

Right Main Bronchus Rupture Presenting with Pneumoperitoneum

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We report the case of a 16-year-old male patient who was involved in a traffic accident and transferred to the emergency department with mild chest pain. We initially did not find evidence of tracheal injury on computed tomography (CT). Within an hour after presentation, the patient developed severe dyspnea and newly developed subcutaneous emphysema and pneumoperitoneum were discovered. Abdominal CT showed no intra-abdominal injury. However, destruction of the right main bronchus was identified on coronal images of the initially performed CT scan. Emergency exploratory surgery was performed. The amputated right main bronchus was identified. End-to-end tracheobronchial anastomosis was performed, and the patient recovered without any complications.

Key words: 1. Bronchial diseases
2. Tracheal injury
3. Blunt trauma

Case report

A 16-year-old male patient presented to the emergency department with mild chest pain that had arisen after he was crushed by a slow-moving vehicle while riding his bicycle. The patient was under the car for only a brief period, and no abnormalities were found on the physical examination, except mild tenderness and swelling of the anterior chest. The patient showed an alert mental status and blood pressure in the normal range, with an elevated heart rate of 120 bpm. No dyspnea was present, and arterial oxygen saturation was 99%. Because a plain-film chest X-ray showed mild pneumomediastinum, a

chest computed tomography (CT) scan was performed to identify potential injuries of the thorax, but no evidence of bronchial or esophageal injury was found in the unreconstructed axial CT images. Thus, oxygen therapy via a nasal cannula was planned for the patient without further examination. However, the patient suddenly developed severe dyspnea, and his arterial oxygen saturation decreased rapidly 1 hour after his arrival at the hospital. An emergency intubation was performed with single lumen endotracheal tube, but the decreased arterial oxygen saturation did not recover. A new chest X-ray showed a massive pneumoperitoneum that had suddenly developed and subcutaneous emphysema with-

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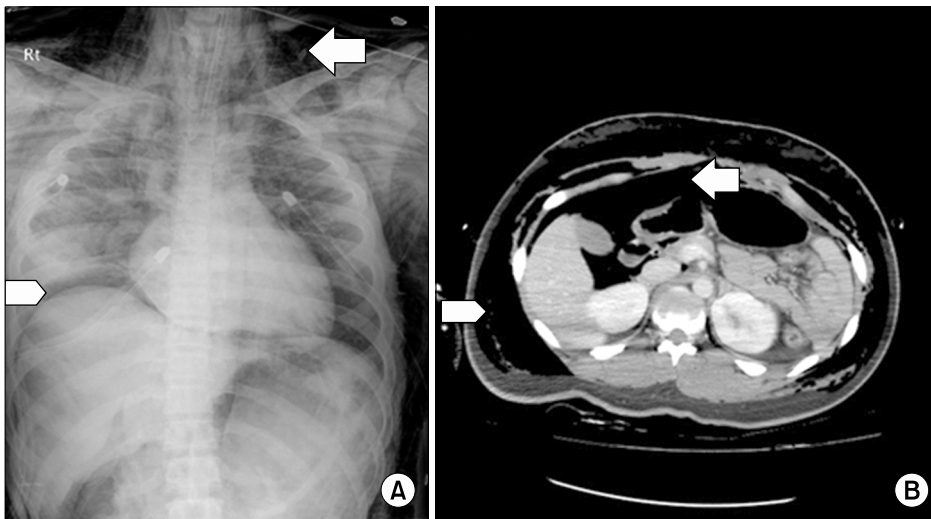


Fig. 1. (A) Taken immediately after intubation, a chest X-ray shows a suddenly developed massive pneumoperitoneum (arrow) and subcutaneous emphysema (arrowhead) without any evidence of pneumothorax. (B) Computed tomography of the abdomen, performed to evaluate the intra-abdominal lesion, shows massive pneumoperitoneum (arrow) and subcutaneous emphysema (arrowhead) without abdominal injury.

