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Danial Laird

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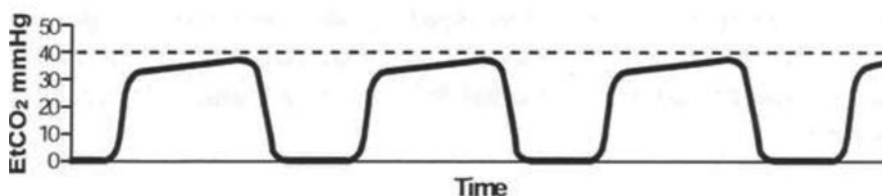


USE OF CONTINUOUS END-TIDAL CARBON DIOXIDE TRACING TO ESTABLISH PRE-HOSPITAL ESOPHAGEAL INTUBATION AS THE CAUSE OF DEATH IN A YOUNG ASTHMATIC WOMAN

Danial Laird, MD, JD, FCLM; Email – DanLairdMDJD@gmail.com
Flamingo Medical Clinic, PLLC, Las Vegas, Nevada

Mechanical ventilation is sometimes used for patients who experience respiratory failure. In order to accomplish this, health care providers sometimes place an endo-tracheal tube into the trachea of a patient experiencing the same. A known but lethal complication of tracheal intubation is inadvertent placement of the endotracheal tube into the esophagus (eating tube), rather than the trachea (breathing tube).

The measurement of end-tidal carbon dioxide (ETCO₂) has long been used as the gold standard to confirm correct placement of the tube in the trachea and not the esophagus. A normal capnogram in a ventilated patient is shown below. Exhalation is represented by the horizontal line between 30 and 40 mm Hg. The capnogram measures carbon dioxide produced by the lungs during respiration. Therefore, in the normal capnogram below, each breath produces carbon dioxide on an indefinite and continuous basis.



When a patient experiences respiratory distress in the field, she is frequently mask ventilated prior to the placement of an endotracheal tube. It is very common during mask ventilation for some carbon dioxide gas to

be forced into the stomach. Therefore, when the esophagus is inadvertently intubated it is common for the capnogram to initially show a carbon dioxide reading, however, when the esophagus and stomach are being ventilated, instead of the lungs, the carbon dioxide level quickly returns to zero since carbon dioxide is produced in the lungs not the esophagus. Within three or four breaths, the capnogram reading quickly returns to zero as the carbon dioxide in the stomach is ventilated away and none is being produced by the stomach.

Placement of an endotracheal tube into the esophagus is not itself, a breach in the standard of care. Even experienced anesthesiologists and emergency room physicians (who frequently intubate the trachea) will occasionally inadvertently intubate the esophagus. However, health care professionals generally agree that it is below the standard of care to fail to immediately recognize an esophageal intubation.

I present the case of a 24-year-old young asthmatic woman, KM, who experienced severe respiratory distress in December 2014. Her boyfriend called 911 and emergency medical personnel responded to their apartment. KM's condition deteriorated and she experienced respiratory, then cardiac arrest. Paramedics intubated KM in the field, however, upon arrival to the hospital, the emergency room physician determined that the endotracheal tube had been placed incorrectly into the esophagus. The emergency room physician immediately replaced the endotracheal tube into the trachea. KM experienced a brief return of spontaneous circulation, however, she died shortly thereafter.

KM's estate and surviving infant filed a lawsuit against the paramedic who placed and failed to immediately recognize the esophageal intubation in the field, arguing the esophageal intubation was the direct cause of KM's death. The defendant paramedic testified that he correctly intubated the trachea at approximately 02:00 AM. He further asserted that based on his assessment, the end-tidal carbon dioxide tracings in the field demonstrated the presence of continuous carbon dioxide placement and therefore, correct tube placement.

Plaintiffs obtained a real time recording of the pre-hospital end-tidal carbon dioxide tracings. Plaintiffs alleged the end-tidal carbon dioxide tracings clearly demonstrate the initial presence of carbon dioxide that quickly abates to a value of zero, consistent with an unrecognized esophageal intubation. The ambulance arrived at the hospital at 02:11 AM, meaning KM was allegedly without oxygen to her brain and other vital organs for approximately 11 minutes while the ambulance was en route to the hospital.

