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Case Report

Anaesthesia Section

One Lung Ventilation Using an Orotracheal Tube and an Endobronchial Blocker in a Patient with Difficult Airway

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ABSTRACT

One-Lung Ventilation (OLV) is achieved in thoracic surgeries to facilitate collapse of one lung for better surgical visualisation. Double-lumen tubes and bronchial blockers are two commonly used devices for OLV. Patients with 'difficult airway' pose significant challenges for insertion of Double Lumen Endotracheal Tube (DLT). Dual malignancy such as carcinoma of lung and head and neck is extremely rare to present with. Patients presenting with restricted mouth opening due to previous surgeries and requiring lung isolation techniques may pose significant challenges to anaesthesiologist. The difficult airway scenario may arise in such patients owing to their previous surgery to the tongue, larynx, neck, mandible or previous radiation. The present case was of 47-year-old of lung isolation achieved in a patient with restricted mouth opening with an orotracheal tube, bougie, endobronchial blocker and a flexible Fibre Optic Bronchoscope (FOB). Left upper lobectomy was successfully performed after passing endobronchial blocker through a conventional orotracheal tube under the guidance of FOB.

Keywords: Bronchial blocker, Double lumen endotracheal tube, Fibre optic bronchoscope

CASE REPORT

A 47-year-old male, weighing 55 kg, was diagnosed of synchronous dual malignancy with carcinoma right buccal mucosa and carcinoma left lung. Carcinoma of lung was an incidental finding on Contrast Enhanced Computed Tomography (CECT) which showed a lesion 6 × 5 cm in the left apical segment. Patient had undergone wide local excision, segmental mandibulectomy and free soft tissue anterolateral thigh flap reconstruction for carcinoma buccal mucosa two months earlier. Previous surgery was done after awake fibre optic nasotracheal intubation done by same anaesthesia team. Patient was scheduled for left upper lobectomy. Patient was evaluated preoperatively, as per department protocol. He had unremarkable laboratory reports. Preoperative echocardiography showed moderate aortic regurgitation with good biventricular function.

Airway examination revealed restricted mouth opening (Mallampatti 4) with inter-incisor distance of one-finger, thyromental distance of three fingers [Table/Fig-1a,b]. With free flap at the right angle of the mouth in situ, presumably make the mask ventilation considered to be difficult. Overall, the airway was considered as 'difficult airway' for both bag and mask ventilation and tracheal intubation especially for insertion of DLT.

[Table/Fig-1a,b]: Restricted mouth opening with inter-incisal distance of one finger a) lateral view b) frontal view.

Upon arrival in operating room peripheral Oxygen Saturation (SpO_2), 5-lead-electrocardiography, non invasive blood pressure, heart rate was monitored. A thoracic epidural catheter was placed at T9 and T10 intervertebral space for the purpose of analgesia. Patient was preoxygenated for three minutes and premedicated with midazolam 2 mg, glycopyrrolate 0.2 mg, fentanyl 50 mcg. He was induced with propofol, i.v., 100 mg. After determining that mask ventilation was possible, inj. succinylcholine, 75 mg, i.v., was administered. Using McCoy laryngoscope, laryngoscopy was attempted by experienced anaesthesiologist. Cormack-Lehan grade classification of three was identified after laryngoscopy. With optimal backward and upward pressure, there was inability to visualise glottis opening including arytenoids or other cartilages. Subsequently, a bougie was passed blindly into trachea. A tracheal tube was passed rail-roading technique without removing the laryngoscope subsequently. At the end, patient was successfully intubated with 8 mm orotracheal tube. Bilateral lung ventilation and air entry was conformed with 5-point auscultation method.

Patient's left subclavian vein was inserted with triple lumen central venous catheter under ultrasound guidance. Left radial arterial catheter was placed simultaneously. An endobronchial blocker (COOPDECH) followed by a flexible fibre optic bronchoscope was passed through the lumen of the orotracheal tube. Under the bronchoscopy guidance endobronchial blocker was passed into the left main bronchus. Negotiating the endobronchial blocker to left main was guided by longitudinal fibres of left main bronchus. Position of the blocker was confirmed when the blue coloured cuff was observed just beyond the carina at its inflation [Table/Fig-2].

