

Rupture of main bronchus due to blunt chest trauma in children: a report of two cases

Çocuklarda ana bronşun künt göğüs travması kaynaklı rüptürü: İki olgu sunumu

İlan Bar,¹ Michael Papiashvili,¹ Abdelghaffar A. Alzaanin,² Vladislav Gofman³

¹Department of Thoracic Surgery, ³Anesthesiology, Assaf Harofeh Medical Center, Israel;

²Department of Cardiothoracic Surgery, Shifa Hospital, Gaza, The Palestinian National Authority, Palestinian

Tracheobronchial injury results from blunt or penetrating chest trauma and is a rare, but potentially fatal condition. Rupture of the main bronchus or carina by blunt trauma is unusual, and it is one of the most severe injuries in children. The diagnosis of this kind of injury is challenging and requires a high degree of clinical suspicion. Here, we report two cases of total rupture of the main bronchus. Primary repair of the bronchial rupture was performed two weeks after the injury in the first case, and immediately after the injury in the second case.

Key words: Bronchi; carina; child; rupture; trauma.

Tracheobronchial injuries (TBIs) have a high mortality rate unless aggressive treatment is used. In 76% of patients, the injury occurs within 2 cm of the carina and in 43% within the first 2 cm of the right main bronchus.^[1] Tracheobronchial injury results from blunt trauma to the thorax and is generally an urgent condition, but sometimes the diagnosis and surgical repair are delayed. The first emergency repair was described by Scannel in 1951.^[2] The occurrence of TBI is uncommon in the pediatric trauma population, and total rupture of the airway after blunt trauma is even rarer.^[3,4] We present two patients with total rupture of the bronchus who were successfully treated surgically.

CASE REPORT

Case 1- A six-year-old girl was admitted to a secondary care hospital in Gaza for observation after being thrown to the ground from a moving car. She was conscious on arrival, slightly dyspneic, and

Trakeobronşiyal yaralanma künt ya da penetran göğüs travmasından kaynaklanır ve nadir ancak potansiyel olarak ölümcül bir durumdur. Ana bronşun ya da karinanın künt travma nedeniyle rüptüre olması nadir bir durumdur ve çocuklarda en ciddi yaralanmalardan biridir. Bu tip yaralanmanın tanısı güçtür ve yüksek seviyeli klinik şüphe gerektirir. Burada iki total ana bronş rüptürü olgusu sunmaktayız. Bronşiyal rüptürün primer onarımı ilk olguda yaralanmadan iki hafta sonra, ikinci olguda ise yaralanmadan hemen sonra gerçekleştirildi.

Anahtar sözcükler: Bronşlar; karina; çocuk; rüptür; travma.

pale. A physical examination revealed subcutaneous emphysema in the right chest, and a chest X-ray showed bilateral pneumothorax (Figure 1). Right and left chest tubes were inserted, and a small air leak was demonstrated from the right chest tube only. The girl was hospitalized for further observation. On the fourth day following injury, an X-ray showed a total collapse of the left lung. A computed tomography (CT) scan revealed total atelectasis of the left lung. A pediatric flexible bronchoscopy revealed complete closure of the left main bronchus 1.5-2 cm from the carina. A total rupture of the left main bronchus was suspected, and the patient was transferred to our department two weeks after the injury.

On arrival the patient was in good health, slightly tachycardic (120 beats/minute), and pale with blood pressure of 100/60 mm/Hg. Physical examination revealed poor respiratory excursion of the left chest and absence of breath sounds over the left hemithorax.

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Correspondence: İlan Bar, M.D. Head, General Thoracic Surgery Unit, Assaf Harofeh Medical Center, 70300 Zerifin, Israel.
Tel: 972-8-9779822 e-mail: fredricag@asaf.health.gov.il



Figure 1. Chest X-ray of the six-year old girl with a bilateral pneumothorax and subcutaneous emphysema on admission to hospital after the injury.

