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Minimally Invasive Treatment of Oesophageal Perforation: Case Series

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Abstract **Case Report**

Oesophageal perforation can be life threatening with high morbidity and mortality rates. The management of oesophageal perforation remains a great challenge despite advancements in modern medicine. With the advent of minimal access surgery, the morbidity normally associated with conventional open thoracotomy has been drastically reduced. Successful management outcomes are not only dictated by the modality of treatment employed but dependant on factors such as; time elapsed between perforation and initiation of treatment, degree of contamination, size of perforation and general condition of the patient. This series demonstrates 3 cases with different etiologies and clinical presentation successfully managed via video assisted thoracoscopic surgery (VATS). Herein the report both early and delayed management of oesophageal perforation through VATS has been highlighted.

Keywords: Oesophageal perforation, Video assisted thoracoscopic surgery (VATS).

INTRODUCTION

A high index of clinical suspicion is normally required to diagnose oesophageal perforation, and the management of such patients can provoke fear in any surgeon due to its high mortality rates (10 - 25%) [1-6]. Early diagnosis and formulation of a treatment plan is paramount to ensure positive treatment outcomes and patient survival. Iatrogenic endoscopic perforation (70%) is amongst the commonest cause of oesophageal perforation due to the advancements in endoscopic therapies This group of patients usually benefit from prompt management as its procedure related and thus identified early. [1,3,6,7]. Oesophageal perforation can also occur spontaneously (15%), in which instance mortality rates up to 90% has been demonstrated if left untreated and even after surgical intervention it can be as high as 40%. [8] Other causes include injury following foreign body ingestion (12%), penetrating trauma (9%) and tumour perforation (2%). [9] The time elapsed between perforation, diagnosis and then initiation of treatment is considered to be crucial in predicting the outcome. Primary closure within 24 hours has been proven to result in the most favourable outcomes with a 92% survival rate [6].

Case 1

A 40-year-old gentleman, a chronic smoker, presented to the emergency department with sudden onset shortness of breath and chest pain following a bout of cough 2 days prior. At presentation he was in sepsis and type 1 respiratory failure requiring ventilator support. Chest radiograph revealed right sided pleural effusion. The sequence of events triggered a suspicion of oesophageal perforation and the patient was subjected to an on table upper endoscopy, which uncovered a 2.5cm perforation at the distal oesophagus. Clinical findings were suggestive of Boerhaave's syndrome.

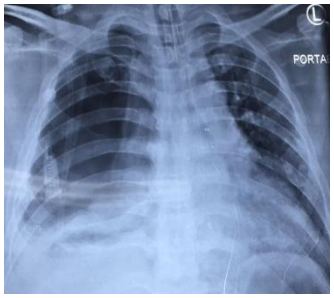

Fig-1: Chest radiograph revealed right sided pleural effusion (Case 1)

Decision was made to proceed with VATS, the pleural cavity was contaminated with food particles and slough; and there were dense adhesions between the parietal and visceral pleura. Thoracoscopic lavage and decortication was performed. The site of perforation was subsequently identified and isolated with endoscopic assistance. The linear tear was repaired primarily with polygalactin suture 2/0 and subsequently strengthened by Surgicel and Histoacryl glue. Recovery over the following 2 weeks were turbulent with persistent oxygen dependency, purulent drainage from chest tube; and recurrent lung infections.

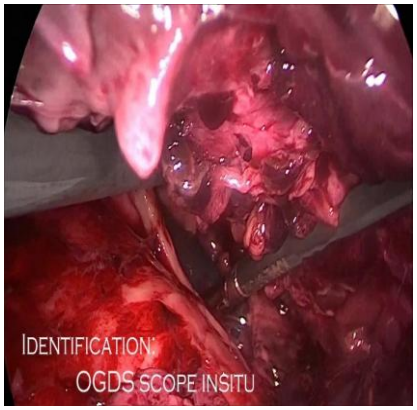

Fig-2: Perforation site identified with endoscopic assistance (Case 1)

At post-operative day 9, barium contrast study demonstrated a leak at the previous repair site. Up till this point patient was receiving total parenteral nutrition (TPN). Re-VATS was performed with a repeat lavage and debridement of the thoracic cavity. There was a 1cm gape at the previous repair site, primary closure of the defect with absorbable sutures was done with a drainage catheter subsequently placed adjacent to the repair site. A feeding jejunostomy was also created during the second surgery and enteral feeding was commenced and established over the next one week.

