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Case report

Anesthetic management of a patient with bronchopleural fistula following blunt trauma chest: A brief report

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Abstract Blunt trauma to the chest resulting in rupture of a major bronchus is rare. These injuries are often fatal because of respiratory distress; difficulties in establishing an airway, and the high frequency of associated multiple organ injuries. We report the anesthetic and intensive care management of a patient with bronchopleural fistula following blunt chest injury and post-thoracotomy stump leak. This case was unique because of shearing of right main bronchus close to carina, such injuries are not only difficult to repair but also, double lumen tube was kept for more than 48 h to prevent reopening of the suture. Successful management of the case is described with brief review of the literature.

1. Introduction

Blunt chest trauma leading to rupture of a main bronchus is a rare entity with a high prehospital mortality [1]. Isolated bronchial tear without associated injury is rare. The incidence of bronchial rupture is low (0.03–2.5%) even in those with severe trauma and are on the rise with increasing number of road traffic accidents [2]. Patients with bronchial rupture reaching hospital alive have a 90% chance of survival and half of such patients may have no other injury. Here, we report the successful management of 19 days old near complete trans-section of right main bronchus with bronchopleural fistula with collapse of right lung. The site of injury was such that double lumen tube (DLT) was kept in postoperative for 48 h so that injury to the suture line could be prevented. There have been no

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reported cases where DLT has been used for such long time in tracheobronchial injuries because of the site of injury and associated inflammation.

2. Case report

A 15-year-old male, weighing 49 kg was brought to our emergency department of JPN Apex trauma centre of All India Institute of Medical Sciences, 19 days after an injury to the right side of his chest by the steering wheel of a tractor. Patient had complaints of pain over the right side of chest and breathlessness soon after the injury. He had no upper airway obstruction and there was no other associated injury. He was initially treated at a peripheral hospital, where intercostal drainage (ICD) was placed. He was then referred to a centre of specialized facilities, where on fiberoptic bronchoscopy near complete transaction of right main bronchus with bronchopleural fistula was diagnosed. The right lung was collapsed. After further investigation and treatment, he was referred to our tertiary centre for further management.

The patient was conscious and co-operative with stable heart rate and blood pressure (pulse rate = 92 beats/min, BP = 120/76 mmHg). Respiratory rate was 19 breaths per minute and peripheral oxygen saturation was 92–97% on room air. On auscultation, air entry was absent on the right side of the chest. There was collection of 250 ml of straw colored fluid in the right ICD. Chest compression test was negative. There were no other associated injuries. Arterial blood gas (ABG) values on room air were within normal limits (pH = 7.46, PCO_2 = 37, PO_2 = 70, HCO_3^- = 26.8, BE = 2.5). Chest radiograph and Computed Tomography (CT) Scan showed right sided pneumothorax with collapsed lung, absent bronchopulmonary markings with ICD in situ (Fig. 1).

Patient was planned for elective thoracotomy under general anesthesia because of massive air leak through bronchopleural fistula. In the operating room, routine monitors were attached and an epidural catheter was placed at T12-L1 level in the sitting position. Epidural infusion of bupivacaine was started. Routine anesthesia induction with fentanyl, propofol and rocuronium was done. Trachea was intubated using 32 Fr left-sided DLT. The position of the tube was confirmed by fiberoptic bronchoscopy (Fujifilm outer diameter 2.8 mm). Anesthesia was maintained with isoflurane in a mixture of oxygen and nitrous oxide (1:2), fentanyl and vecuronium. Patient was positioned in left lateral position and ICD was removed. Thoracotomy was done using a J-shaped incision in the 5th intercostals space. Intraoperative, decision for pneumonectomy was taken as there was severe contusion and collapse of right lung and the margin of the transected right main bronchus was sloughed and unrepairable. Pulmonary vein and artery were clamped and tied separately and right bronchus was cut and sutured. The absence of leak at suture site was confirmed by applying positive pressure ventilation up to 40 cm H_2O. A new ICD was placed in the 6th intercostal space and wound closed in layers. Intraoperative course was uneventful. At the end of surgery, patient was shifted to intensive care unit (ICU). Elective ventilation with DLT in situ was planned in the postoperative period. Any plan to change the DLT with single lumen tube could have resulted in injury and reopening of the repaired stump. At the same time, the positive pressure ventilation through single lumen tracheal tube could have opened the suture line. In the ICU, patient received sedation and analgesia with midazolam and fentanyl along with epidural analgesia. Patient was mechanically ventilated using pressure controlled mode (PCV) with following ventilatory settings: Peak inspiratory pressure of 20 cm H_2O, Respiratory rate 20 breaths/min, I:E ratio 1:2 and positive end expiratory pressure (PEEP) of 3 cm H_2O.

