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RESPIRATORY CASE REPORTS

Rare Complication of Difficult Intubation Using a Double- lumen Tube: Thoracic Esophageal Perforation

Zor Entübasyonda Çift Lümenli Tüp Kullanımının Nadir Bir Komplikasyonu: Torasik Özofagus Perforasyonu

Bahar Ağaoğlu Şanlı[1], Serkan Yazgan[1], Kenan Can Ceylan[1], Ahmet Ucvet[1], Tarık Öztürk[2]

Abstract

Double-lumen intubation is more difficult to achieve than conventional intubation due to the broader, lengthier and stiffer nature of the tube, leading to more frequent complications in execution. Thoracic esophageal perforation was observed following a difficult intubation in a patient who underwent a left lower lobectomy for lung cancer. In this case presentation we share our experiences of the diagnosis, monitoring and treatment of esophageal perforation. We believe that the utilization of auxiliary instruments such as fiberoptic bronchoscopy can aid in the prevention of major complications arising from difficult intubations.

Keywords: *Esophageal Perforation, thoracic surgery, intubation.*

Öz

Çift lümenli entübasyon, tüpün daha geniş, daha uzun ve sert olması nedeniyle konvansiyonel entübasyondan daha zordur. Bu sebeple tek lümenli tüp ile entübasyonlara göre daha sık komplikasyon görülmektedir. Akciğer kanseri nedeniyle sol alt lobektomi yapılan hastada zor entübasyona bağlı torasik özefagusda perforasyon görülmüştür. Olgumuzda perforasyonun tanı, takip ve tedavi sürecindeki deneyimlerimizi paylaşmayı amaçladık. Zor entübasyon bağlı majör komplikasyonları önlemek için, fiberoptik bronkoskopi gibi yardımcı enstrümanların kullanılmasının faydalı olabileceğini düşünmekteyiz.

Anahtar Kelimeler: *Özefagus perforasyonu, göğüs cerrahisi, entübasyon.*

[1]Clinic of Thoracic Surgery, İzmir Dr Suat Seren Chest Diseases and Surgery Medical Practice and Research Center, İzmir, Türkiye
[2]Clinic of Anesthesiology and Reanimation, İzmir Dr Suat Seren Chest Diseases And Surgery Medical Practice and Research Center, İzmir, Türkiye

[1]İzmir Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Göğüs Cerrahisi Kliniği, İzmir
[2]İzmir Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Anestezi ve Reanimasyon Kliniği, İzmir

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Correspondence (İletişim): Bahar Ağaoğlu Şanlı, Clinic of Thoracic Surgery, İzmir Dr Suat Seren Chest Diseases and Surgery Medical Practice and Research Center, İzmir, Türkiye

e-mail: drbaharagaoglu@hotmail.com

For anesthesia ahead of thoracic surgical interventions, single-lung ventilation using a double-lumen intubation tube is often required, although double-lumen intubation can be more challenging than conventional intubation due to the wider diameter, longer length, and curved and rigid structure of the tube. The placement of double-lumen tubes is more challenging than single-lumen tubes even in patients with a normal airway, while in cases with a difficult airway, the difficulty is further amplified, leading to an increased likelihood of complications (1). In this case presentation we report on the early-stage primary repair of a thoracic esophageal perforation with a right thoracotomy in which the perforation resulted from difficult intubation with a double-lumen tube in a patient scheduled for left thoracotomy due to lung cancer, supported by a review of literature on this topic.