Fig-3: A drainage catheter was placed adjacent to the repair site (Case 1)

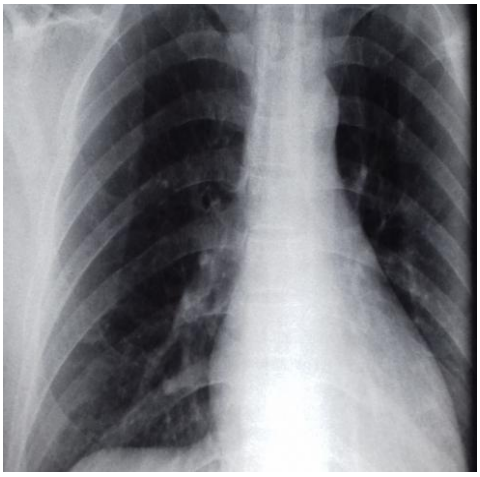

Fig 4 : Chest radiograph prior to discharge (Case 1)

Patient showed steady progress over the following 3 weeks with withdrawal of oxygen therapy and the resolution of sepsis, and the re-study showed evidence of a radiological leak which was contained. A controlled fistula was created by gradually decreasing the calibre of the drainage catheter before finally removing the catheter before discharge. Patient was discharged home following a near 2 month long hospital admission. The fistula showed signs of closure at the second week of follow up and one year down the line, he was gaining weight with mild symptoms of dysphagia and no evidence of oesophageal stricture.

Case 2

A 51-year-old alcoholic with features of chronic liver disease presented with class III hypovolemic shock secondary to upper gastrointestinal bleed. Patient was intubated and a Sengstaken Blakemore tube was inserted with concurrent resuscitation with blood and blood products for a suspected variceal bleed. Patient was transferred to the Intensive care unit, and once

stabilized, upper endoscopy was performed at the operation theatre. There was a linear mucosal tear over the mid-oesophagus and a Forrest 1a ulcer at D1/D2 junction. It was a failed endoscopic attempt to arrest bleeding, and thus subjected to an exploratory laparotomy and underrunning of ulcer. Patient required high ventilator settings post-operatively, and had developed right sided haemopneumothorax. Contrast enhanced computed topography (CECT) done showed presence of paraesophageal air suggestive of perforation. He was subjected to VATS with the lapse of 72 hours from the time of perforation; thoracoscopic lavage, decortication and primary repair of the perforation was performed. There was an 8cm longitudinal tear along the mid oesophagus that was repaired with interrupted absorbable sutures. Integrity of the repair was examined both via laparoscopy and endoscopy. Patient was kept strictly nil by mouth and on TPN. Gastrografin contrast study done 2 weeks later showed no evidence of leak. Patient was discharged home well and able to tolerate oral feeds after a 3-week long hospital stay.

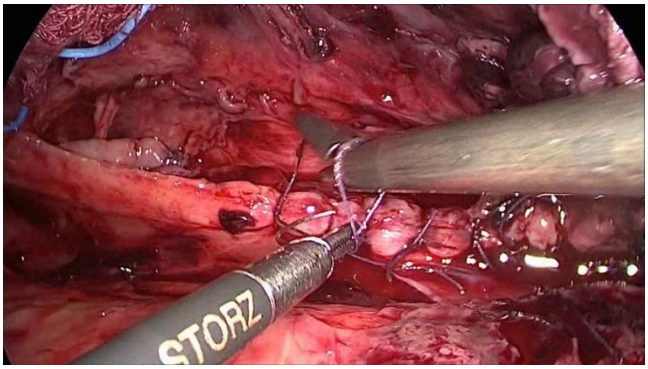

Fig-5: 8cm longitudinal tear along the mid oesophagus that was repaired with interrupted absorbable sutures (Case 2)

