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CASE REPORT

ANAESTHESIA FOR A PAEDIATRICS PATIENT POSTED FOR VIDEO: ASSISTED THORACOSCOPIC EXCISION OF AN ANTERIOR MEDIASTINAL MASS

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ABSTRACT: Video-assisted thoracoscopic surgery (VATS) is less invasive approach for thoracoscopic surgery. It is used to diagnose and treat various conditions in the chest. It renders less postoperative pain, fewer operative complications, and shortened hospital stay which makes it favorable for pediatric patients. VATS can be used for different purposes, ranging from a biopsy to removal of tumors or entire lobes from the lung. A thorough knowledge of the associated pathophysiological changes, appropriate monitoring and good planning allows the safe provision of anesthesia for these procedures and this is based on the expertise in the fields of both pediatric and thoracic anesthesia. Unrecognized congenital heart defect, airway compromise with an abnormal airway or extrinsic tracheal compression which may place the patient at an increased risk during anaesthesia. And this article focuses on VATS surgery done on a pediatric patient for excision of anterior mediastinal mass & the various strategies adopted by us to optimize oxygenation during one-lung anesthesia.
KEYWORDS: video-assisted thoracoscopic surgery, one lung ventilation.

CASE REPORT: Here we report a case of a 3 year old child weighing 15kgs posted for VATS to excise an anterior mediastinal mass. Detailed history of the child revealed recurrent chest infections since birth and last episode being just a week back on treatment. Parents also gave past history of surgery when the child was 7 months old for cystic hygroma. This history made the pediatricians suspect intrathoracic extension or recurrence of the condition. Pediatric surgeons evaluated the child and subjected for further investigations.

The preoperative interview revealed an active child with stable vital signs and a room air oxygen saturation of 98%. On examination chest wall & movements appeared to be normal with no deviation of trachea. On auscultation occasional crepts were heard over the left lower lung fields. Child's airway was normal. Previous anesthetic records showed no perioperative complications. The child was subjected to Blood investigations like complete haemogram renal function tests, liver function tests, serum electrolytes and the reports were within normal limits.

He was also subjected to detailed cardiac evaluation.2 D ECHO was within normal limits. Arterial blood gas analysis was a normal study. As chest-X ray was inconclusive, MRI showed cystic lesion measuring 6x7cm in the retrosternal region in the superior mediastinum pushing trachea and adjacent structures suggestive of thymoma or lymphatic cyst. There was no evidence of calcification and tumor markers were negative.

A team of pediatric surgeons and pediatric anesthetists discussed the feasibility of taking up the patient for VATS as good co-operation is a necessity for the success of such procedures. Since the lesion was close to major vessels, blood was kept in reserve. Theatre was also informed of a possibility of converting VATS to open thoracotomy.

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Child presented in our case history is a 3 year old, not co-operating to our regular clinical examinations. Hence pre-operative pulmonary function testing (PFT) was not possible in this case. Preoperatively child was put on antibiotic prophylaxis and bronco-dilator with steroid nebulization.

After obtaining the informed consents for surgey and anaesthesia, the patient was shifted on to the operating table. Esophageal stethoscope, pulse oximeter, temperature probe (peripheral and core), electrocardiogram (ECG) and non-invasive blood pressure (NIBP) monitors were attached. Operating room (OR) temperature was maintained at 28˚C and humidity 75% respectively. Intraoperative body temperature of neonate was maintained at 38±1°C.

As the patient already had an intravenous access, anesthesia was induced with fentanyl, 15µg, 75 mg of IV thiopental, 7.5 mg of attracurium and intubated with a No. 4.0 uncuffed endotracheal tube using miller no1 blade. Due to the necessity of isolating the left lung, both SLI and SLV were needed and hence we advanced the single lumen ETT. The lung isolation was checked by auscultation & tube was fixed at 18 cm at the lip, precordial stethoscope was applied to each hemithorax which allows independent auscultation of each lung field. Anaesthesia was maintained on O2/N2O 50/50 and sevoflurane.

The patient was placed in the left lateral position, supported by axillary rolls and beanbag, with the head supported by a donut. Placement of the ETT was verified once again via auscultation. Patient was hand ventilated with a respiratory rate of24/min & tidal volume of roughly about 50-60ml. End-tidal carbon dioxide remained between 32-40 mm of Hg throughout the surgery. Paracetamol suppository180 mg was inserted rectally for postoperative pain control.