CASE

A 70-year-old male patient was admitted for a planned left lower lobectomy after being diagnosed with adenocarcinoma based on the biopsy results of a 3 cm mass located in the left lower lung lobe. The patient's medical history revealed coronary artery disease and current use of clopidogrel, with no other notable features. The patient was classified as ASA 3 (American Society of Anesthesiologists physical status classification system). In the preoperative anesthesia assessment, no abnormalities were detected in the laboratory values, while a physical examination revealed a Mallampati score of III, indicating a short and thick neck structure with a posteriorly positioned lower jaw. The patient was classified as difficult intubation as the procedure failed on the first attempt, while intubation with a double-lumen tube also failed in two subsequent attempts. Successful intubation was finally achieved using a single-lumen tube with the assistance of fiberoptic bronchoscopy. During the operation, which involved left thoracotomy for lower lobectomy and mediastinal lymph node dissection, low saturation (SpO_2 85-90%) was experienced by the patient throughout the procedure, and was subsequently transferred to the postoperative intensive care unit. No issues were reported during extubation. A chest X-ray revealed total pneumothorax on the right side (Figure 1), upon which a chest tube was inserted and connected to a closed underwater drainage system. In the follow-up chest X-ray, both lungs were noted to have re-expanded (Figure 2). On the first postoperative day, in line with the standard procedure for all patients, the patient was monitored while under oral restriction. The patient was generally stable and had no complaints other than severe pain in the epigastric region and back. The patient, after achieving normal chest X-ray and laboratory values, was discharged from the intensive care unit on the first postoperative day and transferred to the ward for further monitoring. Following oral intake, the patient reported a change in drainage color accompanied by severe chest and back pain and an increased shortness of breath, leading to esophageal perforation being considered. The patient was thus administered oral methylene blue, after which methylene blue-stained drainage fluid from the chest tube was observed. Biochemical analysis of a pleural fluid sample revealed an amylase level of 374 u/L, and to confirm the suspected diagnosis and the level of esophageal perforation, the patient underwent Neck and Thorax Computed Tomography (CT) imaging after being administered an oral contrast material. The CT scan revealed extravasation of the contrast material from the lower portion of the thoracic esophagus into the right pleural cavity (Figure 3), and a subsequent laboratory blood analysis revealed leukocytes: 10.7x10.3/uL, C-reactive protein (CRP): 235 mg/L, and hemoglobin: 11.3 gr/dL. The patient's oral intake was discontinued, and broad-spectrum antibiotic therapy was initiated. The patient underwent surgery at the 36th postoperative hour based on the diagnosis of esophageal perforation for which a right thoracotomy was performed on the patient to facilitate access to the perforation site of perforation. The thoracic cavity was irrigated with saline solution, and a 1 cm-sized esophageal perforation area adjacent to the subcarinal region was observed (Figure 4). The perforation was first debrided, after which the membranous and muscular layers were repaired separately using absorbable multifilament 2/0 polyglactin sutures for primary closure. Insufflating air through the nasogastric tube revealed no leakage from the suture line and no other perforation or laceration (Figure 5). The patient was closely monitored in the intensive care unit for the first postoperative day and was transferred to the general ward on the second day. No air or fluid drainage from the right chest tube was observed during follow-up, and the right chest tube was transitioned to a Heimlich valve system on the third postoperative day. Following confirmation with a follow-up chest X-ray, the left chest tube was clamped and removed after a 12-hour observation period. The oral restriction continued for 5 days, during which the patient was fed through total parenteral nutrition. A subsequent leak test involving the administration of approximately 200 cc of water stained with methylene blue resulted in no drainage from the chest tube and no complaints of chest pain, and so the nasogastric tube was removed and controlled oral fluid intake was allowed. No changes were observed in the color or amount of drainage following the resumption of oral intake, a follow-up chest X-ray revealed normal findings, and a decrease was noted in the leukocyte count to 9.7x10.3/uL and CRP level to 122 mg/L. On the seventh postoperative day, the right chest tube was removed after a 12-hour period of clamping and confirmation with a follow-up chest X-ray,

and the patient was discharged on the eighth day. During outpatient follow-up in the second postoperative month, no issues were encountered with the patient. Based on the pathology results, the patient was classified as Stage 3A, and was referred to the oncology clinic for the planning of oncological treatment.