A left explorative thoracotomy was performed on the 16th day post-injury. An endotracheal tube was inserted into the right main bronchus under bronchoscopy guidance, and the left chest was entered via a standard posterolateral incision into the fourth intercostal space. The left lung was airless and small. The left main bronchus was completely divided with the distal and proximal ends covered by fibrous tissue (granulations) and occluded, and there was a 2.5-3 cm gap between the bronchial ends. The distal end of the left main bronchus was opened and a large quantity of gelatinous, clear mucus was aspirated from the bronchial lumen. Both bronchial ends were debrided, and bronchial continuity was re-established using absorbable interrupted sutures (Vicryl 4.0) between the distal and proximal ends of the transected left main bronchus. The endotracheal tube was repositioned into the trachea, and the left lung was inflated and fully expanded without any apparent air leak along the suture line. The chest was drained with one intercostal chest tube, and the wound closed. The patient was extubated 24 hours after surgery.

Postoperatively, the patient was treated with broad-spectrum antibiotics for five days, aggressive

physiotherapy and once-a-day toilet bronchoscopies to remove bronchial secretions. The daily chest radiographs were normal, the chest tube was removed on the fourth postoperative day, and on the fifth postoperative day the girl was discharged home in good health. Follow-up to date is normal.

Case 2- A seven-year-old-girl was admitted to a secondary care hospital in Gaza after being crushed by a collapsed stone wall. She was unconscious and emergently intubated. Spine radiography was normal, and a brain CT scan revealed only a fracture of the right temporal and right mastoid bones. However, a chest X-ray revealed right-sided tension pneumothorax. Consequently, a chest tube was inserted, but the lung remained collapsed, and a large air leak was detected from the chest drain. Total rupture of the right main bronchus was suspected, and the patient was transported to our department. Upon admission, the patient was unconscious, cyanosed, tachypneic with 60 breaths/minute and tachycardic at 150 beats/minute, Glasgow coma scale (GCS)= 6, temperature= 35.6 °C, and blood saturation 85-88%. Also, there were no pathologic reflexes upon neurological examination. The blood gas analysis was as follows: pH 7.3; pCO₂ 73 mm/Hg; pO₂ 48 mm/Hg. A physical examination revealed bilateral subcutaneous emphysema and reduced movement of the right hemithorax. A computed tomography (CT) scan revealed total atelectasis of the right lung (Figure 2). A flexible bronchoscopy was performed intraoperatively that revealed complete closure of the right main bronchus.

An exploratory thoracotomy was urgently performed. An endotracheal tube was inserted into the trachea, and, after exploration, it was repositioned to the left main bronchus under the guidance of the surgeon. The lung was totally airless, and the right main bronchus was completely divided from the carina. Bronchial continuity between the distal and proximal ends of the transected right main bronchus and carina was re-established using interrupted absorbable sutures (Vicryl 4.0). The endotracheal tube was repositioned back into the trachea. The right lung was fully re-expanded without any apparent air leak from the suture line, the chest was drained with one intercostal chest tube, and the wound closed.

Early and late postoperative periods were without complications, the daily chest radiography was normal, and once-a-day toilet bronchoscopies were performed. The patient was treated with broad-spectrum antibiotics for five days following surgery and aggressive physiotherapy and was discharged home on the sixth postoperative day in good health. Follow-up of patients revealed no complication.