Anterior mediastinal mass was identified and dissected out by VATS. As the mass was big slight extension of the incision had to be done for retrieval of tissue. At the end of the surgery, right-sided chest tube was placed.

A total of 600 mL of crystalloid was administered, and 200 mL of packed red blood cells were transfused. The patient was repositioned supine, and the ETT was pulled back, until bilateral breath sounds were auscultated and end-tidal carbon dioxide was visualized. After ensuring good spontaneous respiration, with adequate return of muscle tone & reflexes, patient was extubated uneventfully. On extubation, the patient was crying and continued moving all extremities. She maintained a saturation of 99-100% with 4 l/min oxygen.

She was then transported to the post anesthesia recovery unit. Oxygen saturation remained 99% to 100% throughout the recovery period, and no pulmonary complications were reported. On postoperative day 0 left lung was clear, the right lower lobe was still expanded, and oxygen saturation values remained 97% to99% on room air. On postoperative day 2, the patient was transferred from the pediatric intensive care unit to the ward. Vital signs were stable, she remained afebrile, and was discharged home on 6th post-operative day after removal of chest drains.

DISCUSSION: Ventilation in pediatric lung poses different challenges when compared to adult lung.[1] Pediatric lungs are less compliant with greater airway resistance, which in turn increases the work of breathing**.** It is further complicated if the child has to be put in lateral decubitus position with single lung ventilation.[1,2]

Ventilation (V) and perfusion (Q) are highest on the most dependent portion of the lungs both for adults and children. This is due to pressure gradient and gravitational pull both factors (V and Q) should be well matched for optimum oxygenation. However, during one lung ventilation while performing VATS, there are factors that can increase V/Q mismatch because of a decrease in

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functional residual capacity and tidal volume. General anaesthesia, suboptimal patient positioning, surgical retraction and mechanical ventilation are factors that attribute to for V/Q mismatch.[3]

Lateral decubitus position has great impact on ventilation & perfusion & the mismatch is exaggerated in infants when compared to teens and adults. Placing an adult in a lateral position with the healthy lung on the dependent position causes optimal oxygenation due to hydrostatic pressure gradient between the two lungs and gravitational pull.[3] On the other hand, infants have soft, easily compressible lungs & their residual volume is closer to functional residual capacity. This can hence result in decrease in lung compliance and increase in airway closure even during tidal breathing while ventilating the dependent healthy lung in infants.[1,2,3]

Furthermore, the infant's small size results in the decrease in hydrostatic pressure gradient between dependent and nondependent lung. Hence, there is a loss of the favorable response of increasing perfusion to the dependent ventilated side while reducing the perfusion in the pathologic lung, ultimately resulting increase susceptibility of infants to hypoxia during one lung ventilation while placing them in lateral decubitus position.[4] Considering all the above factors, access to ventilate and provide oxygen on the pathologic side must be maintained during OLV, in the midst of significant oxygen desaturation during operation.[3,4] Hence the modes for one lung ventilation has to be carefully chosen keeping in mind not only the availability but also the feasibility of the technique adopted.[5]

Today, several methods are available for isolating a single lung and instituting single lung ventilation. This will depend on the type of surgery, the patient, and anesthetist feasibility, surgeon preference. Reasons for needing isolation include massive hemorrhage, bronchopleural fistula, unilateral pulmonary disease, and control of secretions during the removal of an infected part of lung tissue, biopsy or excision of mediastinal masses, biopsy of pulmonary infiltrates. VATS is one such procedure used in visualization of intrathoracic structures which requires a partially or totally collapsed ipsilateral lung and hence needs one-lung ventilation (OLV).[6]

In our case, the child had anterior mediastinal mass which needed total collapse of the ipsilateral lung. This approach offered the advantages of a smaller incision, less postoperative pain and a faster postoperative recovery as compared with thoracotomy.

