Anesthetic Management of A Child with Empyema Thoracic Scheduled for Thoracic Decortication Surgery. A Case Report

Case Report

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ABSTRACT

Background: Empyema thoracis is a complex condition, posing a significant therapeutic challenge. If not treated timely and adequately patients become severely restricted due to compromised lung functions.

Case Report: This case report explores the successful anesthetic management of a 9-year-old child posted for thoracic decortication surgery due to right-sided empyema. One lung ventilation on the left side in pediatric patients is a challenge for anesthesiologists. A multifaceted approach to maintain adequate ventilation intraoperatively along with adequate pain relief to facilitate lung expansion in the post operative period is the mainstay for anesthetic management in such cases.

Conclusions: This case emphasizes how important a complete management strategy including meticulous pain management is the key to a successful resolution in conditions like this. Single lumen endotracheal tube can be successfully used for one lung ventilation by advancing it further beyond the carina and erector spinae plane block in conjunction with general anesthesia, is effective and beneficial in paediatric patients.

Key Words: Child, lung disease, nerve block, thoracotomy.

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INTRODUCTION

Exudative uncomplicated parapneumonic pleural effusion if infected results in empyema. Empyema thoracis is more commonly seen in children as compared to adults. It is associated with high morbidity and mortality[1]. Ensuring a quick recovery with no long-term pulmonary complications is the goal of therapy. Medical management includes chest tube drainage and the administration of antibiotics. Surgical intervention in the form of Video-assisted thoracoscopic surgery (VATS) or thoracotomy decortication remains the treatment of choice in complicated cases[2].

CASE REPORT

A 9 year old female child weighing 15kgs was posted for thoracic decortication surgery. History of the child's current illness revealed cough and fever for the last 2 months, difficulty in breathing for 20 days. Patient was admitted in pediatric ward and detail workup lead to the diagnosis of Empyema, for which intercoastal drain (ICD) was inserted and 1.5 litre pus was drained. Couple of days later after draining the pus patient again developed pus in plueral cavity and the right lung was highly collapsed leading to severe breathlessness. High end antibiotic cover was continued and patient was scheduled for decortication surgery.

On preoperative visit the child was tachypnic with a room air oxygen saturation of 90%. She was on 2L oxygen support and was maintaining saturation of 98% on it. On examination chest wall movements appeared to be decreased on the right side compared to left side with right sided deviation of trachea. On auscultation breath sounds were reduced on right apex and absent over right base, no additional sound was heard. Child was malnourished and weight for age was less. Airway examination revealed mouth opening of 3 finger and Mallampati grade II. Routine investigations including complete haemogram, renal function tests, liver function tests, serum electrolytes were within normal limits except that the total leucocyte count (TLC) was on higher side. The chest *X*-Ray showed air fluid level on the right side with ICD in situ. (Figure 1). Pre-operative pulmonary function testing (PFT) was not possible in this case as the child was not cooperative.

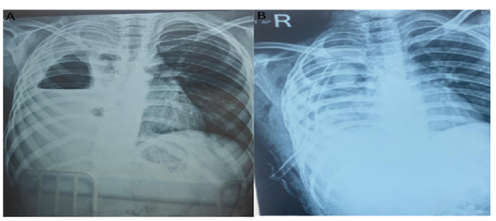

Fig.1: A. chest *X*-Ray showing presence of right sided empyema in the patient; B. chest *X*-Ray showing lung expansion on post operative day 1.

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The inform/ed consents for surgey and anaesthesia including consent for post operative ventilation and ICU stay was taken, the patient was shifted to the operating theatre (OT). All multipara monitors were attached as per ASA monitoring standards. The temperature and humidity levels in the OT were kept at 28˚C and 75% respectively. The child's intraoperative body temperature was kept at 38±1°C.

Intravenous induction was done using iv fentanyl 2µg/kg, iv propofol 2mg/kg, iv atracurium 0.5mg/kg and the child was intubated with a cuffed endotracheal tube of internal diameter of 4.5mm using macintosh size 2 blade. Tube was fixed at 14cm at incisor level. After induction of anesthesia the erector spinae block was given at T6 level under ultrasound guidance, 8ml of 0.25% bupivacaine was given after negative aspiration using the 19G tuhoys needle and thereafter the epidural catheter was threaded under the erector spinae muscle to provide post op analgesia (Figure 2).