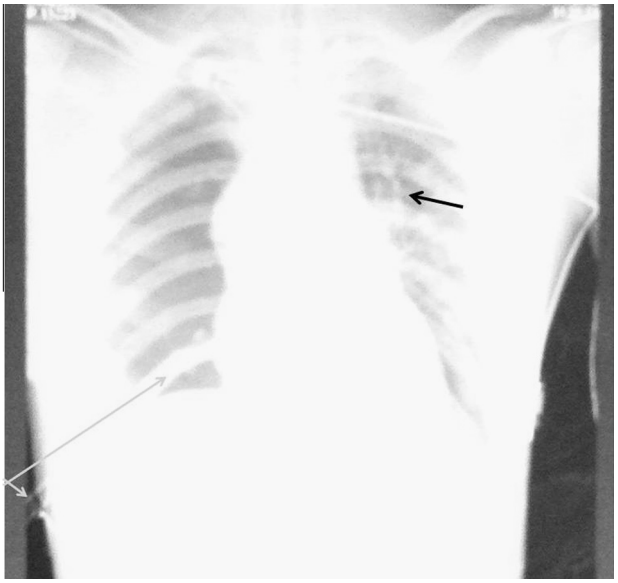

Figure 1 CX Ray showing right side pneumothorax with collapse of right lung. Broncho-pulmonary marking are present only in the left lung field (white arrow) not seen on the right side. Grey arrow shows the ICD in situ on the right side.

Four hours later in the ICU, the stump leaked due to malposition of the DLT, (Fig. 2) leading to difficulty in ventilation. The tube was repositioned with fiberoptic bronchoscope in ICU and the patient re-operated to repair the site of leak. Right thorax was opened through the same incision and major air leak was detected from right main bronchus, which was then secured. After the surgery, patient was again shifted to ICU with DLT in situ and this time patient was kept paralyzed with vecuronium infusion at 3 mg/h for next 48 h.

After two days, DLT was changed with 6 mm portex endotracheal tube using fiberoptic bronchoscope with due care not to injure the stump. The patient was electively ventilated for the next one day. On the third postoperative day, patient was weaned off the ventilator and later tracheally extubated. Further course in the hospital was uneventful and patient was discharged home on 14th day.

3. Discussion

Bronchial rupture usually results from high-speed motor vehicle accident, and it can also be caused by crushing or twisting injuries or a fall from a height. In a review of 265 patients with tracheobronchial injury by Kiser et al., motor vehicle accidents were found to be the most common (59%) cause of injury [3]. Bronchial rupture in children secondary to blunt trauma occurs most commonly in the adolescent age group and is more