Several techniques to isolate a lung include, the double lumen tube, bronchial blockers, the Univent ETT and the single-lumen ETT are available. Each technique has its own advantages and disadvantages. The choice of any method depends on specific equipment availability & feasibility of the technique.[5,6,7]

Double-lumen endobronchial tube (EBT) can provide numerous advantages in executing successful one lung ventilation DLT allows suctioning, administration of continuous positive-airways (CPAP) or oxygen insufflation to the non-operative lung. But these are unsuitable in patients less than 30 to 35 kg because the smallest, commonly available DLT is size 28F.[7]

Balloon-tipped bronchial blockers (BB) remain the 'technique of choice' in Paediatric patients, under the age of 6 years. These devices have a balloon at the end that is inflated to occlude the main bronchus of the operative lung and they are placed under direct vision with a fibreoptic bronchoscope. The disadvantages of this include: dislodgement of the blocker balloon into the trachea, slow collapse of the operated lung, high pressure cuff can damage or even rupture the airway, suctioning of the operative lung not feasible.[5,8]

The Univent tube is like a conventional ETT with a second lumen containing a small hollow non-latex bronchial blocker that can be extended about 8-10 cm beyond the tip and when the balloon is inflated, it serves as a blocker. It is placed in the same manner as a standard tracheal tube and

when one-lung ventilation is required, the bronchial blocker is advanced into the main stem bronchus of the operative lung under direct vision with a flexible fibreoptic bronchoscope.[8]

The simplest means of providing SLV to the desired lung is by using a single-lumen endotracheal tube to achieve selective main stem intubation.[9] After tracheal intubation, the ETT can deliberately be advanced into bronchus to isolate the lungs. The ETT is advanced until breath sounds on the operative side disappear and this can be achieved very quickly.[1,9]

As described in our case report we chose selective main stem intubation with single lumen endotracheal tube. It was challenging in our case because we had to intubate the left bronchus. We rotated the bevel of the tube rotated to180° while the head was turned to the right. The ETT is advanced into the bronchus until the right breath sounds disappeared.

Potential problems with main stem intubation are inadequate seal of the non-operative bronchus, inadequate lung collapse, "Spill over" of secretions to the good lung and do not allow suctioning of the soiled lung. Despite this, single-lumen ETT is still an acceptable option[10]. In our case, we did not face any such problems & the procedure went on successfully.

Various aspects that needs attention while providing general anaesthesia are: Neuromuscular blockers and mechanical ventilation further increase V/Q mismatch. Inhalational anesthetics impair hypoxic pulmonary vasoconstriction (HPV) and neuromuscular blockade decreases functional residual capacity (FRC) and these make the child more prone to develop atelectasis. Due to increase in oxygen consumption in infancy, they are at a very high risk for rapid and profound desaturation during thoracic surgery. In addition to this VATS is one such procedure which is performed in the upright and lateral decubitus positions, which cause mismatch in ventilation to perfusion ratio (V/ Q) after general anaesthesia.[10,11]

To overcome the above factors, we adopted the following strategies to improve Oxygenation:

1. Increased FiO2,
2. Tidal volume - 8-12 ml/kg to the ventilated lung to prevents atelectasis.
3. If airway pressure if high, tidal volume may be decreased and respiratory rate increased.
4. Maintenance of cardiac output.

CONCLUSION: A video assisted thoracoscopic surgery procedure has numerous advantages as compared to open thoracotomy. These include lesser pain, smaller incisional scars and shorter hospitalization. Apart from the surgical challenges, the intraoperative and the postoperative physiological alterations pose significant challenges to the success of VATS. It is important for the anesthesiologist to have a clear understanding of these physiologic changes and potential complications, so as to perform VATS safely.

