INTRODUCTION

Tracheobronchial disruption is an uncommon injury associated with blunt chest trauma (1). According to several articles dealing with radiologic findings of tracheobronchial rupture after blunt chest trauma (2-4), secondary findings of an air leak (pneumomediastinum, subcutaneous emphysema, and persistent pneumothorax despite suction drainage) can be critical hints for the diagnosis of a tracheobronchial rupture. However, these findings are nonspecific in polytraumatized patients, sometimes making an early diagnosis difficult (5, 6).

We report CT features and pathologic findings of two pediatric cases in which a bronchial injury was unnoticed initially but was diagnosed later by appearance of delayed bronchostenosis with distal atelectasis after blunt chest trauma in recent motor vehicle accidents. Pathologically, obliteration of the bronchial lumen was caused by dense fibrous overgrowth and granulation tissue.

CASE REPORTS

Case 1

A 7-yr-old boy was admitted to our hospital after a motor vehicle-pedestrian accident. Initial chest radiograph and chest CT scan obtained using a helical CT scanner (HiSpeed Advan-

Delayed Bronchostenosis After Blunt Chest Trauma in Children: CT and Pathologic Findings

Tracheobronchial disruption is an uncommon injury associated with blunt chest trauma. We report CT features and pathologic findings of two pediatric cases in which a bronchial injury was unnoticed initially but was diagnosed later by appearance of delayed bronchostenosis with distal atelectasis after blunt chest trauma in recent motor vehicle accidents. Pathologically, obliteration of the bronchial lumen was caused by dense fibrous overgrowth and granulation tissue.

Key Words : Bronchial Injuries; Wounds and Injuries; Computed Tomography; Trauma; Multiple Trauma

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left lung was fully re-expanded after surgery, and the recovery was uneventful. Follow-up brain CT obtained on the 38th hospital day showed decreased amount of subdural hemorrhage and a cystic change of intracerebral hemorrhage.

Case 2

A 2-yr-old boy was admitted to our hospital after a motor vehicle-pedestrian accident. Initial chest CT scan obtained on the first hospital day showed bilateral hemopneumothoraces, pneumomediastinum, and subcutaneous emphysema in the chest wall with multiple rib fractures. A large consolidation containing multiple cavities was also noted in the right upper lobe, suggestive of traumatic lung cysts. Conservative management including bilateral chest tube placement was done in the intensive care unit.

Ten days later, a follow-up anteroposterior chest radiograph showed atelectasis of the left upper lobe, which thereafter
cavitary consolidations in the right upper lobe, suggestive of resolv-
portion of the left upper lobe bronchus (arrowheads). Also note
lobe atelectasis. Note complete luminal obliteration of the proximal
portion) obtained 15 days after blunt chest trauma shows left upper
chest trauma. Contrast-enhanced chest CT scan (3-mm-collima-
Fig. 2. 2-yr-old boy with delayed bronchostenosis after recent blunt
chest trauma. Contrast-enhanced chest CT scan (3-mm-collima-
tion) obtained 15 days after blunt chest trauma shows left upper
lobe atelectasis. Note complete luminal obliteration of the proximal
portion of the left upper lobe bronchus (arrowheads). Also note
cavity consolidations in the right upper lobe, suggestive of resolv-
ing traumatic lung cysts (arrows).

persisted for five days at daily routine chest radiographs. Con-
trast-enhanced chest CT scan, which was performed in order
to find out the cause of lobar atelectasis, revealed obliteration
of the proximal portion of the left upper lobe bronchus (Fig.
2). The previous bilateral hemopneumothoraces, pneumome-
diastinum, and subcutaneous emphysema were no longer
seen, and the extent of the cavitary consolidation in the right
upper lobe has decreased. Since left upper lobe atelectasis
persisted for eight days more, a bronchoscopic examination
was performed, which showed near-complete obstruction of
the left upper lobar bronchus.

Four days after the bronchoscopic examination (the 27th
hospital day), bronchial segmental resection and end-to-end
anastomosis of the left upper lobar bronchus was performed.
At surgery, approximately 5-mm-long, stenotic segment was
found at the proximal portion of the left upper lobe bronchus,
showing complete luminal obstruction by fibrotic change.

Pathologic specimen obtained from bronchial segmental
resection showed obliteration of the bronchial lumen by dense
fibrous overgrowth and granulation tissue, which was identi-
cal to the pathologic finding of Case 1. The previously atelec-
tatic left upper lobe was fully re-expanded after surgery, and
the recovery was uneventful.

**DISCUSSION**

In most cases, a tracheobronchial rupture is suspected radi-
ologically in front of pneumomediastinum, cervical and tho-
racic subcutaneous emphysema, and persistent pneumotho-
rax and bronchopleural air leak despite chest tube placement
(2). A bronchoscopic examination can confirm the presence
and location of the airway rupture, which is reconfirmed and
repaired by surgery. Although chest CT scan sometimes visu-
alizes directly the presence of tracheobronchial rupture, it can
generally show only secondary findings of an air leak (2).

Secondary findings of an air leak are consequences of free
communication between the site of the tracheobronchial dis-
ruption and the pleural cavity, which results in a large per-
sistent pneumothorax despite tube thoracotomy (6). If the
bronchial transection is incomplete and there is little com-
unication between the proximal transected bronchus and the
mediastinum and/or the pleural space, a once-developed
pneumomediastinum or pneumothorax will subside well either
spontaneously or after chest tube placement. In this circum-
stance, the tracheobronchial injury will not be noticed radi-
ologically until delayed atelectasis resulting from fibrotic bron-
chostenosis appears as in our cases (6). In our cases, because
the initial pneumomediastinum and subcutaneous emphy-
sema and/or pneumothoraces subsided well either spontane-
ously or after chest tube placement within 15 days with the
vital signs of the patients being stable, the bronchial injury
remained unnoticed over a period of two weeks.

On review of literature regarding bronchial rupture after
blunt chest trauma, one of two patients reported by Epelman
et al. (7) was similar to our cases, in whom a bronchial injury
was identified as delayed atelectasis of the left lower lobe with
bronchial obliteration at CT ten days after blunt chest trau-
ma. Ozcelik et al. (8) reported a case with combined right
main bronchial disruption and chylothorax manifesting as a
consolidated right lung and a small pleural effusion that were
diagnosed 75 days after blunt chest trauma.

In our cases, the cause of delayed atelectasis detected at chest
radiographs and CT was histopathologically proved to be focal
bronchial wall thickening due to exuberant tissue reaction
to recent bronchial wall injury. The subclinical injury to the
bronchial wall (bronchial mucosal tear, undisplaced and/or
incomplete bronchial rupture) was unnoticed initially but
became evident later after development of an active healing
process in the traumatized region. The healing process result-
ed in bronchial wall thickening with resultant airway narrow-
ing, which manifested at chest CT as luminal obliteration of
the involved bronchus with distal atelectasis of the lung. We
think it is noteworthy that the appearance of atelectasis was
seen ten days after the injury in both cases of our series. As
for the initial CT diagnosis of a bronchial rupture, multiplanar
reformation- or three-dimensional images of multi-detector
row CT scan could demonstrate an airway injury better than
axial CT images.

In conclusion, we report two pediatric cases of delayed bron-
chostenosis with distal atelectasis after recent blunt chest tra-
uma with pathologic correlation. We suggest that, when delay-
ed pulmonary atelectasis is encountered in children who sus-
tained a blunt chest trauma, a possibility of subclinical bron-
chial wall injury should be considered in addition to simple
mucoid plugging.
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