. If unplanned, the triple vaccines would be given 2 weeks after recovery from surgery [89]. Nevertheless, splenectomy alongside a palliative gastric resection in advanced disease may ameliorate the haematologic toxicity of hyperthermic intraperitoneal chemotherapy [89].

6. Conclusions

Major oesophagogastric surgery has inherent risks and complications. Patients are more likely to survive their complications following both early and appropriate non-surgical interventions and re-operations in high-volume (low mortality) units with their greater experience and resources. An improved multidisciplinary approach would decrease in-hospital mortality in low volume units.

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No ethical approval required.

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Author contribution

EPW is the main author who conceived and did the review; VV contributed with literature search.

Conflict of interest

Nothing to declare.

Guarantor

AMC and MNN act as guarantors.

Consent

Not applicable.

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