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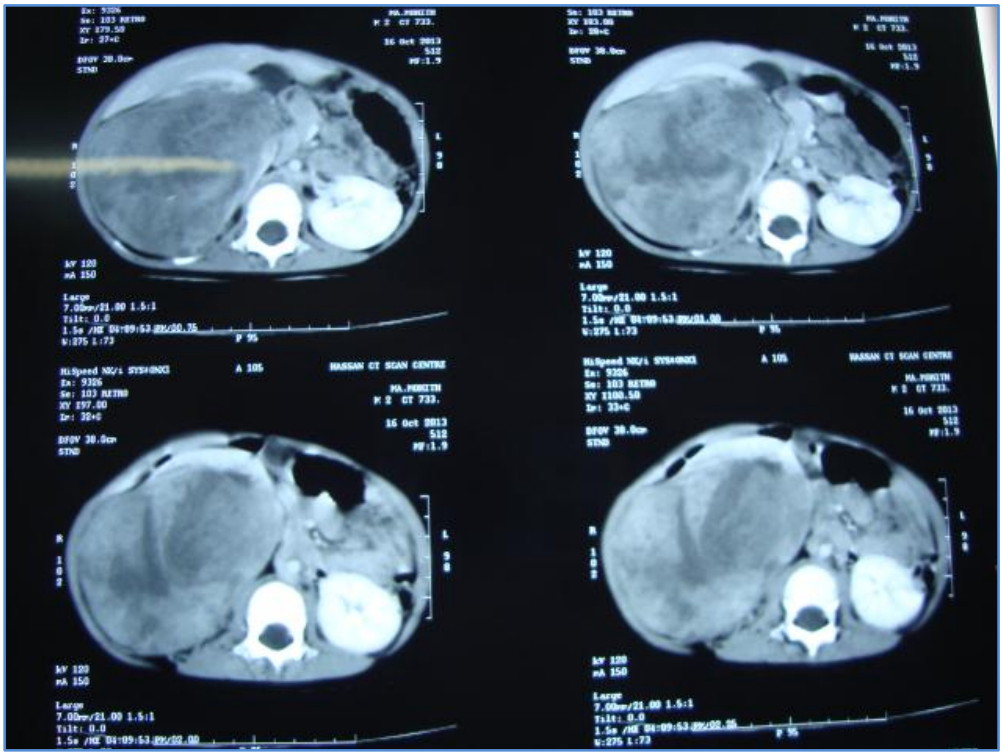

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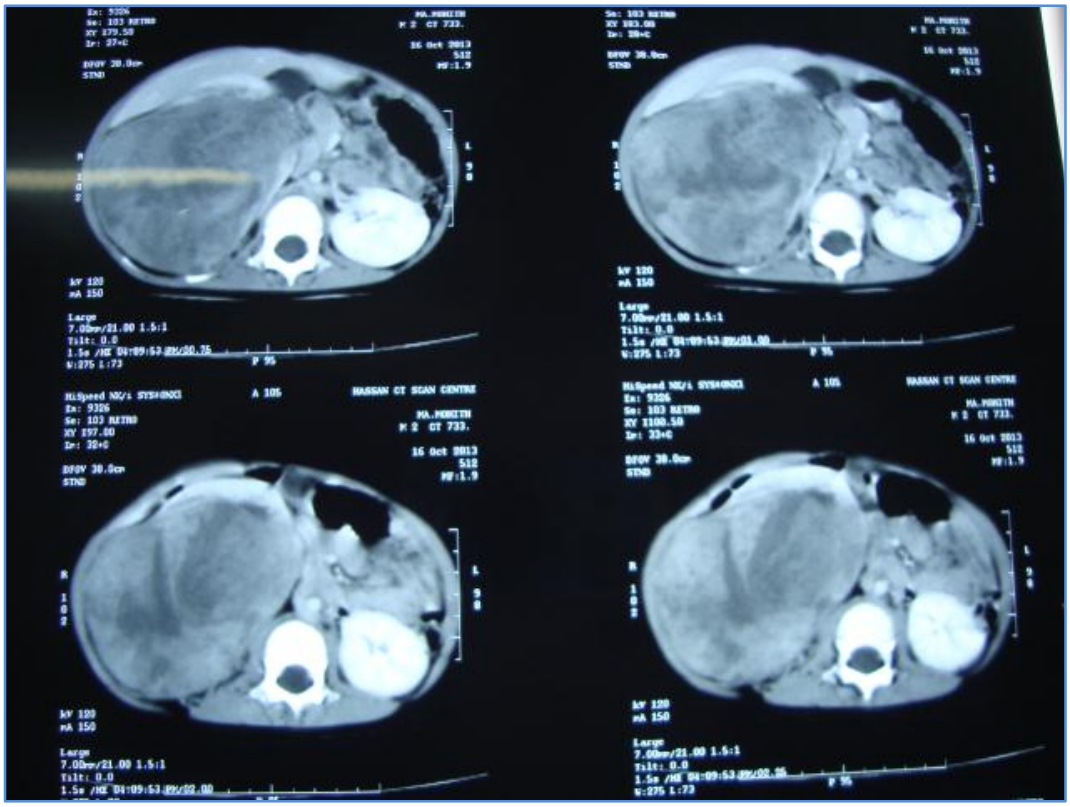

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