Case report

Bronchial rupture in a young child: A case report

G.A. Porro a, C.D. Roche b,*, E. Banderker c, A.B. van As d

a Istituto di Anestesia e Rianimazione, Fondazione IRCCS Ca’ Granda, Ospedale Maggiore Policlinico, Milano, Italy
b The Student Centre, St George’s, University of London, Cranmer Terrace, London SW17 0RE, UK
c Department of Paediatric Radiology, The Red Cross War Memorial Children’s Hospital, Cape Town, South Africa
d Department of Paediatric Trauma, The Red Cross War Memorial Children’s Hospital, Cape Town, South Africa

ARTICLE INFO

Article history:
Accepted 8 January 2014

ABSTRACT

We report a case of bronchial rupture in a five-year-old boy with polytrauma after being hit by a motor vehicle. He was initially found to have a base of skull fracture, bilateral pulmonary contusions, lacerations and haemopneumothoraces, cardiac contusion, left first rib and right scapula fracture, extensive surgical emphysema, liver laceration and splenic laceration. At exploratory laparotomy he became difficult to ventilate with massive right-sided air leak. He returned to ICU where high-frequency ventilation was utilised. He required an exploratory thoracotomy which revealed an avulsed right middle bronchus from the right main bronchus which had not been visible on CT or bronchoscopy. Right middle lobectomy was performed, the bronchial rupture was sutured and chest drains were inserted to reinflate the right lung during his 3-week inpatient stay. His Trauma Revised Injury Severity Score (TRISS) predicted a 30% chance of survival from his injuries. He made excellent progress on the ward and was discharged for rehabilitation at his local medical service.

Conclusion: Bronchial rupture is not always visible on CT and can cause ventilator air leak to develop many hours after the injury.

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1. Introduction

Traumatic lung contusion is the most common type of blunt chest trauma [1]. In the paediatric population the force of the chest trauma and the resulting contusion can be massive without causing a fracture due the more pliable cartilaginous rib cage in children.

Traumatic rupture of the tracheobronchial tree requires even greater force and is therefore a rare injury, especially in children. It is often fatal, with one series reporting a mortality of almost 30% with half of the deaths in the first hour [2]. These traumatic ruptures are usually the consequence of a high speed motor accident and they are usually associated with multiple other organ injuries.

2. Case report

We present a case of polytrauma in a five year old boy who was hit as a pedestrian by a motor vehicle. At the local hospital his GCS dropped from 14 to 12 and he was intubated and transferred. He arrived at the trauma emergency room of our tertiary level trauma centre in the evening at 22:00, four hours after the accident. A right-sided chest drain was inserted which initially drained 300 mls of blood. The patient was initially hypotensive, with a heart rate of 180 bpm, blood pressure 122/85 mmHg, haemoglobin of 8 mg/dl and no urine output and was transfused with 300 mls of blood. Pupils were equal and sluggishly reactive to light and there was clear fluid leaking from the left ear. The abdomen was distended.

A whole-body digital low radiation dose scan (Lodox-scan) was taken (Fig. 1). This showed extensive bilateral pulmonary contusions and lacerations. There was a pneumothorax on the right with an intercostal drain in situ and a pneumothorax on the left. There was extensive subcutaneous emphysema of the right chest and mediastinum. There was no obvious abnormality of the C-spine and no fracture of the long bones.

Subsequent brain CT revealed a base of skull fracture involving the left mastoid bone with no intracranial haemorrhage. A CT scan of the chest confirmed the Lodox findings of extensive bilateral pulmonary contusions involving all lobes with multiple lung lacerations and bilateral pneumothoraces with extensive surgical emphysema involving the right chest wall, the neck, the right flank and the thecal sac. Additional findings revealed by CT were a left 1st rib fracture and fractured right scapula, right lung pleural adhesions and a small right basal haemothorax. Serum troponin...
I was 169 (normal < 10) and CKMB was 325 (normal < 24) which suggested the presence of significant cardiac contusion. The bronchial rupture itself was not seen.

Abdomen CT revealed liver, right adrenal and splenic lacerations with haemoperitoneum and a suspected pancreatic injury. The child was admitted to the ICU that night. He received a further blood transfusion and inotropes. The next morning an exploratory laparotomy was performed because of ongoing hemodynamic instability. Findings were haemoperitoneum with splenic and liver hematoma with no bowel perforation.

At surgery and on return to ICU he became extremely unstable with a left tension pneumothorax which was decompressed with an intercostal drain. He required high frequency ventilation with high FiO₂ and a massive right-sided air-leak was noted. The patient was returned to theatre where he had a bronchoscopy which failed to show the rupture in the right main bronchus. An exploratory right posterolateral thoracotomy was performed through the 5th intercostal space. A large volume of clotted blood in the pleural space was seen. Major air-leaks were noted on the middle lobe bronchus and the rupture was visualised as a complete avulsion of the right middle lobe bronchus from the right main bronchus. The right middle lobe was not viable and a lobectomy was performed. A bronchoplasty was performed whereby the remaining bronchi of the lower and upper lobe were sutured to the right main bronchus.

