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Manual Trans-Tracheal High Frequency Positive Pressure Ventilation for Left Main Bronchus and Carinal Mass Surgical Resection in a Child

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ABSTRACT
Inflammatory myofibroblastic tumor (IMT), also called pseudo-tumor, is a very rare condition and accounts for less than 1% of primary lung tumor. It is most common benign tumor of lung in children. This case is reported with the objective of highlighting the role of manual trans-tracheal high frequency positive pressure ventilation (HFPPV) in facilitating surgical resection with maintenance of adequate oxygenation and a little compromised ventilation. A 9-year boy, weighing 21 kg, was diagnosed as a case of IMT of left main bronchus on biopsy and was successfully treated by surgical excision through left thoracotomy. HFPPV through improvised technique was used for ventilation and oxygenation during surgery. Total Intravenous anaesthesia with propofol infusion and increments of fentanyl was used during HFPPV. After the completion of the surgery, conventional positive pressure ventilation (PPV) was continued through the endotracheal tube (ETT) to check any bronchial stump leak. After the surgery, patient was weaned and extubated in the operating room. Hospital course remained uneventful and the patient was discharged after 6 days. HFPPV with manually improvised technique is applicable in carinal surgery for optimization of oxygenation, ventilation, and uninterrupted surgical resection.

Key Words: High frequency positive pressure ventilation. Inflammatory myofibroblastic tumor. Carinal resection. Child.

INTRODUCTION
Inflammatory myofibroblastic tumor (IMT), also called pseudo-tumor, is a very rare condition and accounts for less than 1% of primary lung tumor. It is most common benign tumor of lung in children. It can occur at any age, but is most common in children and young adults. Although these tumors are benign, they can grow aggressively and cause obstruction and local invasion or may metastasize distantly. Affected patients may present with asthma, chronic cough, repeated infections or respiratory distress. Treatment of choice is surgical resection. Various techniques are described in the literature for facilitating the surgical resection without interference in the surgical field. One of the techniques described in the current case report is high frequency positive pressure ventilation (HFPPV) provided manually through an endotracheal tube (ETT) via suction catheter. This technique is not reported in the literature in local perspective and it can be very helpful to facilitate such challenging surgical cases. This case is reported with the objective of highlighting the role of HFPPV improvised technique in facilitating surgical resection with maintenance of adequate oxygenation and a little compromised ventilation.

CASE REPORT
A 9-year boy, weighing 21 kg, was diagnosed with IMT of left main bronchus on biopsy and successfully treated by surgical excision through left thoracotomy. The patient presented at his home town with cough, shortness of breath, and bilateral wheeze for three months. Treatment for asthma was started (Ventolin and Seretide inhaler), but due to refractoriness to the treatment, further investigations were done. CT chest showed hyperinflated left lung with contralateral mediastinal shift with suspicious density on left main bronchus (Figure 1). Right lung appeared normal. On bronchoscopy, there was a mass originating from left main bronchus with little extension into right main bronchus across the carina. After the tissue diagnosis, patient was referred to Aga Khan University Hospital for further management.