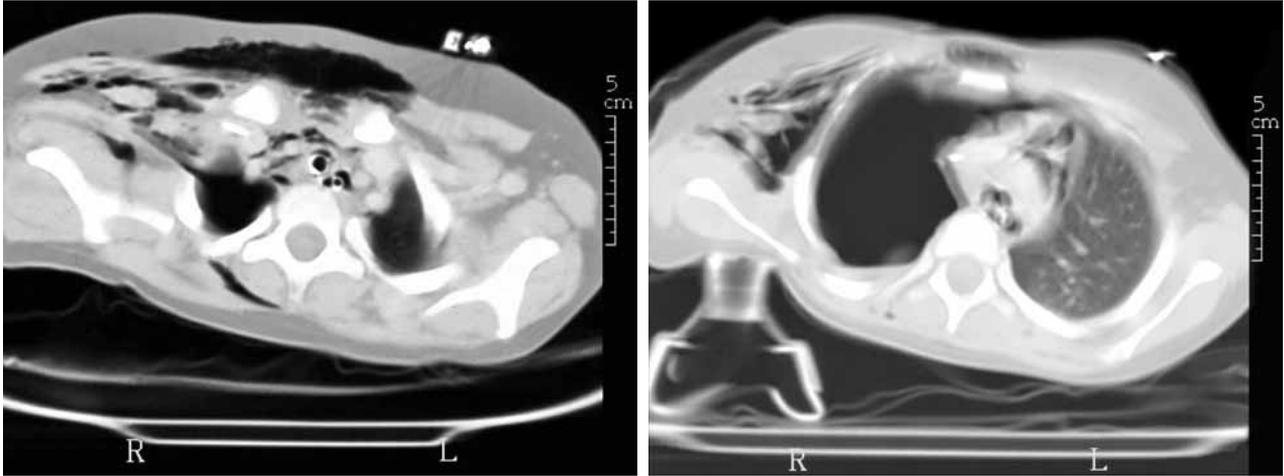


Figure 2. Computed tomography scans of the seven-year-old girl showing total atelectasis of the right lung due to rupture of right main bronchus.

DISCUSSION

Injuries to the major airways are uncommon in childhood with most being caused by blunt trauma. Airway injuries usually occur within 2.0 cm of the carina and may be fatal if not recognized and treated promptly. However, they may cause no immediate ill effects.

Most TBIs occur due to automobile mishaps, usually collisions. Airway disruption should be suspected in the presence of dyspnea, tachypnea, subcutaneous emphysema, cyanosis or pneumothorax. It is also suggested by a continuous air leak or non-expanding lung after pleural drainage insertion. Flexible bronchoscopy provides a definitive diagnosis, but in cases of emergency, this procedure may be omitted.^[4] Chest X-ray remains the basic imaging procedure, but some articles have reported cases of traumatic bronchial rupture diagnosed by CT, which has proven helpful in visualizing the level of the rupture.^[5,6] Traumatic bronchial injuries in children are usually recognized and repaired immediately, but cases of delayed diagnosis due to the total absence or insignificant clinical symptoms have also been described in the literature.^[7]

In bronchial injury, when complete disruption occurs, the distal end retracts inferiorly 1 to 4 cm, and within five to seven days, granulations and secretions obliterate the bronchus. The distal bronchial tree remains sterile and continues to secrete mucus, and air is rapidly absorbed. The lungs become atelectatic, but no cases with infection, abscess, or bronchiectasis have been reported. With time, the proximal and distal bronchial stumps heal completely and epithelize. The goal of surgery is to find the distal and proximal ends of the ruptured bronchus, after primary gentle

debridement of the injured tissue adjacent to the rupture, and reconnect them without causing further trauma to surrounding tissues. This may be quite tedious and difficult because of the danger of injury to pulmonary vessels due to scar tissue that is usually quite dense. As soon as the anastomosis is completed, a fiberoptic bronchoscope is used to ensure that the distal bronchial tree is completely cleared and to remove any blood from the area of the anastomosis.^[8] The success of the surgery depends on the kind of endotracheal tube used for intubation, the most comfortable being a double-lumen endotracheal tube. However, if this is not feasible, intubation of the opposite bronchus can be performed as seen in our cases. After performing anastomosis, the lung must be inflated for a period of time prior to closure of the thorax, especially in cases with delayed surgery due to a chronically collapsed lung. In addition, immediate postoperative extubation is preferred in order to reduce pressure on the new anastomosis.

In conclusion, rupture of the main bronchus is a rare, but potentially serious complication of blunt chest trauma in childhood. Successful repair depends on correct diagnosis and appropriate surgical and anesthesiological management. Postoperative therapeutic toilet bronchoscopies and aggressive physiotherapy are of paramount importance.

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