Surface air leaks were noted in the right upper and lower lobe and a large pseudocyst was seen in the lower lobe. Despite the significant contusions both lobes had a reasonable expansion. One left and two right-sided chest drains were inserted. The patient required 7 days of ventilation in ICU. Two of the chest drains were withdrawn on day 9 and the patient was discharged to the trauma ward with one right-sided chest drain in situ.

Despite the repair, a large posterior right-sided pseudocyst was preventing re-expansion of the right lung (Fig. 2). The remaining right-sided chest drain became blocked and was removed. As the right lung was not re-expanding (Fig. 3), a ‘pigtail’ chest drain was inserted on day 12 to deflate the pseudocyst and moderate lung re-expansion was subsequently seen on chest roentgenogram (Fig. 4). His head injury caused the patient to show some signs of a frontal lobe syndrome, such as an unusual behaviour of sitting up and then throwing himself down onto his left side, but this resolved and he otherwise recovered well with physiotherapy and nursing care. On day 21 after injury he was discharged from hospital with neuro-rehabilitation to be done at his local medical service.

3. Discussion

Tracheobronchial rupture is a very rare injury in children [6,7]. Proposed mechanisms of injury are a rapid decrease in the anteroposterior diameter of the thorax with a compression of the airway between the sternum and vertebrae, a sudden increase in intrabronchial pressure against a narrow glottis and rapid deceleration [8]. It has been reported that 80% of these injuries occurring after blunt trauma take place within 2–3 cm of the

![Fig. 1. The Lodox® scan rapidly produces a whole body roentgenogram, demonstrating bilateral lung opacities and transclucencies, representing bilateral cystic areas, contusions and pneumothoraces with surgical emphysema of the right chest, neck and mediastinum.](image1)

![Fig. 2. Axial slice of CT chest showing large posterior right pseudocyst which resulted from air leak from the bronchial rupture.](image2)

![Fig. 3. Chest roentgenogram showing very poor lung expansion of the right lung following repair of the right bronchial rupture and right middle lobectomy.](image3)

![Fig. 4. Chest roentgenogram showing expansion of the right lung after insertion of a Pigtail intercostal catheter.](image4)
carina [9–11]. In our case the rupture was a complete avulsion of the right middle lobe bronchus from the right main bronchus. The diagnosis of bronchial injury is difficult and can be delayed due to the fact that initial clinical symptoms like dyspnoea or subcutaneous emphysema are non-specific. Furthermore, the high impact trauma that causes bronchial rupture inevitably also results in multiple severe injuries. Our patient had severe injuries to the head, lungs, heart, liver and spleen.

Some clinical signs of bronchial rupture were seen immediately, namely extensive subcutaneous emphysema and ongoing pneumothorax despite the presence of a chest drain. It is of note that the bronchial rupture was not visible on CT, even when reviewed in hindsight by the consultant radiographer after the diagnosis had been made. It was also not seen on bronchoscopy. It might be assumed that such a macroscopic anatomical injury would be likely to be visible, leading the clinician into a false sense of security if these investigations are negative.

The patient only became difficult to ventilate 24 h after the accident. This might also make the diagnosis unclear, especially if the clinician were to reason that if a bronchial rupture were causing the difficult ventilation this would have happened from the time of the rupture and not 24 h afterwards. In this case, it is possible that the increasingly difficult ventilation and air leak developed following anatomical changes surrounding the rupture, such as the large pseudocyst which evolved near the injury in the right lower lobe. It is of note that the child was able to maintain his oxygen saturation until this point, when he became hypoxic, could not be ventilated with conventional ventilation and needed high frequency ventilation. Previous clinical reports have also described the use of high frequency ventilation in bronchopleural fistula and concluded that this method improved alveolar ventilation and decreased the extent of the air leak, making the patient more stable for surgical repair [12,13].

Of relevance to regions with high rates of TB, the radiographic images showed extensive parenchymal opacification throughout both lungs interspersed with radiolucent areas of cyst formation. Given the high prevalence of TB in South Africa, we ruled out pre-existing TB with a Mantoux test which was negative. Knowing that the cystic lesions were the result of the polytrauma rather than an existing infective process allowed us to treat the injuries appropriately.

The patient’s Injury Severity Score (ISS) [3] was calculated to be 57 and his Revised Trauma Score (RTS) [4] to be 6.904. Using these figures the Trauma and Injury Severity Score (TRISS) [5] was used to give a predicted chance of survival of 30%.

4. Conclusion

Clinicians should be aware that a bronchial rupture is not always visible on CT or bronchoscopy. If a large ventilator leak develops in a patient with severe chest trauma, even many hours after the injury, a high index of suspicion is required. High frequency ventilation may be required in order to allow for surgical procedures such as bronchoplastic and/or lobectomy.

References