Airway obstruction during one lung ventilation: A shocking twist in the tube

Sir,

Intraoperative airway obstruction is not an uncommon life threatening emergency. We encountered an incident of unexpected intraoral kinking of double lumen tube (DLT) intraoperatively during one lung ventilation (OLV) in right lateral decubitus position.

A 39-year-old male, diagnosed case of Pott's spine of T12-L1 vertebrae with paraparesis was posted for left sided thoracotomy and corpectomy with fusion of T12-L1 vertebrae. Patient was planned for OLV with DLT for better surgical exposure and was intubated with 39 Fr left sided DLT (SHER-I-BRONCH®; HUDSON RCI, CA, USA) which was fixed at 28 cm mark at the incisors. The patient was turned to right lateral decubitus position and optimal placement of DLT was rechecked with auscultation and fiberoptic bronchoscopy. After 1½ h of surgery, left lung was collapsed, OLV of dependent right lung was instituted with a tidal volume of 500 ml. After 30 min of OLV, peak airway pressure increased from 24 to 32 cm H_2O and expired tidal volume decreased to 400 ml. Peak airway pressure further increased to 45 cm H_2O and expired tidal volume decreased to 100 ml over the next few minutes. End-tidal carbon dioxide rose to 78 mmHg, oxygen saturation dropped to 44%, hypertension and tachycardia were noted. Auscultation revealed absent breath sounds on the right side of the chest. Pressure controlled ventilation was instituted but expired tidal volumes were 100 ml at 40 cm H_2O pressure. Patient was then ventilated manually with reservoir bag, oxygen saturation increased to 92% but there was a high resistance to bag squeeze. A tube block due to secretions or displacement was considered and suction catheter was passed into the tracheal lumen

for suctioning. However, the suction catheter could not be negotiated more than 10 cm. The bronchial lumen was attached to the ventilator circuit and dual lung ventilation was tried. However, the collapsed left lung failed to expand inspite of manual ventilation with high inspiratory tidal volumes. Arterial blood gas analysis revealed severe respiratory acidosis with pH of 6.94, pCO_2 of 121 mmHg, bicarbonate of 26 mmol/L and pO_2 of 148 mmHg. Fiberoptic bronchoscopy was contemplated but was not feasible in this life threatening scenario.

The decision to convert to single lumen endotracheal tube was taken quickly, patient was turned to the supine position, DLT was removed and trachea was reintubated with a 8.5 mm internal diameter cuffed polyvinyl chloride (PVC) endotracheal tube. Adequate ventilation was achieved with air entry present on auscultation over the right lung and left lung expanded visibly. Expired tidal volume, airway pressure and capnometry normalised quickly and repeat arterial blood gas sample showed a pH of 7.44 with a pCO_2 of 46 mmHg. Surgery was continued with retraction of the left lung and completed. Neuromuscular blockade was reversed, patient was extubated and had an uneventful recovery.

Inspection of the DLT after extubation showed a sharp kink along the concavity at around 18 cm mark which was occluding both the lumens. The kink was in the oropharynx at the point where the patients' oral axis and the pharyngeal axis met.

Kinking of the endotracheal tube intraoperatively, though uncommon creates a life-threatening emergency.[1] Kinking generally occurs in PVC tubes during head and neck surgeries due to excessive bending of the neck and are usually extraoral. However, kinking can occur in reinforced tubes and DLTs and can be extraoral, intraoral or intratracheal. Endotracheal kinking of a DLT may occur as a potential complication of inappropriate DLT size selection.[2]

Apart from kinking of the DLT, intraoperative difficulty in ventilation during DLT use may also result from obstruction of the DLT by blood, secretions, foreign body, abnormal anatomy, endobronchial mass and external bronchial compression. Poor pulmonary or chest wall compliance, acute bronchospasm, tension pneumothorax also manifest as difficulty in ventilation.[3] Kinking and other causes of obstruction may present as an inspiratory wheeze, but bronchospasm presents as an expiratory wheeze. However, the most common cause of airway obstruction during DLT use is malposition. It occurs in about one-third of patients while positioning in lateral decubitus position; fiberoptic bronchoscopy to confirm tube placement after positioning is essential.[4]

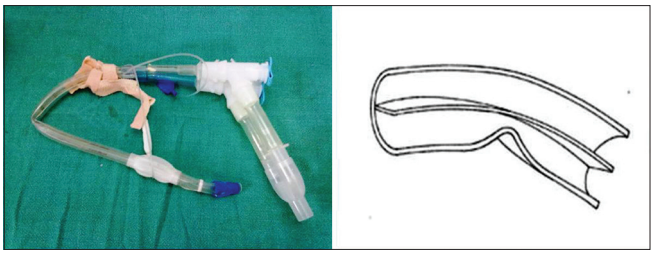

Figure 1: Double lumen tube showing a sharp intraoral kink due to thermal softening

The sudden unforeseen kinking after 2 h in this case at the junction of the oral and pharyngeal axis was caused by thermal softening of the PVC DLT due to the temperature inside the oral cavity. The tube softens and kinking occurs inside the oropharynx due to over bending [Figure 1]. Bending of the PVC DLT along the concave curve at room temperature does not compromise the tube patency but at body temperature kinking and lumen obstruction can occur at a low angle due to tube softening.[5] Medical grade silicon DLTs (Silbronco® DLT; Fuji Systems, Tokyo, Japan) have properties of less tube softening with prolonged use and have a reinforced endobronchial tip to reduce kinking; however further studies are necessary.[6] Failure to secure free airway following airway obstruction due to DLT kinking may be lethal. Early detection and a low threshold for extubation and initiation of rescue ventilation with another DLT, endotracheal tube or laryngeal mask airway is vital.

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