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Letter to Editor

Inadvertent kinking of a flexometallic endotracheal tube

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Dear Editor,

Flexometallic tubes, sometimes referred to as armoured tubes are very commonly used in head, face and neck surgeries due to their added advantages of resistance to kinking, compression and easy angulation away from the surgical field.[1] While nasotracheal intubation is performed during maxillofacial procedures that necessitate an oral approach to surgery, oral methods for intubation using flexo metallic tubes are the preferred method.[2] Here, we report a case of nasotracheal intubation for Le Fort fracture in a 7-year-old child, where high peak pressures and persistently raised end-tidal carbon dioxide levels led us to the introspection of the causes.

A 7-year-old male child came with an alleged history of a road traffic accident between an auto rickshaw and a two-wheeler which resulted in injury to the face with active bleeding from the nose and mouth. There was no history of any loss of consciousness or seizures. The NCCT brain was normal. The three-dimensional (3D) reconstruction imaging of the face revealed a Le-Fort II fracture. The case was posted in the Trauma and Emergency Operation Room (OR) for open reduction and internal fixation (ORIF) of the Le-Fort II fracture.

On the preoperative examination, the child was anxious and irritable. Pulse rate was 110 beats per minute, Blood pressure was 100/74 mmHg with room air saturation of 100%. On airway examination, no gross facial abnormality was noted. Mouth opening was adequate with Mallampati grading class II. No external injuries were noted.

Intra-oral approach to surgery was planned for fracture fixation, so nasal patency was confirmed, and nasal preparation was done with xylometazoline drops and serial dilatation with the nasopharyngeal airway. General anaesthesia was administered with adequate doses of fentanyl, propofol and atracurium was used for muscle relaxation. Nasotracheal intubation was done with an uncuffed flexometallic tube of 4.5 mm size with the help of Magill's forceps. After confirming the position of the tube by five-point auscultation and capnography trace, the tube was fixed at the right nostril, the patient was put on controlled mechanical ventilation. The oropharynx was packed with saline-soaked roller gauze to prevent leaks and blood spillage into the trachea.

Initial measured parameters were peak airway pressure of 11 cm H2O, plateau pressure of 8 cm H2O, and end-tidal carbon dioxide concentration (EtCO2) of 41 mmHg. Persistent gradual rise in EtCO2 was noted from a value of 41 up to 63 mmHg (Figure 1).

From the set tidal volume of 120 ml, only 80-90 ml was being delivered, with a leak of 25-30%. Airway misplacement was ruled out by auscultation and capnography.

Check video laryngoscopy was done intraoperatively to visualise the position and to rule out any kinking

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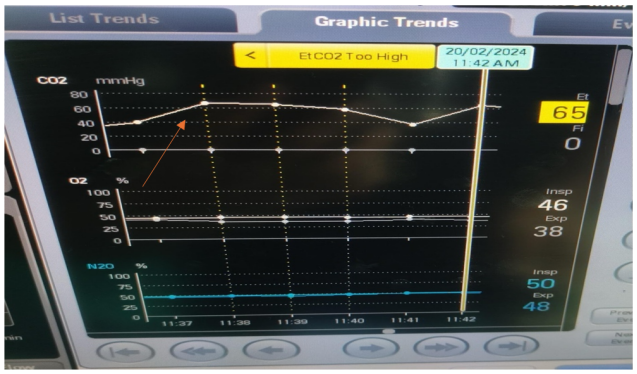

Figure 1: Image of the monitor showing the trend in end tidal CO2 (brown arrow)

of the endotracheal tube due to instrumentation. Manual ventilation was done with the help of the reservoir bag with the APL valve closed at 10 cm H2O to deliver optimum tidal volume and washout of excess CO2. On manual ventilation, the normalisation of EtCO2 was associated with an increase in peak airway pressures from 14 to 26 cm H2O.

During the periods of alternating manual and controlled ventilation, a decrease in EtCO2 values on manual ventilation was associated with an increase in peak airway pressures. Contrarily on controlled ventilation, the increase in EtCO2 was associated with a slight decrease in airway pressure. Changing of the tube was strongly considered but as the surgery was about to conclude we ventilated the patient manually.

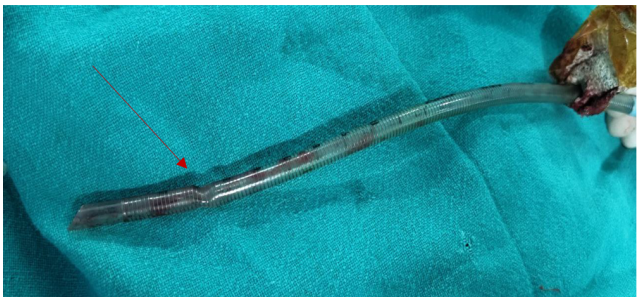

Figure 2: Image showing kinked armoured endotracheal tube (red arrow)

Maxillofacial surgery poses many challenges to the anesthesiologists, mainly because of the management of a shared airway and to provision of adequate surgical access. The surgeries performed via the intraoral approach, require the oral cavity to be free from the tube for which nasal intubation is preferred.[3]

Nasal intubation requires adequate preparation in the form of topical vasoconstriction and serial nasal dilation. Flexometallic tubes are preferred over standard PVC tubes because of their kink-resistant property.[4] Flexometallic tubes have a softer tip with a greater bevel angle as compared to PVC tubes, which are less traumatic to the nasal turbinates during nasal intubation.[1]

Studies have reported complications of tracheal tubes during maxillofacial surgeries like partial and complete transection of tracheal tubes, damage to the pilot balloon and inability to deflate the cuff.[5,6] In these cases there was a visible and evident damage to the tube, unlike in our case where the damage was not visible externally.

Insertion of the nasal flexometallic tube requires the use of Magill's forceps to guide it into the trachea which may lead to damage to the tube/cuff leading to kinking or leak.

Kinking of the tube can lead to various ventilatory issues like ventilator malfunction, mucus plugging, pneumothorax, pulmonary oedema and bronchospasm.[7]

Persistently rising EtCO2 values and peak airway pressures in our case were suggestive of airway obstruction. The differential diagnosis for this condition is malignant hyperthermia, bronchospasm, obstruction or kinking of the circuit/tube, incorrectly positioned endotracheal tube and rarely pneumothorax.[8] Auscultation of the chest ruled out airway obstructions like bronchospasm and endobronchial intubation which made us suspicious of a mechanical obstruction of the endotracheal tube. The possibility of malignant hyperthermia was ruled out due to absence of rise in temperature and muscle rigidity.

The gold standard technique for confirmation of kinking of the endotracheal tube is a paediatric flexible fiberoptic bronchoscope, which may not be available in all settings including ours.

To confirm the mechanical obstruction of the tube, video laryngoscopy was performed which revealed inconclusive findings as only the intra-oral portion of the tube up to the level of the vocal cords was visualised.

The portion of the tube that is intra-nasal and beyond the glottic opening cannot be visualised by video laryngoscopy. Hence, concealed obstruction or kinking beyond the level of the glottis can be visualised by fiberoptic bronchoscopy or after the removal of the endotracheal tube and this must also be considered as a possibility in airway complications.

This case highlights the importance of considering potential kinking of flexometallic endotracheal tubes, particularly if kinking occurs beyond the vocal cords where it may be concealed. Minimal force should be used when guiding tubes through the airway. Ongoing education and vigilance are crucial to prevent and promptly address kinking incidents during intubation procedures.

1. Conflict of Interest

None.

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