

A Case Series in Anaesthetic Challenges and Management of Congenital Lobar Emphysema

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ABSTRACT

Congenital lobar emphysema is a developmental anomaly of the lower respiratory tract, which is characterized by hyperinflation of one or more of pulmonary lobes. It can present as a life threatening event in neonates but early diagnosis and immediate surgical intervention can be lifesaving. Due to its mass effects on normal lobes and opposite lung they can cause cardiopulmonary and vascular compromise. Herewith we present three different cases diagnosed to have congenital lobar emphysema and discussed the anaesthetic management and challenges of an infant with Congenital lobar emphysema when planned for surgery.

Key Words: Congenital lobar emphysema, lobectomy, Anaesthetic challenges, Anaesthetic management

INTRODUCTION

Congenital Lobar Emphysema (CLE) is a developmental anomaly of the lower respiratory tract, which is characterized by hyperinflation of one or more of pulmonary lobes¹ and is a rare cause of sudden respiratory distress in infants. Its incidence is 1 in 70,000 to 1 in 90,000 in live births. CLE is characterized by hyperinflation and progressive air trapping resulting in compression of lung tissue, mediastinal shifting and impaired venous return.

CASE REPORT: 1

7 month old male infant delivered at term vaginally, presently weighing 6.5kg

was brought to our hospital with history of fever, cough and breathlessness for five days.

Child had similar problems for the past 1 month and treated as pneumonia at outside hospital, showed no improvement and referred to our hospital. On examination child was febrile, tachypnoeic, heart rate was 158 per minute, BP - 90/60 mmHg, Respiratory rate 40 per minute, SpO₂ 95% at room air with diminished air entry on the right side of the chest. Cardiovascular system and abdominal examination were normal. Child was admitted in Neonatal Intensive Care Unit (NICU) and treated with intravenous antibiotics, bronchodilators, nebulization and chest physiotherapy.

Blood investigations were normal except WBC count of 21,000 cells per cu mm, chest X-ray revealed consolidation of right upper lobe and collapse of right lower lobe. Computerized Tomography (CT) of the chest showed emphysematous changes of the right middle lobe and collapse of the right lower lobe with mediastinal shift to the left and confirmed the diagnosis of CLE of the right middle lobe. Child was posted for right thoracotomy and middle lobectomy.

Preoperative assessment was done. Antibiotics, bronchodilators and nebulization were continued preoperatively. Consent for general anaesthesia and caudal analgesia obtained.

After adequate period of starvation and maintenance fluid, child was shifted to operation theater and patency of IV line

checked. ASA standard monitors Electrocardiogram, Pulse oximetry, Non invasive blood pressure were connected. The child was pre-oxygenated and premedicated with Inj. Atropine 0.12 mg, Inj. Fentanyl 15 microgram, induced with Inj. Thiopentone 50 mg, Sevoflurane 3%, and intubated with 4 sized uncuffed endotracheal tube, bilateral air entry checked. Muscle relaxant avoided prior to induction and ventilated with low tidal volume to prevent over inflation of the emphysematous lung. Post induction Capnography and temperature probe connected. Anaesthesia maintained with oxygen, air, Sevoflurane and Inj. Atracurium was supplemented after thoracotomy incision. Nitrous oxide was avoided to prevent over inflation of the emphysematous lobe and ventilated with low tidal volumes.



Figure 1 : Emphysematous changes of the right middle lobe with mediastinal shift to left

Under aseptic precautions caudal epidural blockade was done with 6ml of 0.25% of Bupivacaine with Dexmedetomidine 7 microgram.

Child was placed in the left lateral position. Right thoracotomy and right middle lobectomy was done. Intra-operative vitals were stable. Child was extubated on table after adequate recovery. Post operative period was uneventful and chest X-ray showed adequate expansion of right lung. Baby was monitored in the high dependency unit (HDU).

CASE REPORT: 2

A 28 day old 3.3 kg male neonate was admitted in our hospital with progressive respiratory distress for 10 days. On examination child had severe respiratory distress. Blood investigations were within normal limits. Chest x ray showed hyperinflation of right lung. A diagnosis of right middle lobe CLE was made and right posterolateral thoracotomy and middle lobe lobectomy was planned under general anaesthesia with caudal.

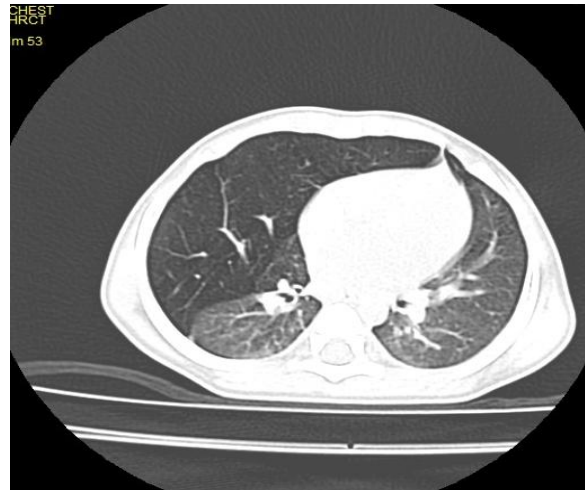


Figure 2 : Emphysematous changes of the right middle lobe and collapse of the right lower lobe with mediastinal shift to the left

Preoperatively baby was optimised with bronchodilators, nebulisation, intravenous antibiotics and nursed on right side prior to procedure. Baseline monitors connected to baby in the operating room; preoxygenation done with 100% oxygen for 3 minutes; premedicated with 0.06 mg atropine and 3µg fentanyl. Anaesthesia was induced with oxygen and sevoflurane in titrated doses, 10% lidocaine sprayed over vocal cords to prevent cough. Baby was intubated using 3.5mm uncuffed endotracheal tube and fixed at 10cm mark while maintaining the baby on spontaneous respiration. Tube placement was confirmed with capnography. 0.25% bupivacaine 4ml was given in caudal using 22G short bevelled needle under strict aseptic precautions.

