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【 CASE REPORT 】

Successful Stenting for Bronchial Stenosis Resulting from Blunt Airway Trauma

Ji Yeon Roh[1], Insu Kim[1], Jung Seop Eom[1], Geewon Lee[2], Hyo Yeong Ahn[3] and Min Ki Lee[1]

Abstract:
Blunt airway trauma is rare but life threatening. Injuries to other vital organs accompany this type of injury in most cases; therefore, conservative treatment may be considered first. In cases of delayed fibrotic airway stenosis after conservative treatment, surgical treatment or bronchoscopic intervention are therapeutic options. We herein report a case of delayed airway stenosis after a blunt traumatic airway injury that was successfully managed by silicone stenting.

Key words: trauma, blunt injuries, airway obstructions, stenosis, stents

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Introduction

Traumatic airway injuries are rare but potentially life threatening. Although penetrating airway injuries account for most cases, tracheobronchial injury from blunt trauma is particularly severe and fatal (1). In addition, damage to other major organs, including cerebral hemorrhaging, abdominal injuries, and open extremity fractures, often accompanies patients with blunt airway trauma (2). If concomitant vital organ injuries are severe enough to require emergency surgery, conservative treatment of an airway injury, such as mechanical ventilation or tracheostomy, should be considered first.

A delayed tracheobronchial stenosis can develop after various airway injuries, such as severe tracheobronchial tuberculosis, prolonged mechanical ventilation, and radiotherapy (3-5). Regardless of the etiology, a severe benign airway stenosis generally requires mechanical dilatation with or without placement of a silicone stent via a rigid bronchoscope under general anesthesia.

We herein report a patient who developed delayed fibrotic airway stenosis after conservative treatment for a blunt traumatic airway injury and was successfully managed with a silicone stent.

Case Report

A 59-year-old woman was transported to the trauma emergency center for multiple traumas caused by a car accident. X-ray showed fractures to the right humerus, multiple ribs, left femur, and a dislocated thoracic vertebra. Chest computed tomography revealed anterior pneumomediastinum, right pneumothorax, and a left main bronchus injury (Fig. 1A). We decided to treat the blunt airway injury at the left main bronchus conservatively while performing surgery for the traumatic fractures. On the first day of hospitalization, open reduction and internal fixation was performed for the right humerus fracture, and posterior fusion was performed for the dislocation combined with the burst fracture of the thoracic vertebrae. The blowout fracture was corrected on hospital day 2. Finally, closed reduction and internal fixation were performed for the left femur neck fracture on hospital day 10.

The patient was hospitalized in the intensive-care unit while maintaining mechanical ventilation during surgeries for multiple traumatic fractures. On day 3 of hospitalization, bronchoscopy was performed to identify the traumatic airway injury, which revealed a 5-cm laceration from the carina to the left main bronchus (Fig. 1B). Follow-up bronchoscopy performed on day 10 found a small granulation

[1]Department of Intermal Medicine, Pusan National University School of Medicine, Korea, [2]Department of Radiology, Pusan National University School of Medicine, Korea and [3]Department of Thoracic and Cardiovascular Surgery, Pusan National University School of Medicine, Korea
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Correspondence to Dr. Jung Seop Eom, ejspulm@gmail.com

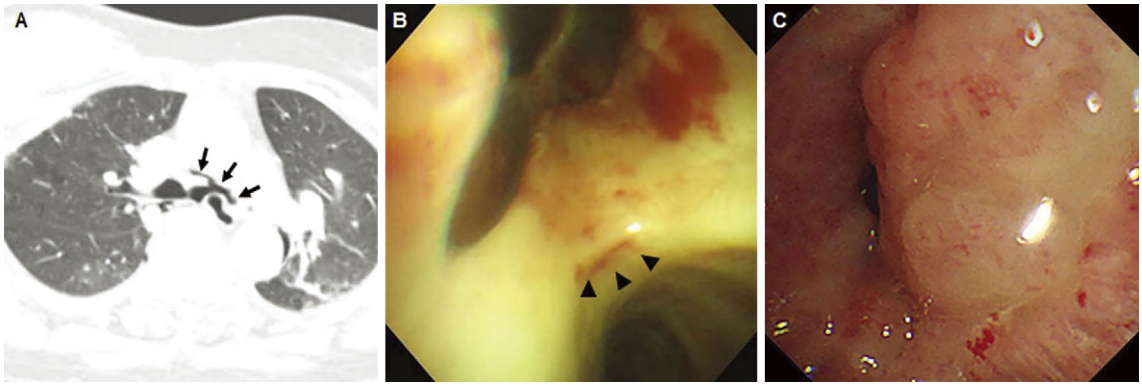

Figure 1. Initial chest computed tomography (CT) and bronchoscopic findings of the patient with blunt airway trauma. (A) Chest CT shows pneumomediastinum and a left main bronchus injury (arrow). (B) A bronchoscopic image of a laceration from the carina (arrowhead) to the left main bronchus. (C) Granulation tissue overgrowth at the laceration site was found through follow-up bronchoscopy.

