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Anaesthesia

Anaesthesia Management of Child with Congenital Cystic Adenomatoid Malformation Posted for Lobectomy

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Abstract **Case Report**

Congenital cystic adenomatoid malformation (CCAM) is a benign lung lesion that appears before birth as a cyst or mass in the chest. It is made up of abnormal lung tissue that does not function properly, but continues to grow. These lesions compress the adjacent normal lung tissues. CCAMs occur sporadically, and there is no genetic predisposition. They are usually unilobed and unilateral, with arterial supply and venous drainage from the pulmonary circulation. The postnatal management of symptomatic CCAM varies on whether the patient has respiratory distress or is asymptomatic. Symptomatic patients require a lobectomy or pneumonectomy. Perioperative anaesthetic management is challenging because it involves thoracotomy in a young patient that may lead to hemodynamic compromise and inadequate ventilation.

Keywords: Congenital cystic adenomatoid malformation, lobectomy, thoracic epidural.

INTRODUCTION

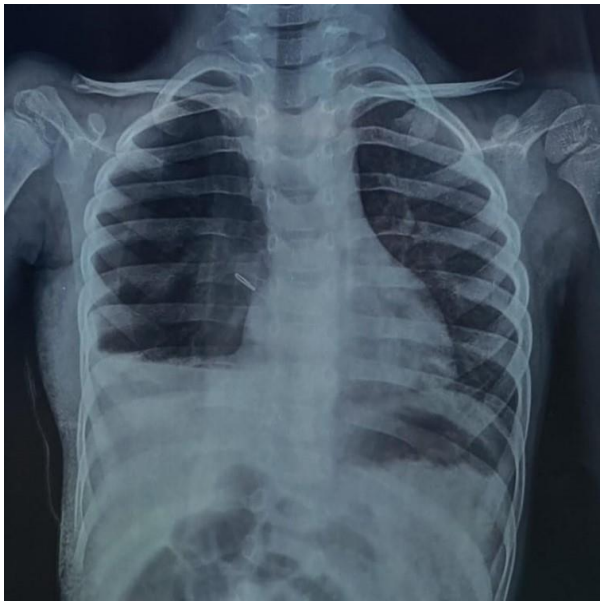
CCAM is rare congenital lung lesion which appears before birth and continues to grow. Patient present with breathlessness or failure to grow. In 1949 Chin and Tang first reported a case of CCAM; it was later studied by Kwitten and Reiner in 1962 and it was classified by Stocker in 1977 With advances in medical field it can be treated antenatally. Best age to undergo surgery is 2 years and as patient was stable and asymptomatic, operation was done. This is a challenging case for anaesthetist.

CASE STUDY

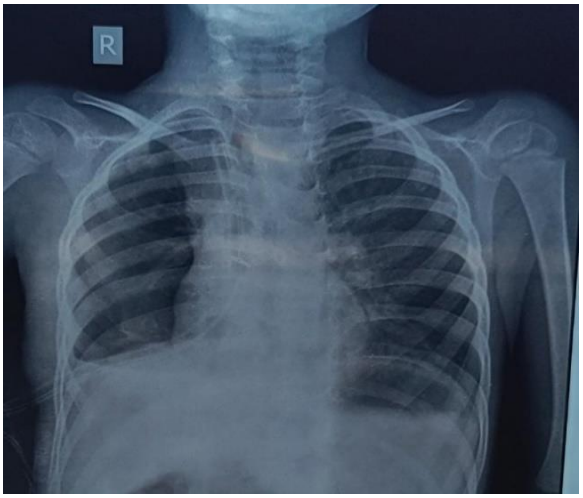
We report a 3 year-old male weighing 16.5 kg. He was born full term. Parents gave history of repeated chest infection on and off. On admission air entry was decreased on right base, respiratory rate was 20/min and saturation was 98% on air. X ray showed cyst in lung. HRCT showed large air-filled cystic lesion in right lower lobe causing major effect on lung parenchyma with volume loss of right upper lobe probably type 1 CCAM. There was no other congenital anomaly. 2-D Echo was normal. Patient was advised cystectomy if needed lobectomy. Patient was evaluated for baseline investigations. Patient had no cough and fever and was posted for surgery. NBM status was confirmed and high-risk consent was taken. The patient was premedicated with IV midazolam (0.02 mg/ kg) through existing iv line in preoperative area. In the operating room, standard monitors were attached. Inj emset 0.04 mg/kg and inj. glycopyrrolate 0.02 mg/kg was given i.v. He was preoxygenated. A modified rapid sequence induction (RSI) using IV fentanyl (2 mcg/kg), propofol (2 mg/kg), and succinyl choline (2 mg/kg) with minimum positive pressure ventilation (PPV) was performed. Because of the unavailability of an appropriately sized double-lumen tube or bronchial blocker in the institution, the airway was secured using a single lumen cuffed endotracheal tube (ETT) size 4.5 tube. It was advanced till one lung ventilation was achieved. We confirmed that there was no air entry on the chest area where lung cyst was present. We decided to manually ventilate with minimum tidal volume monitoring ETCO2, SPO2 and haemodynamic stability and providing good operative field to facilitate surgery. Anaesthesia was maintained with O2, air and sevoflurane 2 vol% and muscle relaxation with 0.5 mg/kg of inj. atracurium. Second wide bore iv lines were secured. Left lateral position, right side up was given to patient. Intermittently both lungs were ventilated. During surgery retractors were used to facilitate surgical exposure of the operative field. Patient had one episode of desaturation and surgeon was asked to stop and suctioning was done and endotracheal tube was withdrawn a bit, air entry was normal, parameters returned to normal and surgery proceeded.

