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Surgical treatment of complete bronchial rupture due to blunt thoracic trauma with bronchoplasty

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Abstract

Tracheobronchial ruptures are rare but potentially life-threatening injuries. These injuries can develop as a result of high-energy motor vehicle accidents, falling from a height, crushing, and penetrating injuries. If diagnosed early, tracheobronchial ruptures can be successfully treated.The most common symptoms include shortness of breath, subcutaneous emphysema, and pneumomediastinum. Diagnosis may be delayed due to other accompanying system injuries. Pneumomediastinum, which does not respond to tubular toracostomy, massive air leakage from the thoracic drain and the presence of pneumothorax should warn the clinic of the possibility of intratorastic tracheobronchial rupture. Early diagnosis prevents non-reversible loss of parenchym, resulting in fewer complications and an increase in survival.

Introduction

This study presents the case of a 24 years old male patient who was referred from another center to the Thoracic Surgery Clinic at Inonu University Turgut Ozal Medical Center. The patient was intubated after his general condition deteriorated following a motor vehicle accident and underwent right tube thoracostomy due to pneumothorax. However, despite this intervention, his condition continued to worsen. The patient had thoracic vertebra fracture, pneumothorax, pneumomediastinum, and multiple traumas, but no rib fractures.

Case Report

This study details the medical process of a 24 years old patient following a motor vehicle accident. The patient, who had undergone right tube thoracostomy and intubation due to pneumothorax at an external center, was referred to the Thoracic Surgery Clinic at İnönü University Turgut Özal Medical Center. Physical examination revealed a tube thoracostomy at the right 5th intercostal space, extensive subcutaneous emphysema in the chest and neck regions, decreased breath sounds in the right hemithorax, and continued excessive air leakage from the closed underwater drainage system.

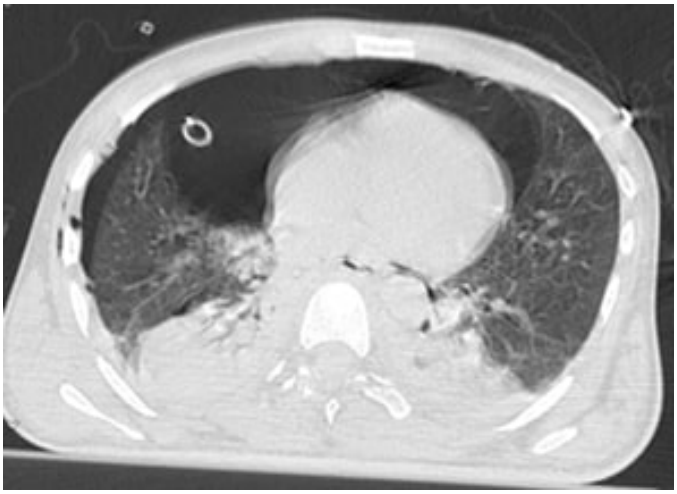

Figure 1. Despite tube thoracostomy, an increase in pneumothorax and subcutaneous emphysema with a collapsed lung is observed.

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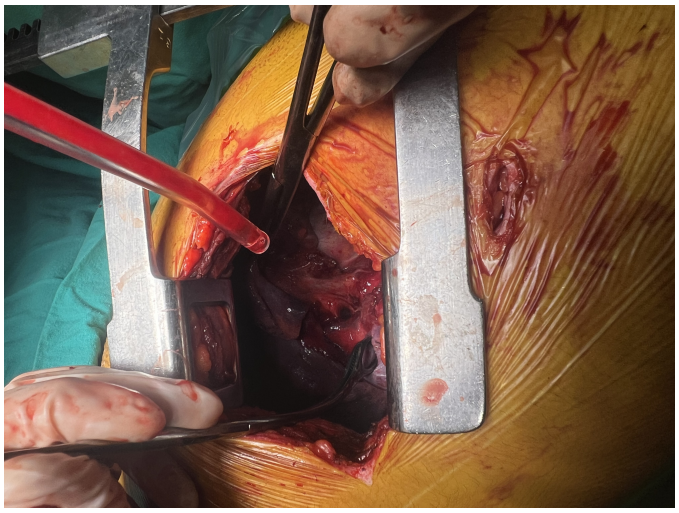

Figure 2. Intraoperative view of the right middle lobe bronchus rupture (black arrow).

Figure 3. Postoperative control Posterior-Anterior chest radiograph.