DISCUSSION

The use of double-lumen tubes is crucial for the anesthesia management of patients undergoing lung surgery. The separation and isolation of the lungs provide significant convenience to the surgeon during lung resections, although the placement of double-lumen tubes can be more challenging than single-lumen tubes, even in patients without airway pathologies due to the long length and large diameter of the tube, and its curved shape and rigid structure. Indeed, in the presence of a difficult airway, this situation can make the anesthetist's job quite complex (2). We describe here our management of an esophageal perforation of a difficult airway, a rare but life-threatening complication, that occurred during intubation with a double lumen tube in a patient with a Mallampati score of 3 who was scheduled for elective lung cancer surgery.

Difficult airway intubations can be encountered in any healthcare setting, with a reported incidence of approximately 6% in anesthesia practice (3). Difficult airway during endotracheal general anesthesia can lead to various complications, ranging from trauma to the trachea or esophagus, to myocardial infarction, cardiopulmonary arrest, hypoxic injury and even death. Published guidelines and practices relating to the management of difficult airways have identified different intubation techniques and alternative airway devices aimed at reducing such complications and securing the airway (4). It is certain that having access to proper equipment and proficiency in the established techniques will help reduce the risk of complications. The use of a specially designed fiberoptic laryngoscope set for difficult intubations, along with a suitable diameter flexible fiberoptic bronchoscopy (FOB) set to assist in double-lumen tube intubation, is highly recommended for the safety of the procedure.

The correct placement of blindly inserted double-lumen endotracheal tubes can be confirmed by observing the movement of the chest wall and auscultating both lungs. It should be noted, however, that these assessments may not always detect incorrect placement of the tube. There are numerous publications reporting that more than 30% of blindly inserted double-lumen endotracheal tubes are misplaced, highlighting the need for the use of FOB in patients undergoing planned double-lumen intubation to ensure accurate tube placement. That said, there are also publications advocating against the routine use of FOB due to its cost, the longer procedure time and the need for specialized training for its application (5). The search is thus continuing for alternative devices or methods to FOB for the confirmation of the correct placement of double-lumen endotracheal tubes. The wireless video endoscope, designed specifically for challenging intubation cases, is a lightweight and user-friendly device that allows visualization through the tube and can be advanced up to a distance of 37-48 cm, and can also serve as a basic bronchoscope. Our clinic has access to a standard fiberoptic bronchoscope that is used occasionally as an adjunct instrument for single-lumen intubations, as the diameter of the double-lumen intubation tube is not suitable for the standard fiberoptic bronchoscope. Moreover, our hospital lacks a wireless video endoscope or a fiberoptic bronchoscope suitable for pediatric patients. All of these limitations increase the risk of complications associated with double-lumen intubations in cases with difficult airways, as exemplified in the presented case.

