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Case Report

Managing a major traumatic bronchopleural fistula in a resource scarce community

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A case of penetrating chest trauma owing to bull horn goring injury was managed surgically. Postoperative respiratory distress and severe hypoxia was managed initially by conventional modes of ventilatory assistance. We were unable to correct non resolving hypoxaemia through usual course of tracheal intubation and positive pressure ventilation. Large amount of persistent air leak at the intercostal chest tube drainage site arose the suspicion of associated severe traumatic bronchopleural fistula and led to try out alternative methods of respiratory support. An early tracheostomy was planned due to lack of facility for high frequency jet ventilation, which provided two-pronged benefits of a lowered airway resistance to breathing and avoided the need for positive pressure breaths.

Key words: Chest trauma, bull horn goring injury, hypoxaemia, traumatic bronchopleural fistula.

INTRODUCTION

We report a case of penetrating chest trauma with open haemopneumothorax with flail chest segment subsequent to bull horn goring injury brought to us in the emergency. Post-thoracotomy, augmented air leak at the chest tube drainage site on positive pressure ventilation confirm the diagnosis of full-blown bronchopleural fistula (BPF). Non-resolving severe hypoxaemia and ventilation perfusion mismatch in the postoperative period posed a major challenge to the trauma team and was judicially tackled and timely managed with help of an early tracheostomy. left side of the chest with paradoxical movement in the

CASE REPORT

A middle-aged man, weighing ~50 kg was received in the emergency, three hours after sustaining a bull gore injury to the left lower chest. The patient was conscious, restless with labored breathing.

Examination revealed a 4 × 3 cm, sucking wound on the adjacent chest wall. After initial resuscitation the wound was covered with a dressing, sealed on three sides and a chest drain inserted. X-Ray chest showed a left haemopneumothorax with fracture of ribs (5th, 6th, 7th and 8th).

Pre-operatively the patient had the following parameters- BP 124/86, Pulse rate 126/min and SpO_2 varying between 85.80% {ABG values were: paO_2= 52 mmHg, pCO_2 = 38 mm Hg, pH =7.33}.

He was shifted to operation theatre immediately and was preoxygenated with 100% oxygen. Injection midazolam 0.04 mg/kg and fentanyl 2 µg-kg was given as premedication. Induction was done with thiopentone sodium (200 mg) and relaxation was achieved with succinylcholine (1 mg/kg). One lung ventilation was instituted to isolate the healthy and collapse the injured lung with left sided double lumen endotracheal tube size 37 FG. The oxygen saturation was improved and maintained more than 95% throughout procedure.

Anaesthesia was maintained with 50% nitrous oxide in oxygen, intermittent ketamine and vecuronium bromide for muscular relaxation. Intraoperatively the BP was maintained between 100 to 110 mmHg systolic, pulse rate was 80 to 90 /min. The SpO2 and the blood gases were stabilized within normal limits. Left anterior

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thoracotomy was done. Multiple lacerations in the lung parenchyma were found at and around the injury site were sutured. A thoracostomy tube was placed in the left pleural space after cleaning the wound. Procedure was completed within one hour.

Extubation was carried out after reversing the neuromuscular blockade with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg and was shifted to intensive care unit for further monitoring.

In the ICU patient became restless and SpO2 dropped below 80% with 100% oxygen {ABG values were: paO_2 = 82 mmHg, pCO_2 = 37 mm Hg, pH = 7.36}. The flail chest segment showed excessive paradoxical excursions. The patient was reintubated immediately with single lumen tracheal tube size 8 mm to avoid any further respiratory compromise.

However, we are not able to achieve adequate saturation with volume ventilation. Pressure control ventilation (PCV) was initiated with rate = 18 breaths/minute, 100% FiO2 and + 5 PEEP (ABG: pH = 7.31, PaCO2 = 48 mmHg, PaO2 = 65 mmHg, SaO2 = 86%).

The major air leak was evident from the site of intercostal drainage tube mimicking a full-blown major bronchopleural fistula. The operating surgeons were consulted and the need for reoperation was considered. They were of the opinion that since the injury to the lung was parenchymal in nature and the laceration was extensive some amount of leak was inevitable and it would heal by itself.

The oxygen saturation decreased further below 80%. Patient has profuse blood mixed secretions including some clots in the endotracheal tube.

The insertion of the double lumen tube was inadvisable due to the danger of disrupting the operated rent in the left major bronchus, and the other alterations in the ventilatory modes were also failed to resolve the hypoxia. A new approach altogether was contemplated as facility for high frequency jet ventilation was lacking in our ICU.

We decided to go back to our initial decision of spontaneous ventilation but this time with a lowered airway resistance and thus decreased work of breathing and to avoid excessive pulmonary air leak hence less loss of tidal volume.

