CASE REPORT

Anesthetic Management of a Case of Lung Cyst in a Child - A Case Report

Smita R. Engineer, Janaki Kumar, Archan A. Shah, Grishma J. Patel

Department of Anaesthesia, B. J. Medical College, Civil Hospital, Ahmedabad, Gujarat, India

ABSTRACT

We report the anesthetic management of a 6-year-old female child with lung cyst who underwent thoracoscopy followed by minithoracotomy for resection of lung cyst. Intraoperative controlled ventilation with modified Ayer's T-piece allowed better surgical access and enabled complete resection of the lesion as well as $ETCO_2$ and hemodynamic parameters were maintained. Lumber epidural catheter placed in thoracic region provided good post-operative analgesia. The child was extubated on table and had uneventful recovery.

Key words: Ayre's T-piece, anesthesia techniques, child, congenital cystic adenoid malformation

INTRODUCTION

In 1638, 1st time Fontana described pulmonary cystic condition. Lung cyst can be congenital in origin. Review of Conway's suggests that most lung cysts are acquired and appeared as a result of bronchial inflammation and obstruction, and very few are truly congenital in origin.[1] Congenital cystic adenomatoid malformation is a rare bronchopulmonary abnormality that accounts for 95% of congenital cystic disease.[2] It is confirmed to one lobe or part of lobe. They may be single or loculated. Mediastinal structures are pushed on the opposite side, and adjacent lobe may collapse. They appear suddenly during infancy.[3] Surgical resection is the treatment of choice in pediatric population.[3,4]

Spontaneous breathing is advisable when cyst expands with ventilation. Controlled ventilation should be assumed when there will be a sign of deterioration. Adequate ventilation and oxygenation will be provided by controlled ventilation.[1] Spontaneous ventilation or manual controlled ventilation using modification of the Ayre T-piece can be used successfully.[5] Hereby, we are discussing anesthetic management including controlled ventilation by Ayer's T piece in a child with lung cyst.

CASE REPORT

A 6-year-old, 16 kg, female child was admitted with a history of chronic dry cough and difficulty in breathing for 4 months. She was admitted at a local hospital where her chest X-ray showed a radiolucent well-defined area in the right lung. There was no history of similar illnesses, fever, or hemoptysis in the past. She presented with worsening dyspnea and productive cough. On examination, she was conscious, oriented with a heart rate of 140/min, respiratory rate of 54/min, and blood pressure of 130/78 mm of Hg. Respiratory system examination revealed tachypnea and decrease air entry in the right upper and middle zone. Oxygen saturation was 96% on room air. Examination of other systems was unremarkable. Her pre-operative blood investigations were normal and repeat X-ray chest revealed the same findings as before and resembled a cavity. Ultrasonography was suggestive of cystic lesion in the right lung, and contrast-enhanced computed tomography thorax showed thin-walled cystic swelling in the right middle lobe with a communication with the bronchus [Figure 1].

Preoperatively, prophylactic antibiotics and nebulization started. The child was posted for lung cyst excision by

Address for correspondence:
Dr. Smita R. Engineer, 232A, Manekbaug Society, Ambawadi, Ahmedabad - 380015, Gujarat, India.
Phone: +91-9825504948. E-mail: seng_90@yahoo.com

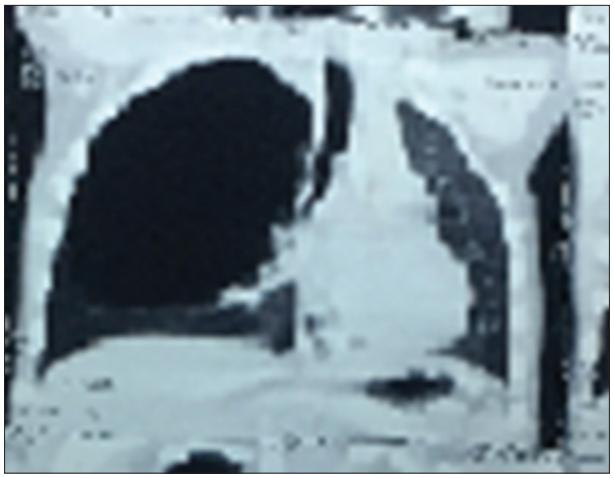

Figure 1: Contrast-enhanced computed tomography thorax - right-sided lung cyst

thoracoscopy and if needed thoracotomy. Written and informed consent of the ASA Grade III was taken.