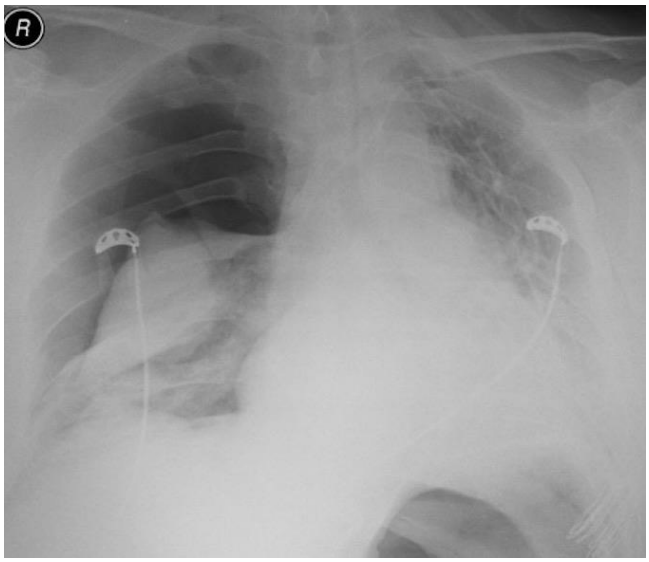

Figure 1: Total pneumothorax on the right side

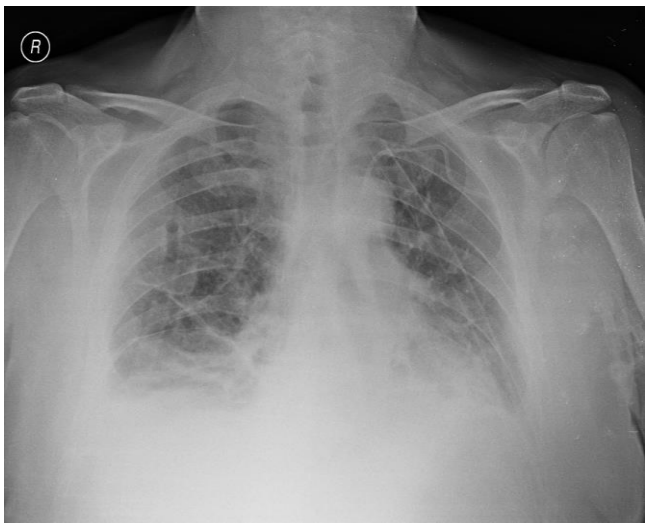

Figure 2: Re-expanded lung after closed underwater drainage

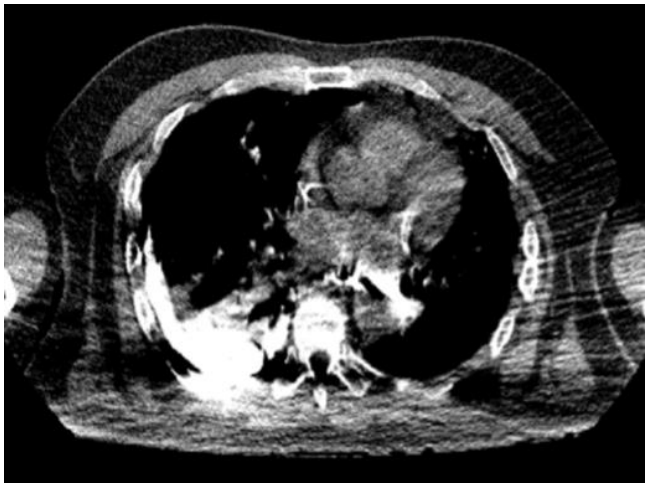

Figure 3: Extravasation of the contrast material

Esophageal perforation is a rare but life-threatening condition with a reported incidence of 3.1 cases per 1 million population (6). The overall mortality rate is 13.3%, but can range from 4–80% depending on the type of perforation and the time to diagnosis (7). Esophageal perforations most frequently have iatrogenic (46.5%), spontaneous (37.8%), foreign body (6.3%), corrosive (1.8%) and traumatic (<1%) causes (8). In general, 72.6% of esophageal perforations are thoracic, 15.2% are cervical and 12.5% are abdominal (9). Iatrogenic injuries related to esophageal intubation are likely underrecognized and underreported. The risk factors for perforation are similar to those for difficult intubations, and include inadequate visualization, macroglossia, trismus and short neck. Another potential cause of esophageal rupture is direct trauma resulting from the misplacement of a double-lumen endotracheal tube into the esophagus, which can be attributed to the characteristics of the tube.

