Disappearance of capnography waveform during anaesthesia in the neonate: Heat and moisture exchanger filter – A significant cause

Sir,

Heat and moisture exchanger filters (HMEFs) are widely used during general anaesthesia to humidify gases and protect the breathing system from expired infective droplets. One of the major advantages includes the prevention of microbial contamination in the breathing circuit which holds a major significance during this evolving coronavirus pandemic. However, they can alter the ventilatory parameters in a mechanically ventilated patient. Moreover, these can alter the capnography waveform, particularly in paediatric patients and can cause the capnogram to disappear altogether. We hereby wish to highlight an unusual case scenario wherein the HMEF resulted in the disappearance of capnography waveform in a neonate under general anaesthesia.

A 4-day old neonate weighing 3 kg was scheduled for excision of occipital encephalocele. General anaesthesia was induced and endotracheal intubation was done with an uncuffed endotracheal tube (ETT) of internal diameter 3 mm. Initially, we tried 3.5 mm tube but it could not be inserted. The correct position was confirmed by auscultation, visible chest rise and capnography. ETT was connected to Drager Primus anaesthesia workstation and ventilated with volume control mode with tidal volume 30 mL and frequency 30 breaths/min. The baseline values for end-tidal carbon dioxide (EtCO$_2$) of 30 mmHg, airway pressures of 20 cm water and oxygen saturation (SpO$_2$) 98% were noted. Prone positioning was done to aid in the surgical field. A fresh paediatric HMEF was connected and CO$_2$ sampling line was attached to the side port of HMEF. Sudden disappearance in capnogram was observed within a few seconds after connecting HMEF but no change in heart rate, SpO$_2$ and tidal volume was noticed. The patient was immediately shifted to the manual mode of ventilation. Paediatric circuit F was attached to Drager machine and the machine provided the ventilator parameters. Bag compliance was found to be normal. Auscultation of the chest revealed equal breath sounds bilaterally and chest rise was adequate. Other possibilities such as kinking of ETT and circuit kink were ruled out. Attempts were made to change the sampling line of EtCO$_2$ and installation of another fresh HMEF but no effect on capnogram was observed. Throughout the surgery, SpO$_2$ was between 97–98% with a fraction of inspired oxygen (FiO$_2$) of 0.5 although a slight increase in airway pressure was noted. Eventually, after removing the HMEF we attached the EtCO$_2$ sampling line between the ETT and breathing circuit which resulted in the appearance of normal capnograph within 1–2 min and airway pressure returned to normal. The problem was diagnosed as excessive dead space in comparison to delivered tidal volume due to HMEF which hampered EtCO$_2$ reading.

HMEF is of great importance in intubated patients where the normal function of the upper respiratory tract is compromised, especially in neonates and infants. However, it has certain drawbacks like breathing circuit disconnection owing to filter weight or moisture condensation. Therefore, we used HMEF after prone positioning. These were electrostatic filters of dead space 30 mL, low resistance, weighing 20 g and having filtration efficiency of 99.99%.

In the present case, after induction of anaesthesia, the position of ETT was confirmed by EtCO$_2$. However, after putting HMEF, EtCO$_2$ decreased and eventually disappeared. HMEF is routinely used for both adult and paediatric patients but we never encountered this problem earlier. Further, Costigan and Snowdon reported a case where the capnography waveform could not be detected with the use of HMEF and documented that accuracy and implementation of anaesthesia monitors are inevitably affected by the use of HMEF.

To conclude, although HMEF adds to significant dead space volume in neonates, one should be vigilant enough to remove it and directly connect the CO$_2$ sampling line to the ETT connector. One should not panic and rather be vigilant in monitoring the ventilatory parameters.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.
Dear Editor,

Moebius syndrome is a rare neurological disorder with a prevalence of 0.0002%-0.002% of live births characterised by unilateral or bilateral facial paralysis and defective extra-ocular movements, secondary to congenital paresis of the facial (VII) and abducens (VI) cranial nerves. It can be associated with various craniofacial (mandibular hypoplasia, microstomia, temporomandibular joint dysfunction, cleft palate, external ear deformities) defects, limb (clubfoot) and musculoskeletal malformations.

We report a case of a 13-year-old boy weighing 38 kg diagnosed with Moebius syndrome who was posted for orthognathic surgery. The patient presented with hemifacial palsy, maxillary and mandibular hypoplasia with restricted mouth opening [Figure 1].

Airway examination revealed a mouth opening of 1.5 cm, thyromental distance of approximately 5 cm, restricted temporomandibular joint mobility and Mallampati Class IV.

Awake retrograde nasotracheal intubation was planned. This was the first choice as our fibre-optic scope was out of order. We did not consider the option of referring to any other centre as ours is a tertiary care post graduate (PG) teaching centre taking care of a lot of congenital facial deformities with difficult airway. The patient was counselled about the procedure of anaesthesia and found to be co-operative. The airway was anaesthetised by 2 ml 2% lignocaine with adrenaline soaked nasal pledgets, 4 puffs 10% lignocaine spray of the throat, and 4 ml of 2% lignocaine to block superior laryngeal nerve and transcricoid injection.

After piercing the cricothyroid membrane with an 18G Tuohy needle, a 0.035 floppy tip Terumo guidewire (Biorad Company) with a smooth flexible tip on one end, was introduced. Guidewire was advanced gently and when it appeared in the mouth, was taken out through the nose with the help of a Ryle’s tube inserted nasally. The flexometallic endotracheal tube was railroaded...

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