Case 3

A 20 years old lady presented to the emergency department (ED) with a week history of progressive dysphagia and odynophagia, symptoms were preceded by the ingestion of fish crackers. She was put through a rigid scope by the otorhinolaryngologist at ED and the study revealed a superficial mucosal tear at 17cm from incisor, and no evidence of foreign body. Immediate post procedure, patient developed shortness of breath and right shoulder pain. Chest radiograph demonstrated a right sided pleural effusion and chest tube drained blood and air from the pleural cavity. CECT thorax and abdomen showed a defect at the posterolateral wall of distal oesophagus 4cm proximal to cardio-oesophageal junction (COJ). Hydrid procedure performed (VATS and upper endoscopy) to identify and repair a 1.5cm perforation with non-absorbable sutures. Patient was extubated 1 day later and discharged home within 1 week.

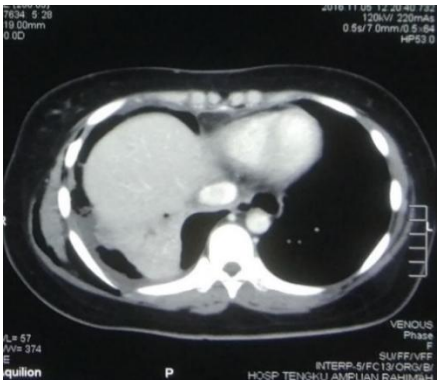

Fig-6: CECT thorax and abdomen showed a defect at the posterolateral wall of distal oesophagus 4cm proximal to cardio-oesophageal junction (COJ). (Case 3)

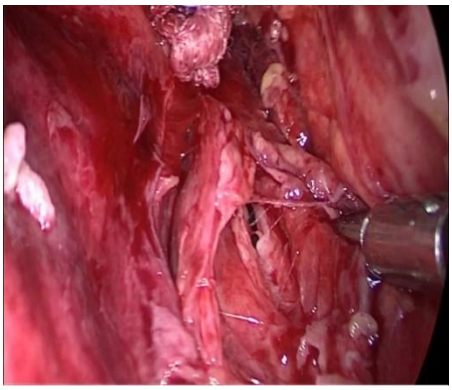

Fig-7: Perforation identified and repair via hybrid procedure (Case 3)

DISCUSSION

The successful treatment of oesophageal perforation remains a complex puzzle as there is no single strategy that can be employed to deal with the spectrum of consequences encountered. The first description of oesophageal perforation has dated as far back as 1723 by Hermann Boerhaave, however the first successful surgical repair was only accomplished by Barrett, Olson and Clagett in 1947, more than 200 years later [10]. The evolution of managing oesophageal perforation has

been protracted, and reduction in morbidity and mortality was only realized following the availability of antibiotics and advancements in diagnostic technology allowing early recognition of perforation.

Arriving at a diagnosis of oesophageal perforation can be difficult as it mimics other conditions such as myocardial infarction, peptic ulcer perforation or aortic aneurysm dissection, thus a high index of suspicion and correlation to history is required. Common clinical presentations are chest pain, dysphagia, dyspnoea, fever, subcutaneous emphysema, tachycardia and tachypnea. Presentation varies based on location of perforation, cervical perforations usually exhibit subtle features as spread to the mediastinum through retroesophageal space is slower due to the attachments of prevertebral fascia [9,11]. In contrast intrathoracic perforations contaminate the mediastinum rapidly extending into the pleural cavity leading to chemical mediastinitis, in which instance shock may develop within hours. The etiology of all 3 cases are varied, the first case was secondary to Boerhaave's syndrome which is the spontaneous rupture of oesophagus secondary to barotrauma caused by the sudden pressure rise within the oesophagus. All three cases presented with symptoms of mediastinitis and respiratory distress, but only two had associated sepsis prior to surgical intervention. Outcomes are poorer in patients with spontaneous perforation due to the gross contamination and presence of sepsis at the time of presentation [6]. This is demonstrated in the first case, patient experienced a stormy recovery, with recurrent bouts of lung infection, the need for repeat surgery, delay in commencement of oral feeds and prolonged hospital stay. The other two cases were iatrogenic oesophageal ruptures, of which the youngest patient with no previous comorbidities was brought into theatre within 24 hours to undergo primary repair of a small defect. This patient exhibited the most favourable outcome with the shortest length of stay.