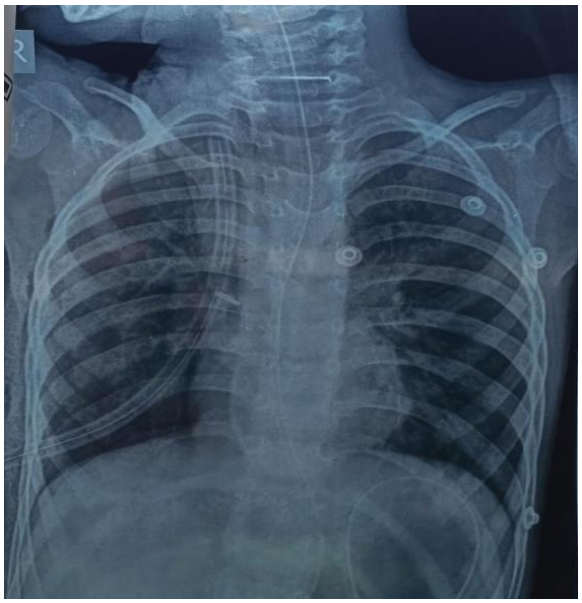
Cyst was densely adherent. Right lower and middle lobectomy was done through posterolateral incision. The patient was hemodynamically stable throughout the 6-hour surgery without any inotropic support. Total blood loss was 100 mL which was replaced. 19-gauge Thoracic epidural was inserted under all aseptic precautions in lateral position at the end of surgery for providing postop analgesia .0.1 % bupivacaine with 10 mcg inj fentanyl diluted to 5 ml was given for postoperative pain relief. At the end of the surgery, blood clots and secretions in the airway were removed through chest clapping and ETT suctioning before extubation. ABG at end of surgery revealed normal acid-base balance and airway pressures were normal. Neuromuscular blockade was fully reversed with neostigmine 0.04 mg/kg and glycopyrrolate 0.02 mg/kg. The patient extubated uneventfully and tolerated it well. The patient remained hemodynamically stable with no episodes of desaturation. Patient was shifted to recovery.

The patient was monitored in postop area. He had no signs of respiratory distress and tolerated low-flow oxygen support via nasal cannula. Post op X-ray was taken. Analgesic regimen included an epidural top up of 0.1% bupivacaine, with 10 mcg of fentanyl diluted to 5 ml three times a day or whenever patient complained of pain and iv paracetamol (10mg/kg/dose) three times a day. The patient was transferred to the ICU for monitoring. He had adequate pain control. No other postoperative complications occurred during the hospital stay. post op x ray confirmed position of drain and full lung expansion He was subsequently discharged after two weeks.



Immediate Pic after surgery [1]





Second Post-operative day

DISCUSSION

Among congenital lung anomalies, CCAM is most common congenital lung lesions, although they are still very rare. They occur in approximately one in 8,000 to 35,000 live births. Patients may present with other concomitant congenital anomalies. In this case 2 D-echo was normal and patient was stable and was advised lobectomy. In terms of lobe involvement, right middle and lower lobes were involved. The challenges for anaesthetist for thoracic surgery in paediatric patients with open chests placed in lateral decubitus position are maintaining hemodynamic stability and adequate oxygenation. General anaesthesia is favoured because it provides control of the airway and ventilation, steady heamodyanamics, immobile patient, and balanced anaesthesia. Anaesthetic management includes tracheal intubation, controlled ventilation, muscle relaxation, maintenance with an inhalational agent, and adequate analgesia. Intraoperative procedural concerns are lateral position, difficult access to the patient by anaesthesiologist post-draping, ventilation, and

