

Unrecognised oesophageal intubation

In November 2021, the Coroner reported the findings of the unexpected death of a 19-month-old child during anaesthesia in the operating theatre in preparation for emergency surgery. The Coroner found that unrecognised oesophageal intubation resulted in the sudden deterioration and death of the child.

The child was intubated using rapid sequence induction, given concern over the fasting time. A size 4 cuffed Endo Tracheal Tube (ETT) was inserted to a depth of 15cm and was connected to the breathing circuit. It was reported there was a good view of the glottis, and air was introduced into the ETT cuff. As this produced an audible leak, more air was introduced, however the air leak remained.

At this point in time the child's chest appeared to be inflating on both sides and the ETT was noted to be misting. There was an ETCO₂ trace, although the waveforms were noted to be small. It was reported the child's oxygen saturations were below 90%.

Due to the low saturations, the ETT was withdrawn slightly. The child's chest was auscultated, and the anaesthetist was able to hear bilateral air entry, as well as a harsh or coarse wheezing sounds, which were thought to be from the upper airway.

Given the clinical findings, care was escalated to a senior anaesthetist and a decision was made to replace the ETT. This was removed and observed to have blood near the cuff and tip. A size 4.5 ETT was placed under direct vision using a laryngoscope. A grade 2A view [visualisation of the glottis after positioning of the laryngoscope] was achieved following manipulation. It was stated that the ETT

passed between the vocal cords, however once in place, the ETT was not secured with tape, in accordance with usual practice. Air was introduced into the cuff however again resulting in an audible leak.

Both anaesthetists auscultated the child's chest, and heard bilateral chest sounds and a harsh wheeze. It was noted that the child's oxygen saturations were falling to 85%, however it was reported the child was thought to be getting some oxygenation. The child's stomach was noted to be distended; therefore, a suction catheter was used to remove air. It was stated that the breathing circuit was at high pressures and that minimal ETCO₂ waveforms were displayed on the monitor.

It was proposed that the child had bronchospasm and anaphylaxis therefore Salbutamol was administered. Fentanyl and Suxamethonium were administered to deepen the anaesthetic and improve ventilation. A short time later the child's oxygen saturations and heart rate dropped dramatically. CPR was initiated and despite the best efforts of the team the child did not survive.

Findings:

The Coroner reported that it was not clear as to whether the oesophageal intubation occurred as a direct consequence of the separate attempts at intubation, or as a result of the ETT becoming subsequently dislodged. The evidence indicated that dislodgement could have occurred upon the laryngoscope being removed, or during inflation of the cuff. The evidence did however establish that oesophageal intubation occurred early in the process and was the direct cause of deterioration and subsequent death.

The Coroner reported the induction technique, the decision to use an ETT as the airway option, and the anaesthetic agents and doses were all appropriate. A postmortem computed tomography (CT) scan noted that the ETT lay in the oesophagus, with its cuff inflated with the tip at the Thoracic vertebra 3 level.

The report excluded anaphylaxis as the cause of death. The post-mortem reported a superficial linear tear, measuring 10 mm in length, present in the mucosa of the oesophagus. Areas of haemorrhage were present in the oesophagus and pharynx consistent with oesophageal intubation.

Lessons:

Persistent high amplitude ETCO₂ waveforms are the gold standard for correct ETT placement.

ETCO₂ wave forms

- ✓ It is reported in the literature that a high amplitude wave may appear initially if the ETT is not in the trachea however this would subsequently quickly disappear altogether or display a very low amplitude wave.
- ✓ It can take up to 4 ventilated breaths before waveform is seen
- ✓ The absence of a persistent ETCO₂ waveform should alert clinicians to the possibility of a misplaced ETT- **‘No trace wrong place’**

In the absence of capnography, a disposable CO₂ detection device such as the Easy Cap II™ or Pedi-Cap™ must be used for any intubation attempt in the early identification of oesophageal intubation. Colour change to gold is one indication of a properly placed tube and should not be missed. In the extreme preterm baby, it may take a few positive pressure breaths for it to change to yellow even if you have a well-placed ETT.

“Gold is Good”

Tracheal intubation

An additional indicator to confirm placement of the ETT involves visualising the ETT passing through the cords. If you cannot see the cords, do not try to pass the ETT. It is important to remove the laryngoscope, reoxygenate, plan and perform subsequent attempts with a different intubator, position of the child, or intubation technique.

“If in doubt pull it out”

Signs of ETT placement

- ✓ Visualisation of the ETT passing through the cords

The following non-sensitive signs (soft signs) do **not** reliably indicate that an ETT has **correctly** been placed in the trachea:

- ✗ Misting of the ETT
- ✗ Chest rise and fall; and
- ✗ Air entry heard bilaterally

Conversely, the following signs are indicative of an **incorrectly** placed ETT:

- ✗ A large air leak which did not resolve with cuff inflation
- ✗ Coarse or harsh upper airway noise being heard upon auscultation of the chest
- ✗ The absence of a persistent ETCO₂ waveform on capnography; and
- ✗ Distension of the stomach.

Chest rise and fall

In infants and small children, it is not well known that it is possible to provide some degree of ventilation of the lungs without the ETT being in the trachea. Therefore, chest rise, and fall is **not** a reliable indicator of correct ETT placement.

Pulse Oximetry:

Hypoxia is a relatively late (and ominous) sign in determining correct ETT position. There is commonly a lag for a few seconds until saturations start coming up after correct ETT insertion.

Recognition of ETT misplacement requires the ability to synthesise several indicators in often challenging environments such as paediatric or neonatal resuscitation. It is critical not to anchor your thinking and fixate upon other reversible causes of deterioration.

Remember- in resuscitation: ‘Oxygenation’ not ‘intubation’ is the goal.

References

<https://dontforgetthebubbles.com/intubation-of-the-critically-unwell-child-in-the-emergency-department/>
https://www.rch.org.au/clinicalguide/guideline_index/Emergency_airway_management/