The rarity of the pathology and the non-specific nature of the symptoms and signs, makes diagnosis a challenge. Chest X-ray, though normal in most; the presence of pleural effusions, pneumomediastinum, subcutaneous emphysema, hydropneumothorax, or sub-diaphragmatic air should heighten suspicion of perforation and instigate further investigations to confirm diagnosis. Contrast oesophagogram with water soluble contrast is a good modality to delineate the presence and site of perforation. Negative scan does not exclude presence of perforation, especially in the cervical oesophagus because of the rapid transit of the thin contrast [12]. Contrast enhanced CT (CECT) scan of the chest should be performed when there is delay in acquiring a contrast oesophagogram or in the presence of high clinical suspicion despite negative contrast study and/or to rule out an alternative diagnosis [13]. CT scan helps in delineating the location and size of the perforation, whether the leak is contained within the mediastinum and to look for the presence of pleural or mediastinal fluid. Extravasation of contrast into the pleural space dictates the need for surgical intervention, either a drainage procedure only or drainage and repair. In our case series, the first case was diagnosed by upper endoscopy prior to proceeding with primary repair whilst the other two cases were diagnosed by CECT scan. Endoscopic study in oesophageal perforation is controversial as some believe the insufflation of air during endoscopy will disseminate the contamination and enlarge the perforation [14]. All patients underwent follow up CECT scans post repair to assess the integrity of the repair and to look out for other simultaneous complications such as fistulation or abscess collection.

Early recognition and initiation of treatment of oesophageal perforation reduces the morbidity and mortality significantly [15]. The need for early repair cannot be overstated, and as there are no randomized prospective studies performed for the management of oesophageal perforation, there is neither an algorithm nor recommendation available for the best treatment modality. Thus treatment is tailored individually, as standardization of management strategy is difficult. The main aims of management are to achieve adequate drainage, surgical intervention (direct repair or surgical isolation of oesophagus), start appropriate antibiotics and treat underlying sepsis, and to establish feeding via enteral and/or parental nutrition.

Management options include non-operative or operative procedures. Non operative interventions are employed in selected cases when contamination in contained with localized contrast extravasation and patients are not in sepsis. Suggested criteria (Cameron criteria) to safely proceed with conservative management is when the leak is contained within the mediastinum and when there is presence of mild symptoms with minimal evidence of clinical sepsis responding to treatment; [16]; it is wise to also ensure there is no distal obstruction and that the perforation is not through underlying malignancy.

Endoscopic stent placement is an adjunct to non-operative management and it is just as effective as surgical repair in acute perforations with shorter length of stay, lower cost and morbidity rates [6,16]. Stenting in cervical perforation may not be possible due to difficulty in visualizing the area involved, but it is a popular option for thoracic perforations. Freeman et al also reported that the patients in the stent placement cohort were able to initiate oral intake significantly sooner with a lower rate requiring enteral feeding via nasogastric tube or jejunostomy compared to the open repair cohort. There were higher rates of post-operative dysphagia seen in the open repair group [16]. Oesophageal stenting is also preferred in those with fistula or anastomotic leak. Contained thoracic perforations can be safely managed conservatively with careful in patient monitoring without significant

mortality and morbidity [17]. The major issues with stenting is stent migration and stent retrieval due to tissue overgrowth making it adherent to the oesophagus. The optimal time of stent placement ranges between 4 to 6 weeks, this is to avoid complications such as secondary perforation and haemorrhage, and stent impaction [18]. Other adjuncts to conservative treatment is the application of endoscopic clips and fibrin glue. Haemoclipping has been shown to be successful in defects less than 2.5cm and 25% of circumference [19]. In all cases managed conservatively patients must be kept nil by mouth with parenteral nutrition, broad spectrum antibiotics and proton pump inhibitors for at least 14 to 21 days with ongoing chest physiotherapy and radiological drainage of any abscess collection. Patients are kept fasted for an average of 7 days until a restudy is done with check contrast swallows to assess the site of perforation. Surgery will be indicated in the presence of conversion to uncontained leak, pleural effusion, empyema thoracis and mediastinal abscess [17]. Successful conservative management has been reported to be as high as 96% with an overall mortality of 4.2% [9]. None of our patients were managed conservatively as they did not meet the criteria.