oxygenation, ETT movement, hemodynamic status, arrythmias, bleeding, and cross lung contamination. Midazolam is given to avoid agitation and crying Which may lead to air trapping in cyst. Some patient may need central and arterial line and careful monitoring. In our patient we used 2 wide bore peripheral lines but if needed we were prepared to put central line. Likewise, intravenous induction was chosen over inhalational induction since the conduct of inhalation induction may elicit brief crying episodes. Reduced uptake of inhalational agents can delay inhalational induction due to intrapulmonary shunting in patients with lung pathology leading to prolonged induction time and led to an inadequate intubating condition requiring rescue administration of ketamine and succinylcholine to secure the airway. Modified rapid sequence induction was conducted as paralysis facilitates intubation and ensures low peak airway pressures. Also, this allowed maximizing the oxygen reserves of the patients and reduces the likelihood of rapid desaturation that occurs with classical RSI. We intubated our patient using propofol and succinylcholine with ventilating with minimum tidal volume. We took care during ventilation that minimal air will enter the cyst and it should not increase in size causing pressure effect. Conventional two-lung mechanical ventilation is known to cause compression of the nearby lung lobes due to the enlargement of cysts by ball-valve air entrapment. Cyst resection may require one-lung ventilation (OLV) as it provides better surgical access, causes less bleeding, and gives protection from contralateral lung contaminants. This is technically more challenging to perform in young patients as length of trachea is small. In addition, paediatric OLV devices such as paediatric double lumen tubes, univent tubes, and bronchial blockers are not be readily available in every institution. In the patient presented, traditional single-lumen ETT appropriate for age and weight was used due to the unavailability of Peadiatric OLV devices. Since this was open thoracotomy, surgical exposure of the operative field was accomplished through mechanical retraction. We manually ventilated the patient to avoid the risk for barotrauma and ventilation of non-dependant lung to facilitate surgery. Successful lobectomy and pneumonectomy via open thoracotomy in infants with lung cyst using single lumen ETT and manual retraction can be done, ensuring adequate gas exchange while avoiding atelectasis and iatrogenic barotrauma were issues of concern for these patients. During surgery there was episode of desaturation and surgeon was asked to stop and tube was adjusted. Infants and young children have smaller functional residual capacity (FRC), larger closing volume, and greater chest wall compliance making them more susceptible to atelectasis under general anaesthesia [1]. Unlike adults, wherein V/Q matching is improved with lateral decubitus position, i.e. Oxygenation is optimal when the healthy lung is dependent (“down”) and the diseased lung is non-dependent (“up”), the opposite effect is observed in infants wherein oxygenation is improved with the healthy lung “up” and the diseased lung “down”. This is primarily due to the soft compliant ribcage of infants. Lee et al. observed fewer pulmonary complications in patients who received TV at 6 mL/kg during two-lung ventilation compared to those who received TV at 10ml/kg and it reduces the risk of spillage. ETT suctioning before and after a shift in patient position was done to prevent lung contamination. Ensuring adequate postoperative pain control promote early extubation and prevent postoperative splinting. Fajardo-Escolar *et al*., showed that the infant who received continuous epidural infusion were extubated immediately after the surgery [2]. Continuous epidural analgesia using bupivacaine provided better analgesia than single shot ICNB. There are chances of spinal cord injury during inserting a thoracic epidural catheter during general anaesthesia [4]. This should be reserved for extended thoracic procedures and must be performed by experienced anaesthesiologists. Alternatively, an epidural catheter can be introduced in the caudal space and threaded cephalad to the thoracic level [2, 3]. Ultrasound guidance further increases the safety of its performance. USG machine is not available in OT so epidural catheter was introduced through caudal space and advanced till thoracic level. Neonates and infants are more sensitive to opioids. Hence, opioids are to be administered carefully. Small children are more prone to apnoea from the imbalance of mu-receptors and increased susceptibility to hypoventilation because of the decreased ventilatory response to hypoxia and hypercapnia. paediatric patients can tolerate on-table extubation provided that children have a relatively good preoperative condition, uneventful intraoperative course, low airway pressures, replaced blood loss, normal acid-base balance. This patient fulfilled criteria for extubation. Early extubation prevents iatrogenic injury-induced bronchial stump dehiscence from PPV support. The postoperative course depends on the surgical procedure and underlying disease. Early postoperative complications such as air leak, pleural effusion, pneumonia, atelectasis, bleeding, wound infection, and respiratory failure. Late complications include asthma, recurrent pneumonia, and residual disease. The timing of extubation and analgesic regimen most likely contributed to this in this patient, he was extubated on table after giving epidural top up.

CONCLUSION

In children with CCAM for open thoracotomy [5], modified RSI can be used safely among those without difficult airway features and significant cardiorespiratory compromise. Intraoperative ventilatory strategy like ventilation with low tidal volume, nebulisation and avoiding contamination of normal lung helps in improving outcome. Continuous epidural analgesia appears to provide better pain control compared to single-shot ICNB. Preoperative conditions and intraoperative course are significant determinants in the timing of extubation. Whenever permissible, early extubation is sought to avoid iatrogenic injuries. Atelectasis due to airway edema and mucus/blood clots

along the conductive airway are common postoperative issues that should be aggressively monitored and treated.

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