

# Rupture of the Thoracic Trachea and Main Bronchi after Blunt External Trauma

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## SUMMARY

Over a 30-month period, July 1970 - December 1972, 136 patients with multiple rib fractures and other chest injuries were treated in the Lung Unit at the Karl Bremer Hospital. Of these, 2 patients presented with complete avulsion of the right main stem bronchus at the level of the carina. A third patient sustained a tear of the trachea after being kicked on the sternum. In one case the trachea itself, as well as the left main bronchus, was involved in the tear.

The diagnosis was made at bronchoscopy and immediate suture repair was undertaken in 2 patients. The patient with the tracheal tear presented late and was treated conservatively. All 3 patients made a complete recovery. The literature on this type of injury is reviewed and recommendations are made regarding early diagnosis and treatment.

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With the increase in high speed traffic there has been a concomitant increase in the incidence of severe injuries of the tracheobronchial system. Most of the published cases were diagnosed at postmortem examination.<sup>1,2</sup> Rupture of the thoracic trachea is very rare and only 37 cases were published up to 1965.<sup>3</sup>

Over a 30-month period 136 patients were treated in the Lung Unit at Karl Bremer Hospital for multiple rib fractures and pulmonary injuries caused by severe blunt trauma. Two patients presented with complete avulsion of the right main stem bronchus at the level of the carina. In one case the trachea itself, as well as the left main bronchus, was involved in the tear. A third patient sustained a laceration of the thoracic trachea after being kicked on the sternum.

Penetrating injuries of the cervical trachea are common and are not considered here.

The purpose of this report is to draw attention to this serious, but eminently curable, condition and to advocate the use of bronchoscopy in all cases of severe blunt thoracic trauma.

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## CASE REPORTS

### Case 1

A 20-year-old male sustained multiple injuries when his car fell down a steep cliff. He was still able to climb about 100 m to the road and hitch-hike to the nearest hospital, from where he was sent to our unit. Bilateral fractures of the mandible were present, and moderate surgical emphysema was observed on the right side. A contusion was noticed over the right anterior chest wall.

A roentgenogram of the chest revealed surgical emphysema subcutaneously and in the mediastinum, but no haemo- or pneumothorax. No rib fractures could be seen. At bronchoscopy a large tear was observed at the level of the carina, involving the whole circumference of the right main bronchus, the carina itself and the medial part of the left main bronchus.

At thoracotomy a complete avulsion of the right main stem bronchus was found, with separation of the free ends of the bronchus for about 3 cm. A laceration of the medial side of the left main bronchus was also present, the tear going through the carina. A vascular clamp was placed on the right main bronchus stump and the left

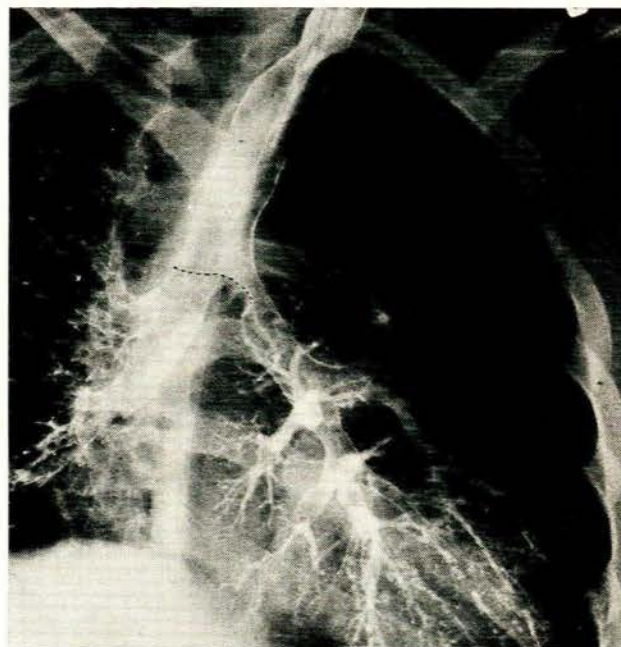


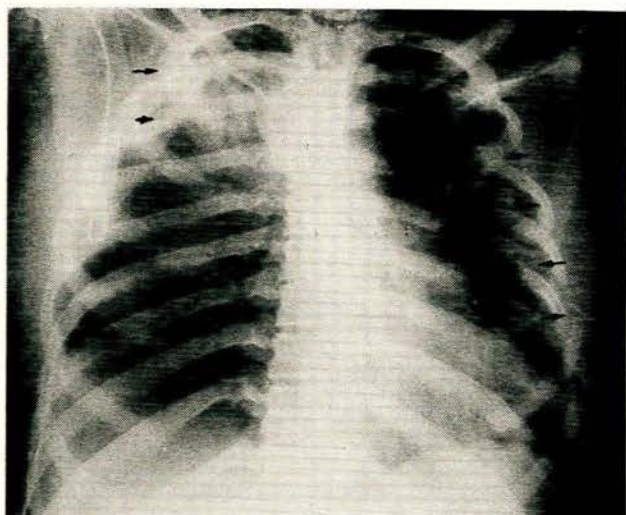
Fig. 1. Case 1. Postoperative bronchogram. The dotted line indicates the extent of the original tear. A suture granuloma is visible near the origin of the left main bronchus.

bronchus was repaired first with interrupted silk sutures. The endotracheal tube was then advanced into the left side and primary suture repair was performed on the right side. A tracheostomy completed the procedure. The postoperative course was uneventful.