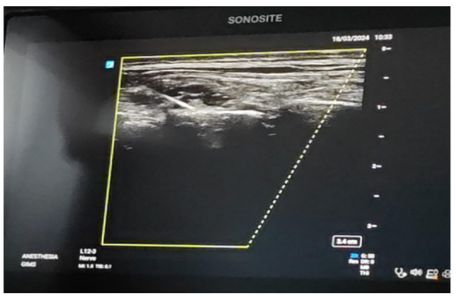

Fig. 2: Erector Spinae Plane Block.

We fixed the catheter using double tunneling method. 0.125% bupivacaine 5ml injected via the indwelling catheter every 8 h for 3 days. The childs visual analog score (VAS) for pain remained less than 4 throughout the postoperative period. Thereafter the endotracheal tube was negotiated towards left side under fiberoptic guidance. (Karl storz pediatric bronchoscope) (Figure 3). The lung isolation was checked by auscultation and tube was fixed at 18cm at the incisior level. Precordial stethoscope was applied to each hemithorax which allows independent auscultation of each lung field. Anaesthesia was maintained on O_2/N_2O 50/50 and isoflurane. The patient was then positioned laterally with the affected right side up, with the arm raised and a bolster under the chest to expand the intercostal gaps. A posterolateral thoracotomy was done through the sixth intercostal spaces. Patient was ventilated with lung protective ventilation keeping the respiratory rate of 20/min and tidal volume of roughly about 60-70ml. End-tidal carbon dioxide was maintained between 32-40mm of Hg throughout the surgery.

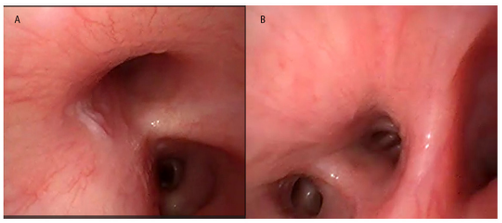

Fig.3: A. Fibreoptic Bronchosco pic image showing carina and both main bronchus; B. Fibreoptic Bronchoscopic image of left main bronchus showing secondary bronchioles.

Intraoperatively the pleura was found to be stony hard in nature and the thick pleural peel was meticulously removed from the surface of the involved lung. Thereafter the surgeon requested for assessment of lung expansion, so the endotracheal tube was gently withdrawn back to 14cm mark to ensure two lung ventilation and manual ventilation was done. Surgical procedure was done uneventfully along with ICD insertion. Blood loss was minimal and urine output was 150ml. At the end of surgery the patient was turned back supine and was successfully extubated once presence of spontaneous respiration was confirmed and the muscles tone and reflexes had returned to normal. She maintained 100% saturation on 4L/min of oxygen in the post operative period.

Multimodal analgesia was used using local anesthetic infiltration at the site of surgical incision towards the end of surgery along with iv opioids and paracetamol infusion. Utmost analgesia was sort after to ensure adequate breathing during the immediate postoperative period.

Throughout the recovery phase, oxygen saturation stayed between 99% and 100% and no reports of pulmonary complication were made. The right lower lobe started to inflate and the right lung was clearly visible on postoperative day 1, the oxygen support was gradually weaned and she was off oxygen on day 2. The patient was then shifted to the ward. She had stable vital signs, stayed afebrile, and was sent home on the tenth post-operative day following the removal of the chest drains.

DISCUSSION

Thoracotomy is not as common in pediatric surgery as it is in adult surgery since fewer pathologies in the pediatric age group call for it. Furthermore, as congenital defects account for the majority of cases in this age range, the guidelines for this treatment in children differ from those in adults. Thoracotomy in pediatric patients calls for a skilled and committed surgical, anesthetic, and critical care team[3]. Our patient had empyema for almost one and half months and thereafter developed severe breathlessness due to it. She was successfully managed by a decortication procedure and was discharged in a healthy condition. Paediatric thoracotomies are a challenging case from anesthesia point of view. The anaesthesiologist has to be

well versed in the various techniques of providing one lung ventilation and managing the intra and postoperative complications. Promt response and vigilance is needed as there is possibility of multiple complications such as arrhythmias, mediastinal shift, hypertension or hypotension and hypercapnia, hypoxia, impaired hypoxic pulmonary vasoconstriction, re-expansion pulmonary oedema, atelectasis and pneumonia[4].