The most common symptom of esophageal perforation is chest pain, and while patients may present with fever, dysphagia, subcutaneous emphysema, injury site swelling and foul-smelling discharge, they may also be asymptomatic. In our patient, the presence of severe chest pain and dyspnea, particularly after initiating oral intake, along with a change in drainage color, raised suspicion of esophageal perforation. Diagnosis is generally confirmed by esophageal contrast studies or Neck and Thorax CT scans with oral contrast administration, and adding esophagoscopy to these investigations not only helps determine the level of rupture, but also provides 100% specificity in ruling out injury. In our case, the clinical suspicion of esophageal perforation led to a direct radiograph being taken followed by the administration of oral methylene blue. After a methylene blue discharge was identified from the thoracic drain, information about the size and location of the perforation was sought through CT imaging with oral contrast. The images revealed a passage of contrast material from the esophagus into the subcarinal area and accumulation in the right hemithorax within the pleural space, confirming the presence of a perforation, and a decision was made to repair the perforation in the thoracic esophagus. The approach to the treatment of esophageal perforations may vary depending on the patient's clinical condition and the size of the defect. Options include fluid resuscitation, broad-spectrum antibiotics, endoscopic treatment with clips, and surgical repair with primary sutures or esophagotomy (10). Non-operative treatment is generally reserved for rare cases in which the patient is contraindicated for surgery due to associated comorbidities or meets the very narrow set of criteria modified by Cameron et al. (11). Another study by Vrouenraets et al. (12) reported that conservative treatment or surgical repair with primary sutures could yield good outcomes in cases where the defect is small, and the patient is asymptomatic. Following perforation, the leakage of gastric content and bacteria into the mediastinum can cause mediastinitis, which is one of the leading causes of mortality, and to prevent mediastinitis, adequate drainage should be ensured, and broad-spectrum antibiotic therapy should be initiated (9).