Bronchography was done 2 months after surgery, and 2 suture granulomata were noted (Fig. 1). At bronchoscopy the offending sutures were removed and the granulomata excised. The patient remains well 2 years postoperatively.

## Case 2

A 25-year-old female was involved in a motor vehicle-pedestrian accident and consequently admitted to the lung unit in a severe state of shock with bilateral rib fractures and a fractured pelvis (Fig. 2). After resuscitation and bilateral tube thoracotomy, a bronchoscopy was done and a tear of the right main bronchus noticed.



**Fig. 2. Case 2. Roentgenogram of the chest showing 9 rib fractures on the left, and fractures of the 2nd and 3rd ribs posteriorly on the right (arrows). A haemothorax is present on the right side with evidence of contusion of the upper lobe. The right main bronchus was completely avulsed.**

At thoracotomy a complete avulsion of the right main stem bronchus was repaired by primary suture—wide separation of the free ends of the bronchus was again observed. A tracheostomy was done. The patient had to be ventilated for one month because of severe intrapulmonary contusion. The postoperative course was complicated by a small bronchopleural fistula and a *Pseudomonas aeruginosa* infection in the right pleural space, which responded well to drainage and antibiotics.

At bronchoscopy 3 weeks after surgery the orifice of the fistula could be seen and a suture granuloma was removed. At a later stage the bronchopleural fistula was seen to have healed by fibrosis. The patient remains well 18 months postoperatively.

## Case 3

A 30-year-old male was kicked on the sternum and presented one week later with a history of slight haemoptysis. No external injuries could be seen and X-ray films of the chest were normal. At bronchoscopy a longitudinal tear 2 cm long was seen in the membranous trachea 3 cm above the carina. Because of the time elapsed since his injury and the absence of air in the mediastinum or neck, it was decided to treat the patient conservatively. At repeat bronchoscopy 2 weeks later the lesion was seen to have healed almost completely and the patient was asymptomatic.

## DISCUSSION

Tracheobronchial rupture is not common, and very few cases will be seen in the average thoracic surgery department. In an analysis of 585 fatal traffic accidents in the metropolitan New Orleans area,<sup>4</sup> only 5 patients sustained a lacerated trachea. In a series of 265 patients with thoracic injuries,<sup>5</sup> no cases of tracheal or bronchial injuries were seen.

The actual mechanism of tracheobronchial injury caused by blunt trauma is not clear. A number of factors may be involved. Sudden deceleration of the pendulous lungs, fixed at the hilum, may have been the cause in 2 of our patients.<sup>6</sup> A sudden increase in the intraluminal pressure, with the glottis closed, was probably responsible for the tracheal tear in the third case. Direct pressure of the sternum on the vertebral column may in theory crush the trachea and main bronchi, but the majority of cases are probably due to indirect factors.

Most tracheobronchial injuries due to blunt trauma occur in the region of the carina, and the right main stem bronchus is most frequently involved. These patients may have no other injuries, and the actual bronchial rupture may remain unnoticed until the patient presents with the complications of bronchial stenosis. In up to 50% of published cases, no rib fractures were seen.<sup>7-9</sup> This is a very important clinical observation.

In a review of 1 178 necropsy reports on persons dying after trauma, 33 cases of tracheobronchial injury were found.<sup>2</sup> In this series, however, only 3 had no rib fractures. The thoracic trachea was involved in 5 instances and the bronchi in 28. Four patients had a rupture at more than one site.

Initial treatment is for associated injuries and shock, and to ensure an adequate airway. In our unit all cases of severe thoracic trauma undergo bronchoscopy to clear the airways of secretions and to exclude tracheobronchial injuries. An associated pneumothorax is treated by intercostal tube drainage. If tracheostomy is necessary, then the bronchoscopy is performed immediately before this procedure.

Once the diagnosis of airway rupture is established, immediate surgery should be undertaken with primary suture repair of the lesion. A tracheostomy should be done to decrease the intratracheal pressure.

Small tracheal ruptures usually heal without problems, but the patient has to undergo repeat bronchoscopy.

Tracheal or bronchial stenosis usually follows an undiagnosed large rupture. If bronchial stenosis is complete, the distal lung, although atelectatic, may remain free of infection. On the other hand, atelectasis and infection always occur distal to a partially occluded bronchus. In these infected cases pulmonary resection may be the only effective therapy. Reconstruction of the stenotic bronchus should be done when there is no distal pulmonary infection. Stenosis of the trachea after an undiagnosed rupture is a formidable problem, especially when the stenosis is near the larynx. In these cases a permanent tracheostomy is the only answer.

The mortality of acute rupture of the airways depends on the associated injuries and the interval between injury

and diagnosis. In blunt trauma the patient may die of cardiac, brain or abdominal injuries before reaching hospital. Those patients who arrive alive are in the minority.

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