The patient was assessed for anaesthesia fitness with complete history, clinical examination, and relevant laboratory examination. The patient was labeled as ASA-IV. Two packed red blood cells (PRBC) units were arranged for the surgery. On general physical examination, respiratory rate was 40 breaths per minute and oxygen saturation of 99% on 15 liters of oxygen. Signs of respiratory distress including tracheal tug, subcostal and intercostal recessions were observed. There was decreased air entry on left lower zone with bilateral wheeze. The patient was admitted in Pediatric High Dependency Unit.
In the pre-induction phase, meticulous double setup (surgeon and anaesthesiologist both ready for managing difficulty in intubation/ventilation) was arranged. Emergency drugs (Atropine, Adrenaline) were made ready. Availability of appropriate size rigid and flexible bronchoscopes, different size ETTS/LMAs/Gum elastic bogie was made prior to induction. ASA standard monitoring was applied. The patient was induced with Sevoflurane in 100% oxygen with increments of propofol, ketamine 40 mg and fentanyl 50 µg/kg with maintenance of spontaneous breathing. An 18G intra-venous (I/V) cannula was inserted in addition to existing preoperative 20G I/V cannula. Post-induction arterial line (20G Vygon) was inserted in left radial artery. The patient was intubated with ETT 5.5 mm size and fixed at 15 cm with maintenance of spontaneous breathing. Anaesthesia maintenance was done with propofol 50-200 µg/kg/min I/V infusion through infusion pump. Preoperative bronchoscopy confirmed the mass coming out from left main bronchus. After intubation, patient paralyzed and positioned in right lateral decubitus position after confirmation of ventilation by overdriving the patient spontaneous breathing. The surgical approach was left thoracotomy. HFPPV used for ventilation; and oxygenation during surgery was conducted through 10 French catheter passed via ETT attached to HFPPV apparatus (Figure 2). The pressure of 12-14 psi was used during HFPPV with ventilatory rate of 40-60 breaths/minute to maintain oxygenation and ventilation with no interference with surgical resection field. This technique facilitates suturing of left main bronchus stump and maintains oxygenation despite opening in left main bronchus. There was a rise in PaCO2 (56 mm/Hg) as evident from intraoperative performed arterial blood gases (ABGs). Total Intravenous anaesthesia with propofol infusion and increments of fentanyl was used during HFPPV. Initially tried to spare the lung, but eventually resorted to left pneumonectomy as primary anastomosis was not possible. Intraoperative ABGs were done to assess the adequacy of ventilation and extent of hemoglobin drop. Blood loss of only 50-75 milliliters was noted. After the completion of the surgery, the catheter was pulled out and conventional PPV was continued through the ETT to check any bronchial stump leak. This technique was found to be very useful, as there was no surgical field interference. Total duration of the surgery was 205 minutes and duration of HFPPV was approximately 140 minutes.

Paravertebral catheter was inserted by the surgeon through extra-pleural space intraoperatively for post-operative pain relief through 19G Tuohy needle. The space was loaded with 2.5 ml 0.25% Bupivacaine and then infusion was started at 2-4 ml/hour for 72 hours post-operatively. Supplemental analgesia by IV paracetamol and ketorolac was administered postoperatively. This excellent analgesia facilitates smooth extubation and good incentive spirometry postoperatively.

After the surgery, patient was weaned and extubated in the operating room. Hospital course remained uneventful and the patient was discharged after 6 days. The patient was followed-up up to one year with no recurrence on follow-up CT scan.

DISCUSSION

IMT is a rare tumor of mesenchymal origin. Its etiology is still unknown; it is postulated that it may be due to inflammatory response. Complete surgical resection is a gold standard to prevent recurrence. Lobectomy or pneumonectomy is usually done to ensure radical resection with clear margins. Bronchoscopic removal of tracheobronchial IMTs can be done if they are limited to lumen only. Various techniques are described in the literature to facilitate surgical resection including high frequency ventilation. A variety of methods for providing adequate oxygenation and CO2 elimination have been used during
tracheal resection. These include, standard oro-tracheal intubation, insertion of a tube into the opened trachea distal to the area of resection, HFJV through the stenotic area, low frequency jet ventilation for stent insertion, HFPPV and cardiopulmonary bypass, specially when left thoracotomy approach is used.

In the current case, the technique used was that a simple suction catheter (10 French) was attached to the delivery port of the manual high frequency positive pressure ventilator with attachment to central oxygen supply, as shown in Figure 2. The catheter was passed through the ETT into the trachea to deliver low tidal volume breaths with pressure of 10-12 PSI at frequency of 40-60 breaths/minute through HFPPV apparatus manually. Anesthesia maintenance was done with TIVA. The technique facilitates suturing of left main bronchus stump with opened trachea. Though the technique is ideal for oxygenation, but ventilation is compromised due to low tidal breaths and reduced expiratory time.

The lesions at such a critical area can lead to 'can't ventilate' scenario; in which case, only life-saving technique is the availability of cardiopulmonary bypass to maintain oxygenation and ventilation. Such critical surgeries must be referred to centers with all these facilities for best possible outcome.

Proactive approach to anticipate airway and surgical complications and their prevention is the pivot of every successful completion of difficult cases. HFPPV with manually improvised technique through a simple suction catheter passed across ETT, is applicable in carinal surgery for optimization of oxygenation, ventilation and uninterrupted surgical field.

REFERENCES


