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Case Report

Anesthetic Considerations in a Case of Peumatocele Following Chest Trauma: A Case Report

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ABSTRACT

Pneumatocele is a lung bulla or rather an air filled cavity present within the lung parenchyma. It has various causes of origin. The bullous area is void of bronchoalveolar oxygenation and that certainly could result in dyspnea, hypoxia, symptomatic chest pain or even hemoptysis. This can result in spontaneous pneumothorax, pneumothorax provoked by mechanical ventilation or infection. We present a case of a 47yr old gentleman, who presented with a pneumatocele following trauma to chest. Prior to induction, thoracic epidural was inserted at T6-T7 and then he was intubated with the single lumen tube rather than the conventional double lumen tube for bullectomy. Post-operative pain relief using ropivacaine 0.375% and dexmedetomidine was effective. We discuss the anesthetic management and considerations in such a case.

Introduction

Pneumatocele is a lung bulla or rather an air filled cavity present within the lung parenchyma. It has the potential to either reabsorb spontaneously, expand or even rupture during the perioperative period which may result in life threatening complications. Lung bullae may be seen in patients with COPD, pulmonary infection, trauma or on mechanical ventilation. Giant bullae compress the lung parenchyma, increasing the dead space and causing a decrease in the elastic recoil pressure of lung and thereby resulting in impaired gaseous exchange while increasing the work of breathing [1]. Decompression of large bullae usually improves lung function [2]. Treatment options include surgical bullectomy and several transbronchial bronchoscopic methods [3-5]. We present a patient who presented with a large pneumatocele following trauma to chest, posted for thoracotomy and bullectomy. Anesthetic management in such patients are seldom reported.

Case Report

47yr old, 50kg male patient, chronic smoker and tobacco chewer, was admitted with alleged history of fall and trauma to chest. He had no known comorbidities. After trauma care and all necessary investigations, the patient was diagnosed to have a pneumatocele in the lower lobe of the left lung. Chest roentengenogram (Figure 1) and High-Resolution Computed Tomography (HRCT) revealed a large emphysematous bulla in the left lower lobe measuring 12.7x9.2cms (Figure 2). All other investigations were within normal limits.

On the day of surgery, after confirming adequate NBM hours, the procedure consent and high risk consents were taken. Once in the OT, all standard monitors were attached. The plan of anesthesia was to supplement general anesthesia with thoracic epidural anesthesia. The procedure was thoroughly explained to the patient before-hand. Thoracic epidural was inserted at T6-T7 interspace. Following this, he was induced with inj propofol 2mg/kg, inj fentanyl 2mcg/kg, intubated using 8.5mm, portex single lumen tube, after giving inj scoline

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2mg/kg, all while maintaining spontaneous ventilation, upto bullectomy. Thereafter, intermediate acting muscle relaxant inj vecuronium was given according to weight. He was maintained using 50% air + 50%O2+ sevoflurane with intermittent positive pressure ventilation on closed circuit.

The ventilator was set to deliver a low tidal volume of 5-6ml/kg with a high respiratory rate of 16-18/min, inspiratory: expiratory ratio of 1:3 and peak airway pressure of 8-10 cmH2O, positive end expiratory pressure of 5cmsH2O was given.

Epidural analgesia was given using inj ropivacaine 0.375%, 6ml+ inj dexmedetomidine 10mcg after a test dose of 3ml inj lignocaine+ adrenaline (1:2,00,000). No other intraoperative analgesia was required. The skin-to-skin duration of the surgery was 70mins with minimal blood loss and no intraoperative complications or hemodynamic instability (Figure 3). The analgesic effect lasted for 7 hours postoperatively. Patient was shifted to SICU for postoperative observation and analgesia was maintained through the epidural catheter until day 2 of surgery. After this, patient was shifted to the ward. He was also satisfied and pain-free with the analgesic modality used.