The surgical approach employed is influenced by a multitude of factors such as the location and size of perforation, the viability of oesophageal mucosa and the wound edge, the degree of contamination, the general condition of the patient and the underlying pathology. In all 3 cases the perforation was in the thoracic oesophagus and the treatments employed were via video assisted thoracoscopic surgery (VATS) with primary repair of perforation, and simultaneous debridement and lavage of the thoracic cavity with decortication of the lung. Surgery is mandatory in large perforations, in our series the size of perforation ranged between 1.5cm and 8cm. The large 8cm perforation was seen in the second case, iatrogenic in cause secondary to Sengstaken Blakemore catheter insertion. In this patient, the perforation was repaired primarily despite its size with no evidence of leak post repair. This can be explained by the presence of a linear longitudinal tear in the oesophagus with no tissue loss and a clean edge. Despite the delay in repair by 72 hours, due to a more pressing issue of bleeding duodenal ulcer, contamination was minimal as patient was kept nil by mouth since the event with chest tube drainage of the pleural collection.

Surgical options can be divided into (1) primary repair with or without reinforcement; tissue grafts such as muscular, pleural, diaphragmatic or omental flaps can be used to reinforce the primary repair (2) exclusion and diversion surgery (3) drainage only of thoracic cavity (4) T tube drainage, commonly used in high risk patients with the aim of creating a controlled oesophago-cutaneous fistula (5) oesophageal resection with or without reconstruction. [20] Successful primary closure can be performed despite the time interval from perforation and when the size of defect is not more than one-third of the circumference [12]. Intraoperatively when deciding the treatment options, be wary of the viability of oesophageal tissue post necrosectomy. In delayed presentations the oesophageal wall would be more oedematous and the identification of the wall can be very challenging, thus threatening the integrity of the repair and leading to failure. In this instance, resection or diversion procedures should be considered. Surgery can be performed open or laparoscopically based on available expertise. Thoracoscopic surgery is a viable option for both repair and drainage procedures, it is a safe and effective procedure with lower morbidities compared to open surgery [21]. Additional advantages of VATS include less post-operative pain and faster recovery. With recent advancements and increased experiences with minimal access surgery, the mind-set that open thoracotomy is required to manage such cases has become an antiquity. In our series, all patients were operated via VATS and the outcome has been encouraging despite the level of contamination, time of presentation or size of perforation. Hybrid procedures with upper endoscopy were utilized during surgery to help identify the perforation and to check on the integrity of the repair. VATS also enables meticulous debridement and washout of the thoracic cavity with decortication of the lung; allowing full expansion of the lung and eliminating intra-thoracic sepsis. Distal feeding access i.e. jejunostomy, should be considered for long term nutritional supplementation in those delayed healing is anticipated. Oesophageal resection is indicated in extensive injury with questionable viability of wound edge, obstructive oesophageal disease, malignancy and corrosive injury. It is recommended that reconstruction is delayed to shorten operative time and to provide an opportunity for the resolution of sepsis [22].

In our small series of 3 patients, we had no mortalities and during subsequent follow up only one of the three patients were experiencing symptoms of dysphagia with luminal narrowing at the repair site on endoscopy but not requiring dilatation.

CONCLUSION

The management of oesophageal perforation poses a challenge every step of the way whether it is when; arriving at a diagnosis, contemplating treatment options or managing complications. Though management strategies may seem complicated, one thing is for certain, delaying diagnosis and treatment beyond 24 hours is associated with poorer outcomes. The treatment options for oesophageal perforation are based on an individual case to case basis. VATS can be an effective and less invasive modality of treatment with few limiting factors. However, there is a prolonged learning curve involved with this procedure.

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