Case Report

Thoracoscopic esophageal repair with barbed suture material in a case of Boerhaave's syndrome

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Abstract: A 53-year-old man was referred to our hospital with Boerhaave's syndrome. Thirty hours after onset, a left thoracoscopic operation was performed, with carbon dioxide pneumothorax and the patient in right semi-prone position. The thoracic cavity was copiously irrigated with physiological saline and a 4-cm longitudinal rupture was identified on the left side of the lower esophagus. The esophageal injury was repaired in 2 layers by using barbed absorbable suture material. The patient was allowed oral feeds after contrast esophagography confirmed the absence of contrast leak at the sutured site on postoperative day 7, and discharged by day 28. Suturing of the ruptured esophagus under thoracoscopic guidance is considered to be difficult and requires expertise. This case report demonstrates that the use of a barbed suture material simplifies thoracoscopic esophageal repair and also highlights the importance of pneumothorax and patient position in improving access to the esophagus.

Keywords: Spontaneous esophageal rupture; pneumothorax; carbon dioxide; barbed absorbable suture

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Introduction

Spontaneous esophageal rupture was first reported by Boerhaave in 1724 and typically occurs in conjunction with vomiting, retching, or swallowing a large food bolus. This condition is potentially life threatening and causes severe mediastinitis, empyema, and sepsis, unless appropriate and early treatment is initiated (1). Surgical results for the treatment of this condition with thoracoscopic surgery are similar to those with conventional thoracotomy (2,3). Patients are usually operated in the lateral decubitus position for thoracoscopy as well as for open thoracotomy, which only provides limited access to the esophagus. Thoracoscopic suturing of esophagus requires advanced expertise, irrespective of whether an intracorporeal hand-sewn technique or an extracorporeal technique is used. Recent report suggests that laparoscopic gastrojejunostomy can be performed safely and efficiently by using barbed suture material (4). Herein, we report the first successful case of thoracoscopic repair of a spontaneous rupture of the esophagus by using barbed suture material.

Case presentation

A 53-year-old man was admitted to a local hospital with complaints of violent vomiting and hematemesis following excessive alcohol consumption. Upper gastrointestinal endoscopy, performed with the suspicion of Mallory-Weiss syndrome, revealed a perforation on the left side of his lower esophagus. Patient then sustained a cardiopulmonary arrest secondary to tension pneumothorax. He was transferred to our hospital after resuscitation and insertion of a thoracic drain. Urgent computed tomography (CT) of the chest revealed pneumomediastinum, left pneumothorax, and left pleural empyema (*Figure 1*). The findings on computed tomography and upper gastrointestinal endoscopy confirmed the diagnosis of Boerhaave's syndrome, without the need for a contrast study. At admission in our hospital, the patient was conscious, with a blood pressure of 115/82 mmHg and heart rate of 127 bpm. Laboratory tests revealed a hemoglobin concentration of 12.2 g/dL, white blood cell count of 3,400/mm^3, and C-reactive protein level of 28.7 mg/dL. Arterial blood gas analysis at inspired

Figure 1 Computed tomography of the chest demonstrating pneumomediastinum, left pneumothorax, and left pleural empyema.

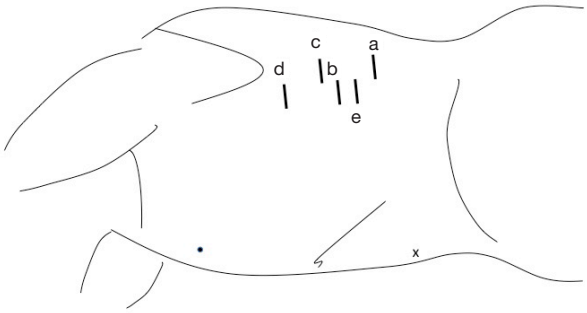

Figure 2 The schema of thoracoscopic port placement in the semi-prone position. a, a 12-mm port in the 9th intercostal space along the posterior axillary line (video camera); b, a 12-mm port in the 7th intercostal space along the middle axillary line (operator's use); c, a 5-mm port in the 6th intercostal space along the posterior axillary line (grasping forceps); d, a 5-mm port in the 5th intercostal space along the middle axillary line (grasping forceps); e, a 12-mm port in the 8th intercostal space along the middle axillary line (assistant's use).

oxygen flows of 3.0 L/min revealed the following results: pH, 7.503; oxygen tension, 81.2 mmHg; and carbon dioxide tension, 32.4 mmHg. A thoracoscopic operation was performed 30 h after the onset of his symptoms.