Baby was maintained on spontaneous respiration till thoracotomy

incision, opening of thoracic cavity and the damaged lobe has been exposed. Baby was paralysed with atracurium 1.5 mg intravenously and intermittent positive pressure ventilation initiated. Manual ventilation was done throughout with Jackson Rees circuit. Blood loss was minimal and the baby was extubated on table after reversing with neostigmine 0.2 mg and atropine 0.6mg. Intraoperative surgery period was uneventful. Recovery was smooth with good spontaneous respiratory movements and tone.

CASE REPORT: 3

2 month old male infant weighing 3.8 kg with left apical lobe CLE who was planned for left apical lobectomy. The baby had presented with intermittent fever associated with tachypnoea and grunting. CT was suggestive of left apical lobe CLE.

Baby was optimized with nebulization, steroids, intravenous antibiotics. Baseline monitors were connected in the operating room and baby was premedicated with atropine and pentazocine. Induction was done with sevoflurane in titrated dose and thiopentone followed by intubation. Spontaneous respiration was allowed with gentle assisted ventilation until the resection of emphysematous lung. Following the resection, patient was paralysed with Atracurium and maintained with intermittent positive pressure ventilation. The left upper lobectomy was performed under General Anesthesia. Intraoperatively haemodynamics was stable with negligible blood loss. The duration of the surgery was 90 minutes. Patient was extubated at the end of surgery. Analgesia was achieved by Local anesthetic through caudal epidural.

The anesthetic challenges involved in the management of CLE are in view of age, cardiorespiratory distress and need for proper ventilatory strategies as spontaneous respiration may not be adequate and positive pressure ventilation can worsen hyperinflation and its consequences.

DISCUSSION

Congenital lobar emphysema is a rare congenital anomaly in the neonatal period². Most common cause is congenital bronchial cartilage dysplasia³. The other etiologies may be bronchial obstruction due to mucosal folds or septum, mucous plugging or anomalous vasculature.

It is common in males with a male to female ratio of 3:1⁴. The prevalence is 1 in 20000 to 1 in 30000⁵. It is more common in left lung (43%) followed by right middle lobe (32%) right upper lobe (21%)⁶ An infant presenting with repeated respiratory infection or with a respiratory distress; and repeated respiratory infection in older children should be suspected of Congenital lobar emphysema. High suspicion, early diagnosis and intervention in terms of conservative or surgical intervention can benefit the child. It may be associated with congenital cardiac anomalies.

In CLE lung inflation occurs during inhalation but there is obstruction during exhalation which results in air trapping, emphysema and compression of surrounding normal lung, mediastinal shift, reduced venous return, reduced cardiac output leading to hypotension, V/Q mismatch and hypoxia⁷.

The child may present with non-specific symptoms and signs like dyspnea, cyanosis, wheezing, recurrent infections and failure to thrive⁸. Congenital lobar emphysema may present with asymmetrical chest expansion, hyper resonance, displaced cardiac sounds and diminished breath sounds. Chest X-ray may show hyper-inflated lungs and mediastinal shift⁹. CT thorax reveals the diagnosis. Conservative management is suitable for mild cases but severely symptomatic cases will benefit from surgical excision of the affected lobe¹⁰. Treatment in the symptomatic patient is surgical excision of affected lung lobe¹⁰.

Anaesthesia to the children with CLE is challenging. If the child is crying and struggling before induction the air trapping in the emphysematous lung can be increased¹¹. Beside progressive respiratory

distress there is a risk of increasing emphysema with intermittent positive pressure ventilation or coughing during intubation. We should avoid positive pressure ventilation before thoracotomy as it may cause rapid inflation of the emphysematous lobe, mediastinal shift and cardiac arrest¹². Hence spontaneous ventilation is preferred, during induction and intubation to maintain air way pressure till thoracotomy¹⁵.

After thoracotomy muscle relaxant can be given and positive pressure ventilation can be safely given. Nitrous oxide should be avoided to prevent overinflation of the emphysematous lobe and ventilated with low tidal volumes¹⁴. One lung ventilation using double lumen tube or bronchial blockers is preferred. Endo-bronchial intubation using single lumen endotracheal tube is an alternative method.

Mridu et al described CLE in a 6 week old baby with sudden respiratory distress and IPPV was not commenced until the endobronchial intubation of normal lung was achieved¹⁵. Badiu et al described CLE in a 4 month old child with unilateral bronchiolitis¹⁶. Suman et al used gentle IPPV with a pressure limit of <25cm H₂O during hypoventilation under deep anaesthetic plane with thoracotomy¹⁷.

Anaesthetic challenges are smooth induction, intubation without a relaxant, if IPPV is needed gentle ventilation during induction, till thoracotomy is desirable. Nitrous oxide to be avoided. Standby surgical team should be available during induction for emergency thoracotomy if child desaturates due to enlargement of cyst. We did not use double lumen tube or bronchial blockers because smaller size double lumen tube and bronchial blockers were not available¹⁸.

CONCLUSION

Congenital lobar emphysema is a rare but potentially fatal congenital disorder. Due to its mass effects on normal lobes and opposite lung they can cause

cardiopulmonary and vascular compromise. A high degree of awareness of the complications and thorough preoperative evaluation and vigilant intra and postoperative management with a coordinated team effort minimises the adverse outcomes. A high degree of awareness of the complications, thorough preoperative evaluation, vigilant intra and postoperative analgesia with monitoring in high dependency unit with multidisciplinary team approach helps in smooth management of the case.

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