Ventilation was continued initially with volume-controlled mode, tidal volume of 450 mL, respiratory rate of 14 cycles per minute, Fraction of Inspired Oxygen (FiO_2) of 0.5. End Tidal Carbon Dioxide ($EtCO_2$) was monitored throughout the surgery. Anaesthesia was maintained with sevoflurane of 2%, propofol infusion, opioids and intravenous boluses of cis-atracurium. Patient was positioned right laterally; position of the bronchial blocker was confirmed again using fibre optic bronchoscope.

Surgical procedure included thoracotomy and resection of apical lobe. Before opening the thoracic cavity, the OLV was initiated by inflating the blocker cuff. A suction catheter was passed through the tracheal tube to clear the trachea. The bronchial blocker lumen was used for suctioning for faster deflation of the non dependent operative lung. Ventilation was continued on volume-controlled

[Table/Fig-2]: Bronchial blocker placed in a difficult airway subject; the red arrow represents the bronchial blocker and white arrow represents the fibre optic image of appropriately placed blocker's blue cuff portion near the carina.

mode but with a reduction in tidal volume. Arterial Blood Gas (ABG) analysis was done upon initiating OLV (when $EtCO_2$ was 36 mmHg) which showed a pH 7.30, pO_2 248 and pCO_2 50. ABG was repeated after 30 minutes however showed no significant difference in arterial-alveolar pCO_2 gradient. SpO_2 remained above 97% throughout the surgery, with a FiO_2 of 0.5. Patient remained haemodynamically stable throughout the surgery and subsequent blood gas readings did not show clinically significant abnormal values. After the resection of particular lobe, the bronchial blocker was deflated and two-lung ventilation was resumed. Total duration of OLV was for 3.25 hours.

On attempting spontaneous breathing, patient was reversed with inj. neostigmine, i.v., 2.5 mg and inj. glycopyrrolate, i.v. 0.2 mg and trachea was extubated. Patient was shifted to intensive care unit was monitored as per departmental protocols. Postoperative analgesia was maintained with epidural infusion of inj. ropivacaine, 0.2% and inj. buprenorphine, 3 mcg/hour, with additional doses of intravenous boluses of tramadol. Patient was advised to continue deep spirometric breathing exercises. Postoperative period was uneventful and patient was discharged on 6th day.

DISCUSSION

The OLV in patients undergoing thoracic surgery is typically achieved with DLT. Patients with 'difficult airway' pose significant challenges for insertion of DLT [1-3]. Endobronchial blockers are being used for OLV in patients with restricted mouth opening who require thoracic surgery [4-7]. Dual malignancy is often uncommon and moreover, carcinoma of lung and head and neck is extremely rare combination to present with. The difficult airway scenario may arise in patients due to poor mouth opening (Mallampati 3 or 4), prominent upper incisors and a receding mandible, limited cervical mobility or previous surgery to the tongue, larynx, neck, mandible or previous radiation [8].

Awake fibre optic intubation with a DLT is problematic in a patient with difficult airway because of the large size of the tube and greater difficulty in blunting the laryngeal and carinal stimulation during DLT placement. If a conventional orotracheal tube is used to secure the airway, an endobronchial blocker may be the safest means of establishing lung isolation as it avoids the need for a tube exchange [9]. When conventional orotracheal tube is used, if postoperative ventilator support is required, the bronchial blocker may simply be removed at end of the case [10].