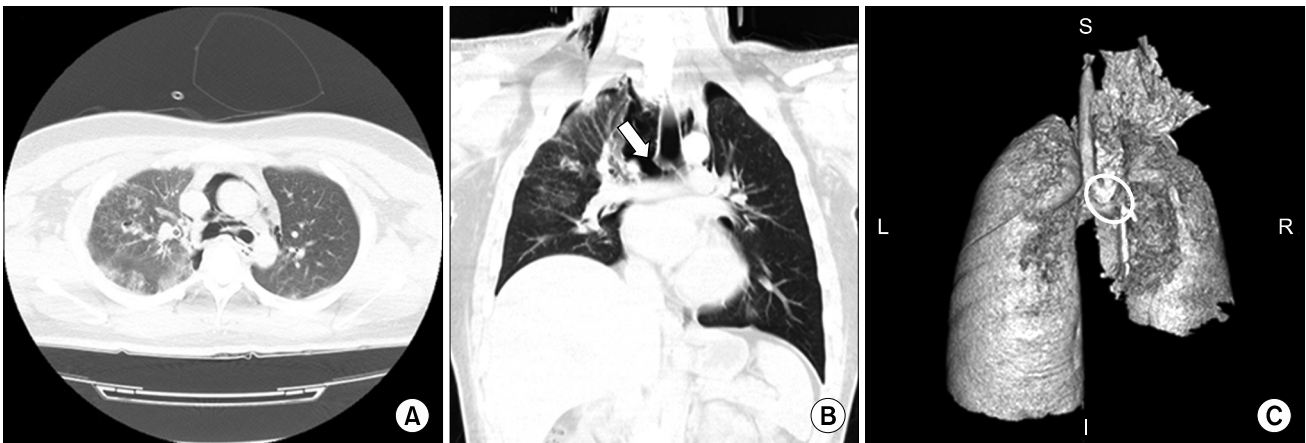


Fig. 2. (A) An axial image from the initial chest computed tomography (CT) scan shows the defect of the bronchus in only 1 cut, which we missed in the initial diagnosis. (B) A reconstructed coronal image from the initial chest CT scan definitely shows the amputated right main bronchus (arrow) without pneumoperitoneum. (C) A 3-dimensional reconstruction of the chest CT scan also shows the discontinuity of the right main bronchus (dotted circle).

out any evidence of pneumothorax. Another CT scan was performed on the abdomen to check for any visceral perforation, but no evidence of visceral injury was seen (Fig. 1). However, rupture of the right main bronchus was revealed on the initially-obtained chest CT image, which was only reconstructed after some delay (Fig. 2). Since the patient showed hypotension and hypoxia, a double-lumen endotracheal tube was inserted into the left bronchus to ventilate the left lung and to block the path to the perforated right main bronchus. A few minutes after intubation, the patient was stabilized and transferred to the operating room. Exploration via an emergency right thor-

acotomy was performed under general anesthesia with the pre-positioned endotracheal tube. After the unperforated mediastinal pleura was divided, the completely amputated right main bronchus was found, with no injury to the lung parenchyma (Fig. 3). End-to-end anastomosis of the trachea to the right main bronchus was performed. Bronchoscopy performed 2 days later indicated an intact anastomosis without any evidence of leakage. After a few days of recovery, the patient was discharged without any complications.

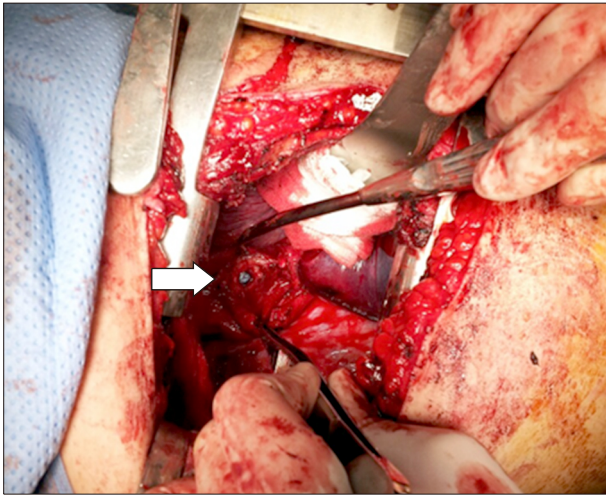


Fig. 3. The completely amputated right main bronchus (arrow) was found with no injury to the mediastinal pleura and lung parenchyma.

Discussion

Tracheobronchial injury after blunt trauma is a rare consequence that occurs in less than 1% of blunt chest trauma patients [1]. However, because patients with a tracheobronchial injury often do not survive the journey to the hospital, the true incidence of tracheobronchial injuries is unknown. The delayed diagnosis of tracheobronchial injuries may be fatal and often requires lung parenchyma resection, which is associated with long-term complications. Thus, a rigorous evaluation, including bronchoscopy, is necessary when the possibility of tracheobronchial injury exists [2]. After blunt trauma, injuries of the bronchus are seen more frequently than those of the trachea, with the most common site of injury being the right side within 2.5 cm of the carina, followed by the left main bronchus [3]. Injury of the cervical trachea is infrequent, although it can result from a direct blow to the neck, even if the force of the blow is small.