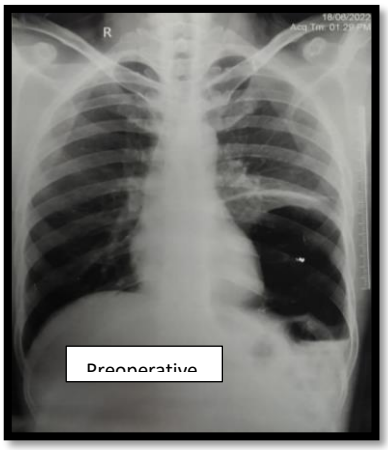

Figure 1- Chest roentengenogram

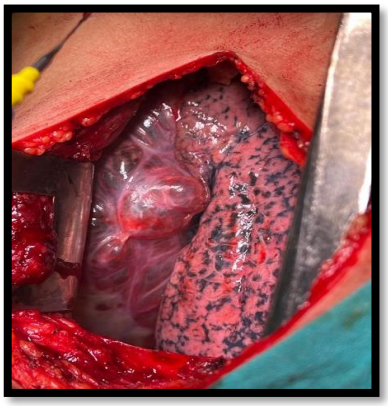

Figure 2- Pneumatocele

Figure 3- Stable intraoperative hemodynamics

Discussion

A pneumatocele is an air filled cavity which develops in the lung parenchyma. There are various causative reasons, trauma being one of them. The pathophysiology of traumatic pneumatocele is different from the infectious type [6]. There is an initial compression of the lung because of the external force of trauma, followed by rapid decompression due to an increase in negative intrathoracic pressure. A "bursting lesion" of the lung occurs and leads to pneumatocele formation. Intraoperative rupture of an emphysematous bulla with positive pressure ventilation can result in devastating life threatening complications like pneumothorax, pneumopericardium and hypoxemia due to ventilation perfusion mismatch. Owing to the possibility of impending pneumothorax, nitrous oxide is usually avoided [7]. Timely recognition and treatment of complications is of utmost importance to prevent mortality [8]. This manifests intraoperatively as changes in pulmonary compliance, increased airway pressures, arterial hypotension, arrhythmias and progressive hypoxia [9]. Some surgeons prefer placing an indwelling catheter prior to the surgery so as to cause intracavity drainage. In this case, the surgeon directly went ahead with thoracotomy and bullectomy.

The various anesthetic considerations include providing high FiO2 perioperatively, prevention of tension pneumothorax, low tidal volume ventilation, avoidance of nitrous oxide, prolonged expiratory time resulting in reduced lung injury and improved oxygenation.

Low tidal volume commonly results in hypercapnia. Good communication with the surgeon and periodic ABG, to evaluate P2 and pH while instituting low tidal volume ventilation strategy is advisable. Elevated CO2 levels are well tolerated by most patients during surgery;

however, when the pH falls below 7.2, minute ventilation has to be increased [10]. Hence, first increase the rate of ventilation, while being completely aware of the risk of increased auto-PEEP. Again, communication with the surgeon to anticipate surgical duration is imperative. There is evidence that following bullectomy, improvement is rapid and occurs within just hours of surgery. Airflow improves with more efficient chest wall and diaphragm mechanics [11]. Alveoli that were compressed by the bullae are recruited, resulting in improved ventilation and perfusion due to decrease in pulmonary vascular resistance, improved right ventricular function and an increase in venous return as the intrathoracic pressure reduces [12-13]. However, re-expansion pulmonary edema following rupture of bullae have also been reported [14].

As our patient was a chronic smoker, he may have been predisposed to chronic obstructive pulmonary disease, although he did not show any signs and symptoms. It is therefore prudent to consider such patients as high risk for development of post-operative pulmonary complications. Hence, appropriate and adequate preoperative testing should be considered. Patient must be closely monitored for postoperative complications.

Various anesthetic techniques have been described in literature like, spontaneous ventilation with total intravenous anesthesia (TIVA) and inhalational agents [15], thoracic epidural + general anesthesia using single lumen tube and general anesthesia with double lumen tubes [16].

Conclusion

Good preoperative assessment and evaluation along with appropriate anesthetic management as well as postoperative pain relief is the key to a successful surgical outcome. With epidural anesthesia, surgeon expertise, appropriate ventilation strategies and effective communication with the surgeon, single lumen tubes may also suffice for a bullectomy. Selection of patient however, is important.

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