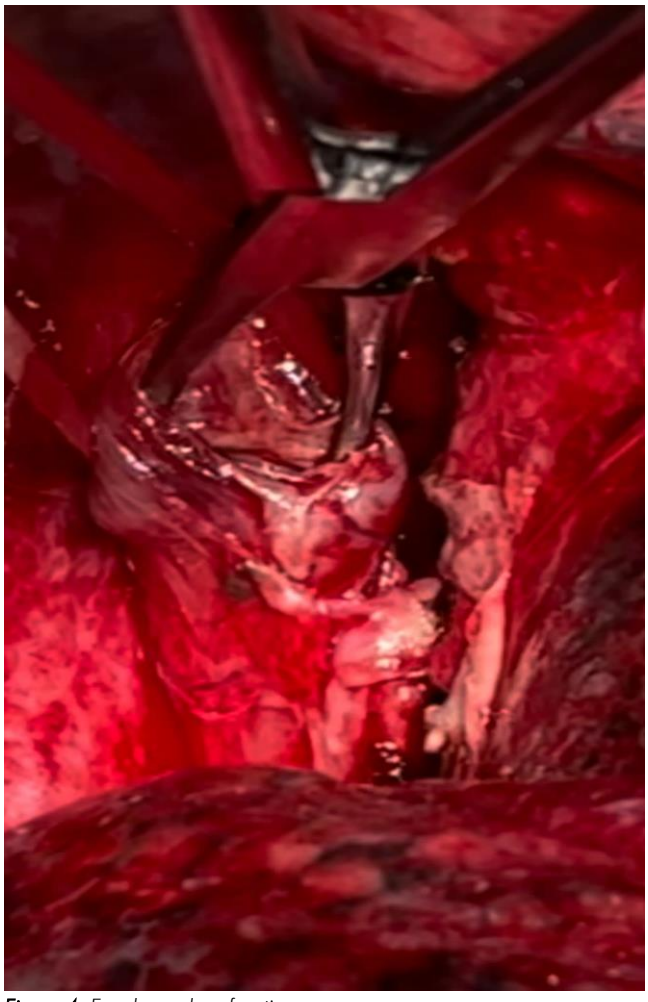

Figure 4: Esophageal perforation area

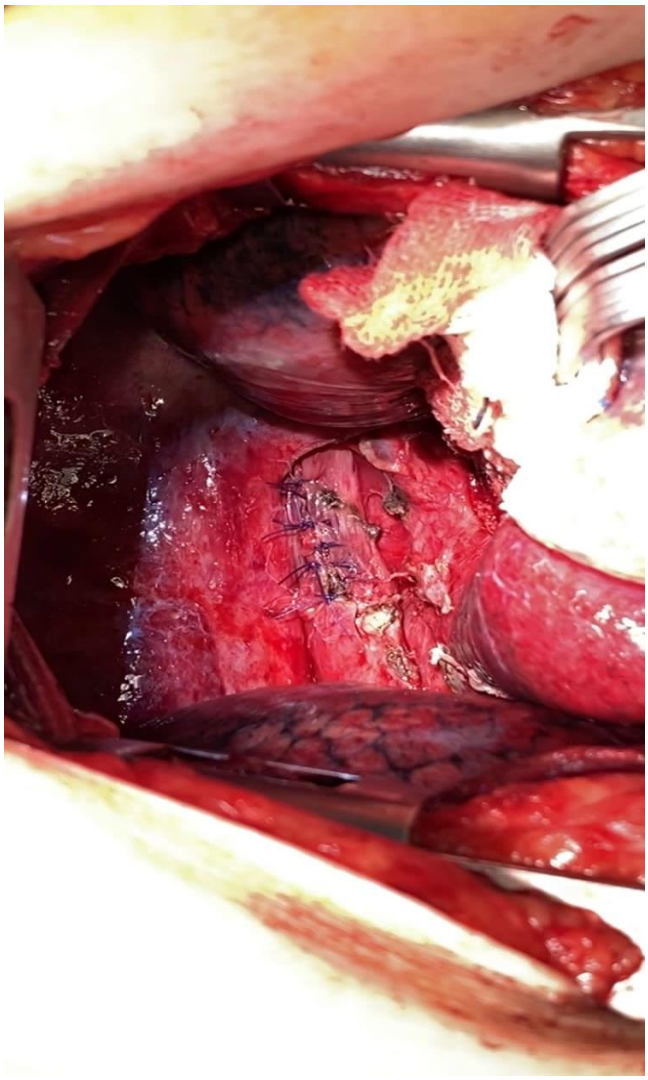

Figure 5: Repaired area

In our patient, who was scheduled for lobectomy due to lung cancer and developed the rare complication of esophageal perforation during difficult intubation with a double lumen tube, the prompt diagnosis and rapid surgical treatment without the development of mediastinitis contributed to treatment success. An ideal treatment for iatrogenic intrathoracic esophageal perforation should involve direct closure of the perforation to prevent further contamination of the mediastinum, prevention of gastric reflux at the perforation site, elimination of infection in the mediastinum and pleural spaces, preservation of gastrointestinal integrity, and, preferably, enteral or parenteral nutritional support.

CONCLUSION

Iatrogenic esophageal perforations can be diagnostically and therapeutically challenging, and any delay in treatment exceeding 24–48 hours significantly increase morbidity and mortality. In cases of esophageal perforation due to intubation injury, an early diagnosis and prompt intervention involving the primary repair of the esophagus within the first 48 hours can be considered an appropriate approach. In the presented case, the use of auxiliary instruments such as FOB could be considered necessary for the prevention of major complications during difficult intubation.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - B.A.Ş., S.Y., A.U., K.C.C., T.Ö.; Planning and Design - B.A.Ş., S.Y., A.U., K.C.C., T.Ö.; Supervision - B.A.Ş., S.Y., A.U., K.C.C., T.Ö.; Funding - B.A.Ş., A.U.; Materials - B.A.Ş., S.Y.; Data Collection and/or Processing - B.A.Ş., T.Ö.; Analysis and/or Interpretation - B.A.Ş., S.Y.; Literature Review - B.A.Ş., S.Y.; Writing - B.A.Ş., A.U.; Critical Review - B.A.Ş., K.C.C.

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