A tracheostomy was therefore conducted percutaneously and the ventilation supported with 4 to 8 cm H_2O CPAP.

For pain relief injection tramadol hydrochloride (100 mg) I.V was given and repeated six hourly along with deep intramuscular injection of diclofenac sodium (75 mg) eight hourly.

The labored breathing pattern stabilized over a period of 3 h, while the SpO2 values crossed the 95% mark and the blood gas values stabilized, initially with 100% and later 60% oxygen sufficed to achieve these goals. The patient stayed in the ICU for a period of 7 days, in which the tracheostomy closure was uneventfully achieved on the 6th day.

DISCUSSION

Severe chest injury with respiratory embarrassment is not an infrequent occurrence. The problems get worsened if there is fistulous communication between major bronchus and pleural cavity, which causes loss of delivered tidal volume (loss of TV is directly proportional to the size of fistula) and abnormal gas exchange[1, 2]. Furthermore, flail chest with paradoxical respiration and excessive oozing from rent site trickles into the tracheal tube require repeated suctioning beside severe chest pain, were the factors which contributed and further aggravate the hypoxaemia along with the possibility of a blow out disruption of the repaired lung laceration.

Bronchopleural fistula is an area of low resistance and all the oxygen was preferentially leaking through the path of least resistance thus compromising the proper ventilation of the unaffected lung along with significant loss of tidal volume, thus jeopardizing the minute ventilation and oxygenation[3].

Management of large bronchopleural fistula of ventilated patient is difficult, as achievement of adequate ventilation perpetually impairs fistula repair and the persistent air leak decreases the chance of survival[2]. The main threat is hypoxia not hypercarbia. Usually the high frequency ventilation was considered as FDA approved method of ventilation in the condition of massive air leak due to BPF[2] (particularly when associated with normal lung parenchyma and proximal BPF) which are difficult to manage by conventional modes of ventilation. AS in our case, in spite of pressure support ventilation with reduced inspiratory time and associated PEEP was unable to achieve the goal of improved oxygenation. The peak airway pressure and transpulmonary pressure (alveolar pressure minus intra-pleural pressure) minimization may solve the problem (as reduced airway pressure reduces fistulous flow hence, loss of tidal volume), which can be achieved with high frequency ventilation. Conversely, the facility for HFV was lacking in our ICU.

Our patient has dual and contradictory problem in terms of the ventilatory strategy to be adopted. A flail chest responds obviously better to IPPV while an air leak increases in the presence of positive pressure ventilation.

The insertion of the double lumen tube was inadvisable due to the danger of disrupting the operative rent in the major bronchus, the soiling of other lung was not the problem here. Non-surgical closure of BPL in the form of endoscopic Bio-glues, coils, stents etc was not possible due to lack of facility in our institution. It was decided to encourage spontaneous ventilation which might minimize the air leak with excessive loss of tidal volume and difficulty in maintenance of adequate minute ventilation; the main cause of severe refractory hypoxaemia in this case.

Furthermore, the patient was not tolerating the endotracheal tube and needs repeated suctioning of excessive tracheo-bronchial secretion and blood clots.

Finally an emergency tracheostomy was planned. This offered the following advantages: 1. it decreased the work of breathing, 2. it facilitated the proper suctioning of the tracheo-bronchial secretions including clots which would have repeatedly blocked the lumen of the endotracheal tube, and 3. it would be better tolerated by the patient.

The other possible fallouts of the trauma, like pain was aptly addressed by injection tramadol (100 mg) I.V. six hourly along with injection diclofenac sodium (75 mg) intramuscularly.

Tracheostomy is usually employed in several clinical settings, including facilitation of weaning from mechanical ventilation. In this case tracheostomy was done to solve the problem of non resolving severe hypoxia, as a simple method for management of major traumatic broncho-pleural fistula especially at centre which are lacking in advance facility. Furthermore, the shorter length of a tracheostomy tube compared to an endotracheal tube is associated with less airway resistance, which is required in our case (Bersten et al., 1989). Furthermore, the inspiratory resistive work, the PEEP, inspiratory pressure-time product (which closely correlates with the oxygen cost of breathing), as well as its resistive and elastic components are significantly reduced by tracheostomy (Moscovici et al., 2002). The overall reduced airway resistance decreases the work of breathing (Habib, 1989).

In nutshell, the patient benefited from early tracheostomy in more ways than one. The effects of the tracheostomy were broadly two fold, firstly interrupting the positive pressure ventilation prevented the air leak from the ‘blow out’ of the surgical site and by reducing the respiratory efforts required for normal tidal breaths (decreased airway resistance and decreased work of breathing) improved the oxygenation, hence save the life of the patient.

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