The patient was placed in the right semi-prone position (*Figure 2*), and carbon dioxide pneumothorax was created at a pressure of 6 to 8 mmHg. Port placement included a 12-mm port in the 9th intercostal space along the posterior axillary line (video camera), a 12-mm port in the 7th intercostal space along the middle axillary line (operator's use), a 5-mm port each in the 5th intercostal space along the middle axillary line, and 6th intercostal space along the posterior axillary line (grasping forceps), and a 12-mm port in the 8th intercostal space along the middle axillary line (assistant's use) (*Figure 2*). The mediastinum was widely incised, and copiously irrigated with physiological saline. In the semi-prone position, the irrigation fluid accumulates anteriorly, enabling effective suctioning (*Figure 3A*). The esophagus was exposed and a 4-cm longitudinal perforation was identified on the left side of the lower esophagus (*Figure 3B*). The esophageal tear was repaired in 2 layers, mucosal and muscularis, by using barbed absorbable suture material (V-Loc™180, VLOCL0804, Medtronics, Minneapolis, USA) (*Figure 3C,D*). Intraoperative esophageal endoscopy, and subsequent air insufflation confirmed the integrity of the esophageal repair. The chest wall was closed after inserting three catheters to drain the chest. Of the total time taken for the procedure of 245 min, only 32 min were taken to complete suture repair of the esophagus by using barbed suture material. Patient recovered well, and was shifted out of the intensive care unit three days after the operation. Oral feeds were started on the postoperative day 7 after upper gastrointestinal endoscopy and barium swallow confirmed the absence of any leak or stenosis at site of the esophageal repair (*Figure 4*). The empyema caused by the esophageal perforation responded well to intra-operative lavage, and the catheters draining the chest were removed by postoperative day 21. The patient was discharged from the hospital on postoperative day 28, and followed up in the outpatient clinic of the local hospital for 2 months. He did not require further re-hospitalization in the course of his recovery.

Discussion

Spontaneous perforation of the esophagus (Boerhaave's syndrome) is a life-threatening condition. Early diagnosis and appropriate treatment are necessary to prevent sepsis and lethal outcomes. Diagnostic upper gastrointestinal endoscopy, following a clinical diagnosis of Mallory-Weiss syndrome at another hospital, resulted in the patient developing tension pneumothorax and sustaining a cardiopulmonary arrest. There are other reports, of unusual presentations of Boerhaave's syndrome, and upper gastrointestinal endoscopy therein resulting in respiratory distress secondary to pneumothorax (5). It is important to consider Boerhaave's syndrome in the differential diagnosis of patients presenting with hematemesis, or suspected Mallory-Weiss syndrome.