tissue overgrowth on the laceration site of the left main bronchus, which was removed using biopsy forceps. On day 13 of hospitalization, a tracheostomy was performed because of the long-term intubation. During follow-up bronchoscopy on day 16, additional granulation tissue overgrowth was removed from the laceration site with biopsy forceps (Fig. 1C). On day 19, the patient was transferred from the intensive-care unit to the general ward. On day 23 of hospitalization, chest radiographs showed total left lung atelectasis with aggravating dyspnea (Fig. 2A), and a 3-cm fibrotic stenosis of the left main bronchus was confirmed by bronchoscopy.

Emergent rigid bronchoscopy was performed to restore airway patency of the left main bronchus. Under general anesthesia, the patient was intubated with a rigid bronchoscope (Karl-Storz, Tuttlingen, Germany), and a flexible bronchoscope (BF-1T260; Olympus, Tokyo, Japan) was introduced via the rigid bronchoscope to identify the airway stenosis in the left main bronchus. First, flexible biopsy forceps were introduced into a suspicious small opening in the fibrotic segment, and we found a small communication from the trachea and distal left main bronchus (Fig. 2B). A balloon (Boston Scientific, Natick, USA) was used cautiously to mechanically dilate the stenotic airway, and the stenotic segment was dilated to approximately 3 mm in diameter. Subsequently, bougination using a rigid bronchoscope was used to restore an adequate airway diameter (Fig. 2C). The patient's head was rotated to the right side to align the two axes of the trachea and left main bronchus in order to avoid iatrogenic bronchial laceration during bougination. To maintain airway patency after mechanical dilation, a 35-mm silicone bronchial stent (Dumon stent; Novatech, Plan de Grasse, France) was inserted using a stent introducer (Tonn Tracheobronchial Stent Applicator, Novatech, La Ciotat, France) without fluoroscopic guidance (Fig. 2D). The length of the silicone bronchial stent was determined according to a visual assessment of the stenotic segment using a scale marked on the body of the flexible bronchoscope.

Following rigid bronchoscopy and placement of the silicone stent, chest radiographs showed improvement in the atelectasis, and the respiratory symptoms related to airway stenosis disappeared immediately. Follow-up bronchoscopy on day 30 after stenting confirmed the proper location of the stent and a patent airway. Furthermore, we confirmed that the bronchial stent in the left main bronchus was stable without any complications, such as mucostasis inside the stent, migration, or granulation tissue overgrowth at the tip of the stent, through bronchoscopy 12 months after placing the stent.

Discussion

Although the treatment of choice is surgical repair in most cases of traumatic airway injury, surgery is not always possible for various reasons, such as a poor general condition or other associated organ injuries (6). In particular, blunt airway trauma is commonly associated with damage to multiple organs, including orthopedic, facial, pulmonary, and intra-abdominal injuries (7, 8). In addition, the diagnosis of blunt airway trauma may be delayed because of injuries to other organs requiring immediate management.

The treatment consensus or guidelines for fibrotic airway stenosis after blunt airway trauma have not been established until now. Either surgical treatment or bronchoscopic intervention is generally considered a reasonable treatment strategy to restore airway patency (9). In cases of severe concomitant organ injuries that require urgent surgical management, conservative treatment (e.g., tracheostomy or mechanical ventilation) should be considered primarily as a therapeutic option for adequate airway protection (10).