Radiographs generally reveal subcutaneous emphysema, and pneumothorax also presents frequently [4]. Despite the frequent occurrence of pneumomediastinum in patients with a tracheobronchial injury, the presentation of pneumoperitoneum has not yet been documented. In our case, the development of pneumoperitoneum could have resulted from the severely injured bronchus in combination with the

intact mediastinal pleura. It is possible that, after the injury, the air that had leaked into the mediastinum created more space between the 2 sides of the destroyed bronchus, which could have gradually increased the flow of air into the mediastinum as time passed. Since continuous air leakage was blocked by the undamaged mediastinal pleura, the pressure could conceivably have been high enough to result in pneumoperitoneum through the esophageal or aortic hiatus.

Although bronchoscopy may be a definitive diagnostic modality, it can only be performed by a skilled practitioner. Thus, it is not always readily available in emergency situations. Otherwise, CT readily enables the diagnosis of tracheobronchial injuries when the patient is hemodynamically stable. Scaglione et al. [5] reported 18 patients with tracheobronchial injuries who underwent CT scans. The CT images of 17 patients showed direct evidence of tracheobronchial injuries, including discontinuity of the tracheal or bronchial wall, endotracheal cuff herniation, overdistention of the endotracheal cuff, and bronchial enlargement. The CT image of only 1 patient showed air leakage at the level of the carina, and the small injury was confirmed using bronchoscopy. However, a simple examination of the CT scan with only axial CT sections resulted in the diagnosis being overlooked. In fact, only about 75% of tracheal ruptures are diagnosed using conventional axial sections of CT images [6]. Therefore, multiple reformatting and 3-dimensional image reconstruction are necessary to avoid misdiagnosis.

While approximately half of the patients with a tracheobronchial injury are diagnosed within 48 hours, delayed diagnoses do occur frequently [2]. Since the common presentations of tracheobronchial injury, pneumothorax and subcutaneous emphysema, also arise from bony injuries of the thorax, it is easy to overlook the possibility of tracheobronchial injury even with those signs. According to the report of Kiser and colleagues [4], in contrast to when the diagnosis is made early (within 48 hours), the risk of death after tracheobronchial injury is 3 times higher when the diagnosis is made between 2 and 7 days after trauma. Therefore, a more rigorous evaluation for tracheobronchial injury is required when any sign of thoracic trauma is present. In our case, the injury was missed in the first evaluation, even though evi-

dence of bronchial rupture was present in the CT image. However, because the patient's symptoms worsened so quickly, the diagnosis was made within 1 hour of his arrival at the emergency department, and a rapid intervention was performed without further delay.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

References

1. Sangster GP, Gonzalez-Beicos A, Carbo AI, et al. *Blunt traumatic injuries of the lung parenchyma, pleura, thoracic wall, and intrathoracic airways: multidetector computer tomography imaging findings.* Emerg Radiol 2007;14:297-310.
2. Hwang JJ, Kim YJ, Cho HM, Lee TY. *Traumatic tracheobronchial injury: delayed diagnosis and treatment outcome.* Korean J Thorac Cardiovasc Surg 2013;46:197-201.
3. Zinck SE, Primack SL. *Radiographic and CT findings in blunt chest trauma.* J Thorac Imaging 2000;15:87-96.
4. Rossbach MM, Johnson SB, Gomez MA, Sako EY, Miller OL, Calhoun JH. *Management of major tracheobronchial injuries: a 28-year experience.* Ann Thorac Surg 1998;65:182-6.
5. Scaglione M, Romano S, Pinto A, Sparano A, Scialpi M, Rotondo A. *Acute tracheobronchial injuries: Impact of imaging on diagnosis and management implications.* Eur J Radiol 2006;59:336-43.
6. Le Guen M, Beigelman C, Bouhemad B, Wenjie Y, Marmion F, Rouby JJ. *Chest computed tomography with multiplanar reformatted images for diagnosing traumatic bronchial rupture: a case report.* Crit Care 2007;11:R94.