In the operation theater, electrocardiography, non-invasive blood pressure, $ETCO_2$, saturation, and temperature monitoring were started and a peripheral line secured. Standard precautions to avoid hypothermia were taken. Intravenous premedication injection glycopyrrolate 0.06 mg and fentanyl 30 µgm was given. After pre-oxygenated with 100% oxygen with Jackson Rees circuit for 5 min, induction was done by O_2, sevoflurane 2–4%, and injection propofol 2 mg/kg (pre-mixed with lignocaine). Trachea was intubated with 4.5 mm ID cuffed endotracheal tubes. Gentle assisted ventilation was done with hand using Jackson Rees circuit. The child was placed in the left lateral position and anesthesia was maintained with sevoflurane 1–2% in 100% O_2. 20-gauge epidural catheter was placed at T6 level after introducing it through L1–L2 interspace using 19-gauge epidural needle. Epidurally injection bupivacaine 0.25% 3 ml was administered. During thoracoscopy, anesthesia was maintained with O_2, sevoflurane (2–3%), and injection vecuronium bromide 0.05 mg/kg bolus. Controlled ventilation was provided by using modification of Ayer's T-piece and intermittently occluding end of expiratory limb, avoiding high peak airway pressures. Fresh gas flow (FGF) was kept 3 times the minute volume to avoid rebreathing. Ventilation with modified Ayer's T-piece prevented high inflation of the lung and was well tolerated. Hemodynamic parameters were stable. Oxygen saturation was maintained above 95%. During procedure, $ETCO_2$ increased above 50 was corrected by stopping the procedure and ventilating lungs by JR circuit. A small incision of thoracotomy was made to remove the thick capsule of the cyst. At the end of surgery, neuromuscular block was reversed with intravenous injection neostigmine 0.75 mg with injection glycopyrrolate 0.12 mg. Post-operative analgesia was given by continuous infusion of bupivacaine 0.625% for 72 h. The child had an uneventful recovery.

DISCUSSION

True congenital bronchial cysts are rare. They arise from the trachea or bronchus or may press on the trachea or bronchus from outside and kink or obstruct it. They do not usually present a severe anesthetic problem. Cysts occurring at the periphery of the lung creates problems due to a flap valve mechanism, localized lobar, or lobular emphysema. It requires surgical removal of the cyst.[1] Cystic malformation is a benign mass of abnormal lung tissue, located usually on one lobe of the lung. It is caused by the overgrowth of abnormal lung tissue that may form fluid-filled cysts or result in the failure of the development of the tiny air sacs that characterize a normal lung.[6] The anesthetic challenge during thoracotomy in patients with lung cyst is to maintain hemodynamic stability and adequate saturation.[7] Lung cyst is commonly presentation in infants and young children.[2]

Early symptoms include cough, anorexia, and moderately rapid breathing followed by severe dyspnea, cyanosis feeding difficulties, and failure to thrive.[2,3] Surgery should be done after medical optimization of infections such as pneumonia with antibiotics or chest physiotherapy and bronchospasm with bronchodilators.[2] On chest auscultation, there will be diminished air entry and hyperresonance note on the affected side and mediastinal structures shift to opposite side.[3]

Our patient had a complaint of a cough and dyspnea. Preoperatively, antibiotics and nebulization were started. There was decreased air entry on the right side. Our anesthetic management included general anesthesia with thoracic epidural analgesia for post-operative pain management. An epidural catheter was placed before the surgery started.

Advantages of thoracic epidural catheter placement before surgery are that it provides excellent post-operative pain management as well as reduce intraoperative anesthetic requirements. Epidural catheter can be inserted by caudal route also.[2] Ultrasound-guided thoracic caudal catheter confirms accurately position of the catheter tip at the level of surgery, monitors the distribution of local anesthetic drug, and rules out intravascular, intraosseous, or intrathecal placement.[8] In our case, thoracic placement was done by measuring the distance between T6 and epidural needle entry. Premedication given was glycopyrrolate and fentanyl. Premedication of albuterol and atropine will dry secretions, blunt cholinergic mediated airway reactivity, and prevent bradycardia during laryngoscopy and intubation.[2] Standard monitoring along with precordial stethoscope, femoral central venous line, and arterial line to monitor continuous blood pressure should be done.[2]

Induction of anesthesia with sevoflurane and propofol gave excellent intubating condition in our case. Propofol (3 mg/kg) with sevoflurane is suitable for rapid induction as it offers the

shortest induction time with excellent intubating conditions, without serious respiratory or hemodynamic adverse events.[9] Induction with lidocaine 1–2 mg/kg, propofol 1 mg/kg, or ketamine or dexmedetomidine before intubation also facilitate placement of the tube without hemodynamic or respiratory responses. In patients with low cardiac reserve, volatile agents may precipitate hypotension.[2] Before and after intubation, assisted ventilation with minimal airway pressure was maintained with O_2 and sevoflurane until the chest was opened. When the air cyst is expanding, it is advisable to allow spontaneous breathing.[1] During induction, positive pressure ventilation and positive end-expiratory pressure should be minimized to prevent rapid expansion of the involved lobe with sudden mediastinal shift and cardiac arrest. Nitrous oxide and controlled mechanical ventilation should be avoided as it will increase the size of cyst. High-frequency oscillatory ventilation is alternative ventilation modalities which might assist the patient and provide a quiet surgical field during thoracotomy.[1,2] Drawbacks of intermittent positive pressure ventilation can be enlargement of cyst along with ball valve air entrapment and barotraumas due to high peak airway pressure.[2]

Once chest was opened controlled ventilation keeping, FGF 6 L/min was done using modified Ayer's T-piece by intermittently occluding end of the expiratory limb with a finger.