While planning for a successful lung isolation technique one has to keep in mind all the techniques available along with the logistics of particular institute. In our patient we used single lumen tube for isolating the lung. Double lumen tubes (DLT) could not be chosen as even the smallest available size of DLT was also larger for the child and we do not have bronchial blockers or univent tubes in our set up.

Advancing a single lumen tube into the desired bronchus is the most simple, basic and quick method of lung isolation in pediatric patients. Placement into the right mainstem bronchus is easier than the left for obvious anatomical reasons. In our case the pathology was on right side so the tube had to be negotiated to the left side under fiberoptic guidance. To facilitate the bronchoscope entry towards the left side the endotracheal tube was rotated from above in an anticlockwise direction and along with it the opposite shoulder of the patient was also lifted to facilitate entry into the left main bronchus. The main problem associated with use of single lumen tubes is the inability to access the operative lung[5].

DLT is the gold standard technique for older children. The main advantage that we could have got with the use of DLT is the ability to quickly alternate from single-lung to double-lung ventilation, ease of insertion, application of CPAP, and suctioning of the operative lung[6]. Bronchial block also provide complete seal and easy transition from double lung to single lung ventilation but they can migrate distally into the trachea and lead to impaired ventilation and hypoxemia[7]. Univent tube can also be used and the bronchial blockers placed via univent tubes do not migrate but they have low volume and high pressure cuff leading to mucosal injury[8].

In this case, fall in oxygen saturation was minimal during one lung ventilation.

Although during one lung ventilation , there is increase in ventilation perfusion (V/Q) mismatch because of a decrease in functional residual capacity and tidal volume. Additional factors that contribute to V/Q mismatch during one lung ventilation include general anaesthesia, inadequate patient placement, surgical retraction, and mechanical ventilation. While hypoxic pulmonary vasoconstriction (HPV) reduces this V/Q mismatch by redirecting blood flow away from the underventilated lung, certain factors reduce HPV, such as the use of inhalational anaesthetics or other vasodilating medications along with high or low fraction of inspired oxygen (FiO_2) thereby increasing the risk of hypoxia in children during one lung ventilation[9].

Since thoracotomies are painful procedures, providing patients enough analgesics is essential for their post-operative care. A multitude of harmful respiratory complications, including atelectasis, pneumonia, and impaired pulmonary function leading to hypoxia, can be consequence of inadequate analgesia. Therefore, it should be standard practice to provide these patients with adequate analgesia and frequent follow-up using a variety of clinical indicators and pain scores for grading their pain.

Multimodal approch of providing analgesia ranging from oral and intravenous medications to nerve blocks, neuraxial blocks have been practiced in children.We opted for the continuous erector spinae plane block (ESPB) for pain relief in this patient which resulted in excellent pain relief for the child. ESPB is a newer block technique which is being used both in adult and pediatric patients. This block aims to block the dorsal and ventral rami of spinal nerves. It is increasingly being used in pediatric population for madriad of surgeries[10]. It is technically easier and has a shorter learning curve than thoracic epidural technique. The complications in this block are less because the injection site is far from the pleura, any major blood vessels, and spinal cord. The erector spinae plane is relatively avascular, so there is less risk of immediate intravascular absorption of LA.

CONCLUSION

Based on our experience with this case, we conclude that the patient's postoperative outcome also depends on the appropriate choice of anaesthesia. Single lumen endotracheal tube can be successfully used for one lung ventilation by advancing it further beyond the carina.

As cited by various studies, erector spinae plane block in conjunction with general anaesthesia, is effective and essential in pediatric patients. It reduces surgical stress, decreases anaesthetic requirement, helps faster pulmonary recovery as the patient is pain free. The findings in this case report are consistent with observations in several randomized control trials that have been cited in literature.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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