Thoracic tomography showed total pneumothorax in the right hemithorax, pneumomediastinum, and subcutaneous emphysema, but no rib fractures. Despite the continuous massive air leakage from the tube thoracostomy and the increasing subcutaneous emphysema and pneumothorax (Figure 1), it was observed that the previous tube thoracostomy was functioning actively, and a second tube thoracostomy was performed on the right hemithorax. As massive air leakage continued from both tubes, tracheobronchial injury was considered, and surgical intervention was planned.

Through right uniportal VATS, the thorax was entered with an endocamera from the right 5^{th} intercostal space, and no parenchymal laceration was observed during exploration, but the mediastinal pleura was found to be opened.

Figure 4. Control Posterior-Anterior chest radiograph after discharge.

Massive air leakage from the hilum led to the dissection of the hilum, revealing that the middle lobe bronchus was nearly totally ruptured (Figure 2). Since adequate exposure could not be achieved due to the vertebra fractures, the incision was extended slightly, and minithoracotomy was performed. Reconstruction was achieved by end-to-end anastomosis of the middle lobe bronchus using 3.0 polydioxanone (PDS). In the same session, vertebra stabilization was performed by the neurosurgery team.

In the postoperative period, a control chest X-ray showed lung expansion (Figure 3), and on the first day, fiberoptic bronchoscopy was performed on the patient who had no air leakage from the tube thoracostomy. Bronchoscopy revealed hemorrhagic secretions in the bilateral bronchial system, which were aspirated. The anastomosis line was intact, and there was no narrowing in the middle lobe bronchus. The patient was extubated on the second postoperative day, and tube thoracostomy was terminated. He was discharged on the fifth postoperative day in good health.

Discussion

Although bronchial ruptures due to blunt thoracic trauma are rare, they are potentially life-threatening injuries. The first step in diagnosing tracheobronchial injuries is suspicion. Bronchial rupture is a rare condition occurring in approximately 1.5% of major traumas [1]. It is generally found in the right main bronchus, with 76% of these cases occurring within the first 2 cm from the carina [2]. Approximately 30% of bronchial ruptures result in mortality, with about half of these deaths occurring within the first hour [3].

Three main mechanisms that can disrupt the intrathoracic tracheobronchial tree have been identified. The first mechanism involves the reduction of the anteroposterior diameter of the thorax due to blunt trauma, resulting in the transverse diameter expanding and causing the lungs to move away from each other. When this tension exceeds the elasticity at the carina, tracheobronchial rupture becomes inevitable. The second mechanism occurs when blunt trauma reduces the anteroposterior diameter of the thorax while the epiglottis is closed, causing the trachea and main bronchi to be compressed between the sternum and the vertebral column, leading to increased intrabronchial pressure and rupture. The third mechanism involves acceleration-deceleration trauma where the pulling force at fixation points like the carina and cricoid cartilage causes rupture.

Different clinical scenarios can be observed depending on whether the mediastinal pleura is intact in bronchial ruptures. If the mediastinal pleura is torn, severe respiratory distress, dyspnea, pneumothorax-tension pneumothorax, progressive mediastinal and subcutaneous emphysema may be seen. In cases where the mediastinal pleura is intact, the symptoms are minimal. Even if the bronchial rupture is complete, pneumothorax may not develop or may develop minimally, not preventing lung expansion. In such cases, if not diagnosed, significant strictures may develop over time [4].

Conclusion

In cases of pneumothorax following blunt trauma, if the lung does not expand despite tube thoracostomy and air leakage continues, bronchial rupture must be considered in the differential diagnosis [5]. Bronchoscopy is the gold standard for diagnosis, but it should be noted that there is a 20-40% false negative rate in bronchoscopy. Therefore, in patients with negative bronchoscopy but clinical suspicion such as massive air leakage and non-expanding lung, exploration should not be delayed. Early diagnosis and exploration are crucial in protecting the patient from late complications such as mediastinitis, atelectasis, pneumonia, and sepsis. If diagnosed late, strictures and necrosis may develop at the ruptured bronchial ends, the parenchyma may become infected, and the infection may spread to the pleura and mediastinum [6].

If diagnosed early, end-to-end anastomosis can be performed more safely without developing such complications. Otherwise, with the development of complications, mortality and morbidity rates inevitably increase [7]. Appropriate and timely intervention yields very satisfactory results. Early diagnosis and emergency surgical treatment are life-saving in patients with tracheobronchial injuries. Additionally, it should be remembered that parenchyma can be preserved with primary repair without resection.

Ethical approval

Approval was received from the Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee (Decision no: 2024/6214).

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