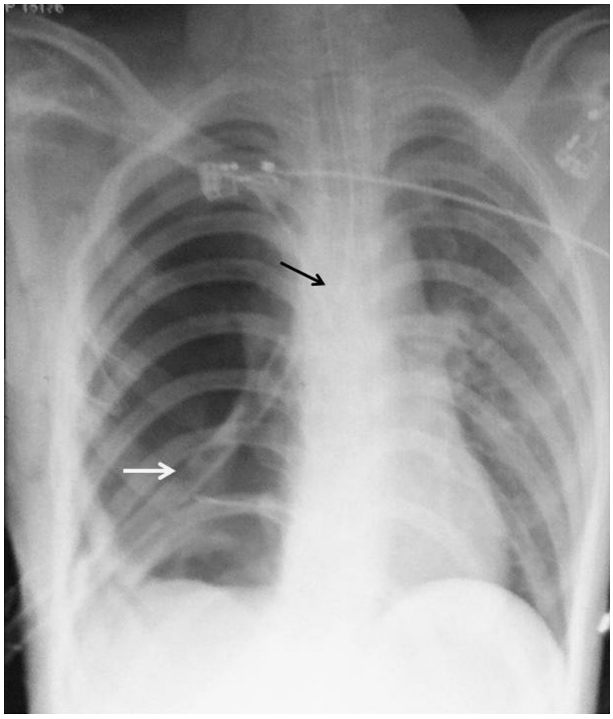

Figure 2 The displaced left DLT into the stump of the right main bronchus (black arrow) causing injury to the suture line. Right side of the thorax having ICD in situ (white arrow).

frequent in males than females [4]. Bronchial injuries commonly occur at the level of the main bronchus with an approximately equal distribution between right and left main bronchus. Approximately 10% injuries involve a lobar bronchus [5]. Late diagnosis of bronchial injuries is common and only 59% of bronchial injuries were diagnosed within 7 days in some studies [6]. The management of delayed presentation is more challenging and is related to the site of injury, degree of major airway destruction and distal pulmonary parenchymal destruction from chronic obstruction and infection.

Tracheobronchial injury should be suspected in cases of severe thoracic trauma involving fracture of the upper ribs. However, it may occur without rib fractures in young patients because of pliability of their chest wall [4]. The mechanisms that lead to bronchial ruptures include the following: sudden increase in intrabronchial pressure with a closed glottis, decrease in the anteroposterior diameter of the thorax and rapid deceleration [7]. Patients with tracheobronchial rupture may present with dyspnea, tachypnea, hemoptysis, subcutaneous and mediastinal emphysema, pneumothorax, atelectasis, persistent air leak and failure to expand the lung with thoracostomy tube drainage apart from other related injuries [8]. Chest X-ray is the basic imaging modality, but CT scan is helpful in visualizing the site of the rupture. Bronchoscopy is the best diagnostic method [9]. The ''fallen lung'' sign on the chest X-ray, atelectatic lung, inadequate expansion of the lung and massive air leak are highly suggestive of bronchial rupture.

In our patient the DLT was kept around 48 h that is not routinely practiced at our centre. The site of injury and subsequent site of repair compelled us to keep the DLT for such long time. Also, any attempt to change the DLT by single lumen endotracheal tube would have led to opening of the repair site. We did not encounter any case in literature where DLT has been kept for such long time.

Prolonged placement of DLT in trachea of our patient may have led to ulceration and edema, especially with movements therefore we paralyzed the patient. Prevention of any unnecessary movement at the surgical site as on coughing and straining was insured by giving muscle relaxant. Therefore in our suggestion it would be wise to keep patient deeply sedated or preferably paralyzed if DLT has to be kept for such long time. Paralyzing the patient completely not only reduces the chance of tracheal injury and edema but also reduces the chances of opening of surgical repair site as in our patient.

After giving ample time for surgical site for repair, on third postoperative day under fiber-optic guidance DLT was changed with single lumen endotracheal tube. Considering that the suture site would still be weak we used lower tidal volumes (i.e. 5–6 ml/kg, ideal body weight) in our patient and limit peak and plateau pressures (less than 35 and 25 cm H_2O respectively). These careful ventilatory settings also help prevent stump leak in our patient.

4. Conclusion

Injury to bronchus though rare is challenging for both the surgeons and the anesthesiologists particularly when close to carina as in our case. There is always a probability of injury to the operative site with the movement of endotracheal tube and thus DLT may be left behind in the postoperative period if planned for elective ventilation. Also the care should be taken to avoid any inadvertent movement of the patient (coughing, straining, bucking etc.) which may cause displacement of the DLT. Thus, deep sedation or even paralyzing the patient is required. Any attempt to change the DLT should be carefully done under vision using fiberoptic bronchoscope. Other precautions to prevent post-pneumonectomy lung injury such as use of low tidal volume (5–6 ml/kg) during controlled ventilation and restricted fluid administration perioperatively should be strictly adhered.

Conflict of interest

The authors declare that there are no conflict of interest.

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