In type 2 Ayer's T-piece, an expiratory limb capacity should be greater than the patient's tidal volume to prevent inspiration of room air. The lungs can be inflated by intermittently occluding end of the expiratory limb with a finger or a bag attached to the expiratory limb. Artificial ventilation carried out manually with positive atmospheric pressure. FGF of 2–3 times the minute volume is necessary to prevent rebreathing.[5]

Controlled respiration with a high concentration of oxygen must be assumed at the first sign of deterioration. It will provide adequate ventilation and oxygenation in the presence of diminished-functioning lung tissue.[1]

The use of one-lung ventilation reduces bleeding, allows better surgical access, maintains the ventilation/perfusion ratio reducing the shunt in that lung, achieves adequate saturation and CO_2 management as well as protects normal lung from contralateral contamination.[7,8,10]

One lung ventilation can be achieved with endobronchial intubation with a standard cuffed endotracheal tube in the contralateral mainstem bronchus.[2] Disadvantage of endobronchial intubation is difficulty in suctioning of secretions of the non-ventilated lung. Three French Fogarty catheter as a bronchial blocker and a balloon-tipped angiography catheter can also be used for one-lung ventilation.[8] 5 F pediatric bronchial blocker adds the advantage of a high volume low-pressure balloon.[2,8] Complications during surgical excision of cystic can be hemorrhage, tracheal wall tear, pneumothorax, and sinus bradycardia. Risk of spillage of infected cystic contents into the tracheobronchial tree may be minimized by avoidance of positive pressure ventilation, careful rib retraction, and one-lung ventilation.[2]

The anesthetic challenge in this patient is to maintain hemodynamic stability and adequate saturation during ventilation in the lateral position. Ventilation with modified Ayer's T-piece prevented high inflation of lung and high airway pressure and was well tolerated. Hemodynamic parameters were stable. Oxygen saturation was maintained above 95%. Post-operative satisfactory analgesia was provided by continuous infusion of bupivacaine through the thoracic epidural catheter.

REFERENCES

1. McCaughey TJ. Anaesthesia for surgical removal of pulmonary cysts in children. Can Anaes Soc J 1962;9:15-25.
2. Helen Victoria Lauro Congenital Cystic Adenomatoid Malformation (CCAM) Available from: https://www.clinicalpainadvisor.com/anesthesiology/congenital-cystic-adenomatoid-m.
3. Albert HM, Willis J. Potts congenital lung cyst in infants. Pediatrics 1953;12:283-7.
4. Barman S, Mandal KC, Kumar R, Biswas SK, Mukhopadhyay M, Mukhopadhyay B, *et al.* Congenital cystic lesions of lung in the paediatric population: A 5-year single institutional study with review of literature. Afr J Paediatr Surg 2015;12:66-70.
5. Harrrison GA. Ayre's t-piece: A review of its modifications. Br J Anaesth 1964;36:115-20.
6. Cystic Lung Disease, Boston Children's Hospital. Available from: http://www.childrenshospital.org/conditions-and-treatments/conditions/./cystic-lung-disease.
7. Fajardo-Escolar AP, Díaz-Bohada L. Anesthetic management in two infants with cystic adenomatoid malformation. Case report. Colomb J Anesthesiol 2017;45:76-80.
8. Guruswamy V, Roberts S, Arnold P, Potter F. Anaesthetic management of a neonate with congenital cyst adenoid malformation. Br J Anaesth 2005;95:240-2.
9. Fawzi HM, Ghada M. Samir Induction of anesthesia and endotracheal intubation in children without muscle relaxant: A comparative study on addition of fentanyl or propofol to sevofl urane. Ain Shams J Anesthesiol 2016;9:39-44.
10. Hammer GB. Pediatric thoracic anesthesia. Anesthesiol Clin North Am 2002;20:153-80.

How to cite this article: Smita RE, Kumar J, Shah AA, Patel GJ. Anesthetic Management of a Case of Lung Cyst in a Child - A Case Report. J Clin Res Anesthesiol 2018;1(2):1-3.