In this case, normal orotracheal tube was considered for intubation. This is because it is extremely difficult to pass a DLT in a patient with restricted mouth opening or sometimes it may be never possible. Nasotracheal intubation is not preferred using DLT owing to its distal curvature(s) and large outer diameter. The initial two attempts to pass DLT (using Seldingers technique, railroading) over the bougie were unsuccessful because, the narrow lumen of the DLT did not facilitate the smooth passage at the distal angled bend tip portion of the bougie. Fibre optic intubation would be better option for such cases however passage of DLT again remains difficult. Conventionally, size 32 of DLT has external diameter of 10.7 mm, and bronchial diameter of 3.5 mm; therefore, it can accommodate only flexible fibre optic bronchoscope of size 2.4 mm. Only 35, 37 or 39 DLTs can accommodate a fibre optic scope of ≥3.5 mm. In this patient, FOI was not done because as 32 size DLT was used. Using fibre optic scope size 2.4, it remains unknown about the feasibility and success of DLT intubation in a difficult airway patient. Furthermore, intubation with DLT when attempted through pediatric size flexible fibre optic scope, may damage the optical fibres.

Endobronchial blockers are thin, rigid catheters with an inner lumen and a distal cuff at the tip. Inflating the cuff prevents distal airflow and lung isolation [11]. A conventional orotracheal tube with an internal diameter of at least 8 mm is recommended for the commonly used 9-Fr bronchial blocker, though smaller tube sizes may be used [12]. The 8 mm orotracheal tube size is comparable in size to that of a 32 Fr DLT. In both right and left-sided operations bronchial blockers are safe and effective for achieving lung isolation [13] and surgical exposure are equivalent to that of left-sided DLTs [14]. Some studies have concluded that bronchial blockers took longer time for positioning or required frequent repositions, more recent reports suggests that bronchial blockers may be help in more rapid and complete lung collapse [7,13-15].

Orhan ME et al., performed an orotracheal intubation technique using a DLT, flexible fibre optic bronchoscope and a stylet in an unanticipated difficult airway due to massive lingular tonsillar hyperplasia, for thoracotomy. They introduced stylet within the DLT, converting flexible scope to rigid scope. Flexible fibre optic bronchoscope tip was shielded by DLT from better visualisation, performing a successful intubation. However, they did not mention the DLT size mentioned anywhere in their report [16]. In another report introduced a video fibre optic scope through nostril to monitor the passage of DLT rather than as an introducer in oral cancer patients. The authors passed a 5.5 mm video fibre optic scope and successfully intubated, proving as an alternative technique for difficult intubation of DLT [17]. Similarly, Liu Z et al., reported successful OLV using an extra luminal uniblocker along with a small Single Lumen Tube (SLT) in an emergency thoracotomy patient, having a large mass on the glottis which obstructed the entry of the DLT [18]. Koo BS et al., performed a bronchoscopic guided introduction of SLT in a 4-year female scheduled for left lower lobectomy. OLV was achieved with limited instrumentation [19]. In contrast to the above cases, usage of bronchial blocker assisted OLV has been reported by only few. Kaza SR et al., achieved OLV by positioning a wire-guided Arndt bronchial blocker through a nasotracheal tube in a patient with distorted upper and lower airway anatomy [20].

Galata M et al., performed selective and sequential lobar ventilation with EZ Blocker (EZB) that allowed identification and the suturing of pulmonary lesions with an optimum oxygenation [21]. EZB is used in selective lobar exclusion where alternate exclusion of different lobes of the lungs is necessary. EZB is a Y shape semi-rigid endobronchial blocker with two distal extensions with two inflatable cuffs which are colour-coded [22]. Rispoli M et al., described that the EZB can be used via tracheostomy [23]. Campos JH et al., conducted a retrospective study on 70 patients with tracheostomy for lung isolation. OLV was achieved with Shiley cuffed low pressure tracheostomy tube with a bronchial blocker in patients who had fresh tracheostomy stoma of <7 days. But in patients with long term stoma, OLV was achieved with a SLT with a bronchial blocker or

SLT guided into a selective bronchus. They used flexible fibre optic bronchoscope in all cases [24]. Irrespective of previously published reports, this case was unique because of dual malignancy associated with difficult airway where OLV was successfully managed using a conventional orotracheal tube.

CONCLUSION(S)

The OLV can be achieved successfully in a patient with restricted mouth opening, after placing an endobronchial blocker through an orotracheal tube under the guidance of flexible fibre optic bronchoscope. This method is best for OLV in situations where placement of a DLT is technically impossible or impractical.

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