Although there are successful reports that endoscopic

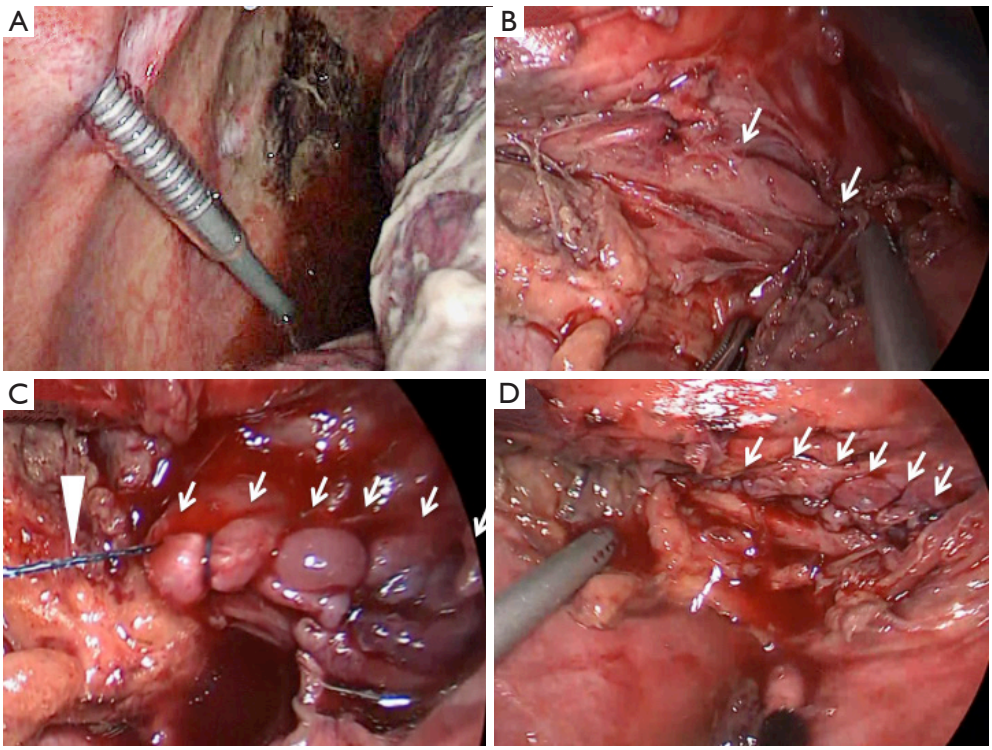

Figure 3 Intraoperative thoracoscopic view. (A) The thoracic cavity is copiously irrigated with physiological saline. In the semi-prone position, the irrigant accumulates anteriorly, enabling effective suctioning; (B) the esophagus is exposed and the longitudinal perforation on the left side of the lower esophagus is identified. Arrows indicate both edges of mucosal tear of the esophagus; (C) the esophageal tear is repaired in 2 layers, of mucosa and muscularis. Arrows indicate the suture line of the mucosal layer. Arrowhead indicates the barbed absorbable material; (D) arrows indicate the suture line of the muscular layer.

clipping closure and stenting was undergone for patients with Boerhaave's syndrome (6,7), the standard recommendation for this disease is to consider surgery within 24 h of onset (8-11).

Tissue necrosis and edema following delay in management may prevent successful primary repair of the esophageal tear. However, successful primary repair of the esophagus in the presence of significant fibrosis has been reported in a case of perforated Barrett's ulcer (12). Several recent reports recommend surgery, regardless of the delay in presentation (13,14). Studies also suggest similar clinical outcomes between thoracoscopic repair and repair with open thoracotomy, for esophageal rupture in patients with Boerhaave's syndrome (2). Minimally invasive thoracoscopic techniques may be associated with lesser surgical stress while allowing wide mediastinal drainage and adequate esophageal repair (2,15). Thoracoscopic suturing of esophageal tears using by conventional surgical instruments is difficult due to the awkward angle between the esophagus and the shaft of the forceps (12). In addition, both intracorporeal and extracorporeal knotting requires advanced thoracoscopic skills. Suturing devices such as Endo Stitch (Medtronics, Minneapolis, USA), or SILS Stitch (Medtronics, Minneapolis, USA), which are routinely used in gynecological and urological surgery, have also been successfully used for esophageal suturing (12). While these devices simplify thoracoscopic placement of sutures, knot-formation continues to remain challenging. Against this background, the use of barbed suture material in gastrointestinal surgery eliminates the need to form knots while performing minimally invasive surgery. Studies have confirmed that barbed suture material is similar to conventional monofilament in safety and efficacy, and enables simpler and quicker suturing while performing laparoscopic gastrointestinal anastomosis (4,16-18). We reinforce the suture line by using fibrin glue (19), and ensure that the cut-end of the barbed thread does not come in to direct contact with the lung.

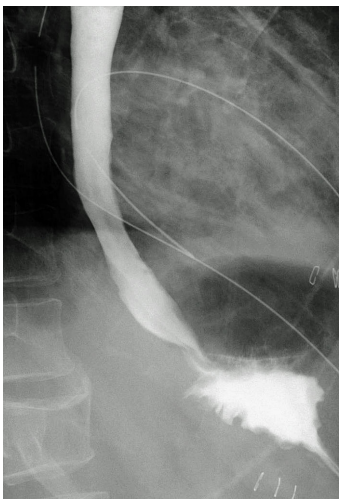

Figure 4 Barium swallow on the postoperative day 7 confirms the absence of any leak or stenosis at the site of the esophageal repair.

Since the esophageal perforation is located deep in the thoracic cavity, and access to it is narrow (12), it is difficult to adequately retract the lung and maintain a clear operative view, with the patient in the lateral position. This limitation was recognized in performing esophagectomy, and overcome by changing the patient position to prone. Minimally invasive esophagectomy in the prone position is associated with improved patient outcomes, and fewer complications such as pneumonia (20,21). In this position, the lungs are naturally retracted from the operative field owing to the effect of gravity and carbon dioxide pneumothorax. The operative space is considered adequate in prone position, even without the use of one-lung ventilation (22). However, we anticipated the need for conversion to the conventional lateral decubitus position or open thoracotomy while operating on the present case. To achieve this, we modified our approach in two ways. One, a double lumen endotracheal tube was used for one-lung ventilation. Two, a semi-prone position was used, instead of prone, as it enables easier positional change to the lateral position, while retaining the benefits of the fully prone position (23,24). In the semi-prone position, similar to the fully prone position, most of the exudate or irrigant accumulates in the anterior chest cavity, away from the site of the esophageal perforation. This enabled meticulous irrigation of the thoracic cavity, and the food debris, and necrotic material could be effectively removed. The semi-prone position also allowed good access to the posterior mediastinum to accomplish the esophageal repair.

Conclusions

Our case report, of a patient with Boerhaave's syndrome, demonstrates successful esophageal repair by using barbed absorbable suture material, and highlights the safety and simplicity of this technique. It also demonstrates the advantages of pneumothorax and semi-prone position in gaining thoracoscopic access to the esophagus.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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