Risk Management Pitfalls For Pediatric Capnography

1. “I confirmed placement of an ETT with a colorimetric CO2 detector, and my patient was on continuous pulse oximetry, so ongoing capnography monitoring was unnecessary.” While colorimetric capnography is useful to quickly confirm that an ETT is in the trachea, an ETT can become dislodged if the tube is not immediately and sufficiently secured, or if the patient moves, is repositioned, or is transported to another location. In infants and children, even slight movements of the head can cause displacement of an ETT. A displaced ETT that goes unrecognized can be catastrophic for the patient. Continuous infrared capnography can detect ETT dislodgement or obstruction in seconds, whereas pulse oximetry may take several minutes to register a decline in oxygenation. The American Heart Association guidelines for both adult and pediatric life support recommend the use of continuous capnography to monitor the position of an ETT.

2. “When providing CPR, I rely on my coworker, who is providing chest compressions, to let me know when he is getting tired and needs to switch. As long as the compressor is pushing hard and fast and is generating a palpable femoral pulse with each compression, the compressions are effective.” Numerous studies confirm that ETCO2 correlates with cardiac output during CPR, and capnography can provide an objective and quantitative measure of the volume of blood flow that is generated by compressions. A drop in the value of ETCO2 on the capnogram can be indicative of compressor fatigue and the need to switch to another provider. The 2010 American Heart Association Guidelines for CPR now recommend the use of capnography to monitor and optimize the effectiveness of chest compressions.

3. “The patient was in cardiac arrest, so the ETCO2 was so low that capnography wouldn’t have been useful in confirming that the ETT was in the trachea.” Current-day infrared ETCO2 detectors are extremely sensitive and can detect residual CO2 in the trachea and reveal a recognizable waveform to indicate the ETT is properly placed. The 2010 American Heart Association guidelines for CPR recommend quantitative waveform capnography to confirm ETT placement in cardiac arrest.

4. “The only way to know if a cardiac arrest patient is responding to resuscitation is to stop CPR every 2 minutes to check for a pulse.” The 2010 American Heart Association guidelines encourage the use of capnography to monitor and optimize CPR as well as to indicate ROSC. Pauses in CPR should be minimized in order to maintain perfusion pressure to essential organs. An increase in ETCO2 noted during resuscitation indicates an increase in pulmonary blood flow. ROSC is recognized by an abrupt increase in ETCO2 to normal or above-normal levels.

5. “The pulse oximeter said my sedated patient had an oxygen saturation of 100%, so I knew he was breathing effectively.” While a pulse oximetry reading of 100% is reassuring to the emergency clinician because it indicates oxygen has been effectively delivered to body tissues, it does not reveal any information about how effectively the patient is ventilating. It is possible to have a pulse oximetry reading of 100% in a patient who is hypoventilating. Pediatric patients have smaller functional residual capacity and higher metabolic demands than adults. If uncorrected, hypoventilation in a child can decompensate quickly to apnea and possibly to cardiac arrest. Continuous capnography monitoring can provide prompt (within 1 breath) objective information about changes in a patient’s ventilatory status. While not yet standard of care, many professional organizations encourage the use of waveform capnography in the monitoring of patients receiving procedural sedation.
6. "My sedated patient had an ETCO2 of 20 mm Hg. That meant he was hyperventilating and I didn't need to worry about respiratory depression.‘‘ Although a high ETCO2 (> 50 mm Hg) is always indicative of hypoventilation, it seems intuitive to assume that a patient who is hyperventilating will breathe down his CO2 and have a low ETCO2 reading; however, this is not always true. As the tidal volume declines, a greater proportion of exhaled ventilation is made up from the dead space. These patients will have a low ETCO2 reading (< 30 mm Hg), and the amplitude of the waveform on capnography will be markedly reduced. Since the patient with hypopneic hypoventilation will have a normal respiratory rate, this form of hypoventilation is often undetected by emergency clinicians who do not use capnography monitoring.

7. "I knew that after a seizure, a postictal patient may hypventilate and become hypoxic, so I kept her on continuous pulse oximetry and a nonrebreather mask to provide supplemental oxygen until she was fully awake.‘‘ Postictal patients often have decreased respiratory drive and may have disordered breathing. While it is important to monitor these patients for hypoxia and provide supplemental oxygen as necessary, pulse oximetry will not provide any clinical data about the adequacy of ventilation. Postictal patients receiving supplemental oxygen can have an oximetry reading of 100% and still have significant hypoventilation and acidosis, leading to further neurologic and respiratory compromise. Supplemental oxygen may also increase the time it takes for a pulse oximeter to register a change in respiratory status if the patient becomes apneic. Capnography is very useful as a continuous monitor of ventilation in these patients, and it can give an immediate indication of apneic or severe hypoventilation.

8. "Prehospital providers often inadvertently hyperventilate intubated pediatric patients, but in the case of this head-injured patient, it was probably okay because hyperventilation will help reduce intracranial pressure.” Current evidence suggests that hyperventilation of head-injured patients may actually lead to decreased cerebral perfusion and ischemia and cause worse neurologic outcomes. Current professional guidelines caution against hyperventilation except in cases of impending herniation. Capnography monitoring can help the clinician in maintaining normal ventilation during resuscitative efforts of head-injured patients. Studies have shown that prehospital providers who had access to ETCO2 monitoring were much more likely to maintain normoventilation in head-injured patients than those providers who did not have access to capnography.
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