However, conservative treatment may cause granulation tissue overgrowth or fibrotic stenosis at the airway injury site. As the primary or secondary injury heals, granulation tissue and scar contracture results in the formation of a stricture one to four weeks after the injury. This can cause dyspnea, wheezing, or stridor, and airway edema or secretions

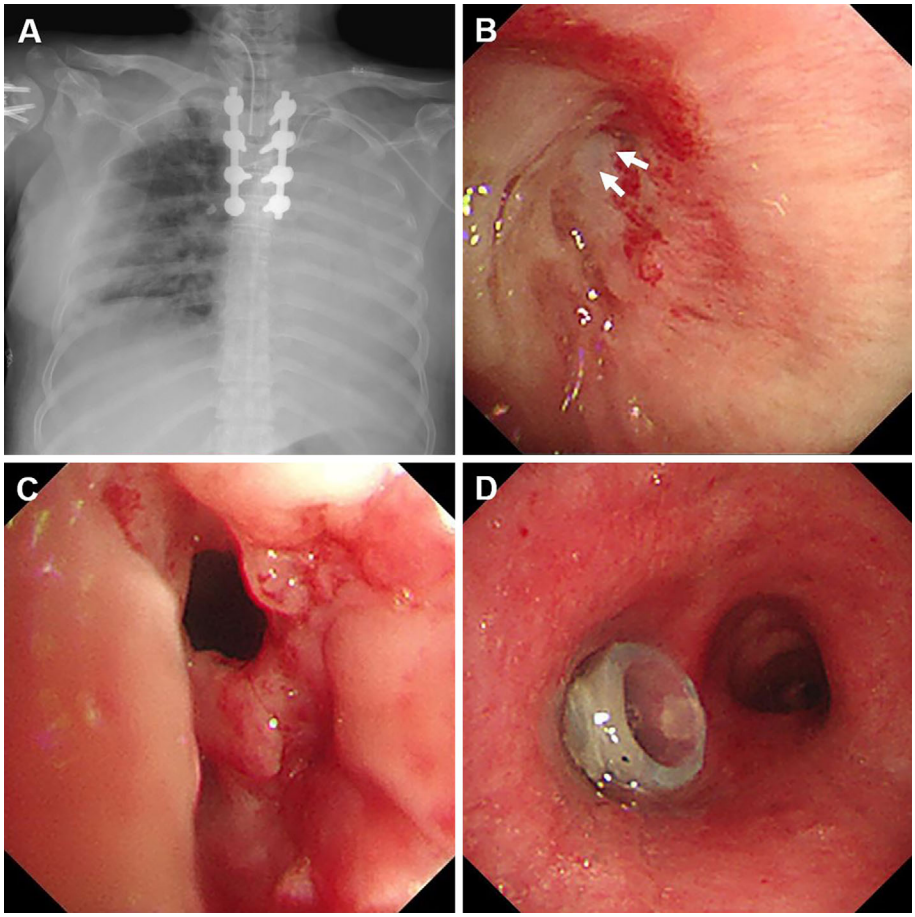

Figure 2. **On day 23 of hospitalization, a chest radiograph showed total atelectasis of the left lung (A). (B) A 3-cm fibrotic stenosis of the left main bronchus was confirmed by bronchoscopy, and flexible biopsy forceps were introduced into a suspicious small opening in the fibrotic segment (arrow). (C) Bougination using a rigid bronchoscope was performed to mechanically dilatate and restore an adequate airway diameter. (D) A silicon stent was inserted to restore airway patency of the left main bronchus.**

can be exacerbated by the contracture. Bronchoscopic intervention may be considered more suitable than surgical treatment if accompanying vital organ injuries are severe enough to require urgent surgery or if the general condition of the patients worsens due to multiple trauma, as it is less invasive. We therefore believe that mechanical dilatation with a silicone stent is a more useful therapeutic strategy in patients with delayed airway stenosis following blunt airway trauma than in those with other benign airway stenoses.

Because post-traumatic airway stenosis is relatively rare, little information is available regarding when to remove the airway stent. Patients with post-traumatic airway stenosis may have multiple other organ injuries from trauma, such as in our case. Therefore, rather than relying on the total duration of stenting, the timing for stent removal should be determined using a multidisciplinary approach. We consulted a rehabilitation physician, physical therapist, and other experts who participated in the surgeries for the other organ injuries to determine the best timing for removing the stent.

Our blunt airway trauma patient underwent conservative treatment for her airway injury because of accompanying organ injuries. Unfortunately, delayed airway stenosis developed with aggravating dyspnea on day 23 of hospitalization. We decided to perform a low-invasive bronchoscopic intervention for the airway stenosis because the patient had a poor general condition due to other previous organ surgeries. Her symptoms and vital signs recovered immediately after airway stenting through a rigid bronchoscope. In addition, we confirmed successful airway stenting without any complications through follow-up bronchoscopy at 12 months after inserting the stent. Based on these findings, we conclude that airway stenting was a useful treatment option in a patient with post-traumatic airway stenosis.

The authors state that they have no Conflict of Interest (COI).

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Ji Yeon Roh and Insu Kim contributed equally to this work.

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