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Pre-hospital use of capnography during emergency sedation analgesia

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ABSTRACT

Background: Providing optimal patient care in the challenging, uncontrolled, and sometimes hostile pre-hospital environment may require the use of potent analgesics and sedatives. During pre-hospital emergencies, narcotics or sedatives administered for sedation, anxiolysis, or analgesia to allow the patient to tolerate unpleasant procedures, such as traction splint application, can result in cardiovascular and respiratory adverse events.[1] Early recognition of poor oxygenation may prevent unnecessary patient hypoxia. The European Society of Anaesthesiology and the American Society of Anaesthesiologist mandate continuous capnography, in addition to standard monitoring which include pulse oximetry, 4-lead ECG, blood pressure, and heart rate measurements.[1,2] Capnography refers to the non-invasive measurement of the partial pressure of carbon dioxide (CO_2) in exhaled breath. Monitoring respiratory status provides early warning, thereby allowing clinicians to intervene before the onset of respiratory depression, potentially leading to bradypnoea, apnoea, hypoxia, and death.[3] In addition, late identification of respiratory failure may lead to unnecessary endotracheal intubation and mechanical ventilation, increasing risk of protracted

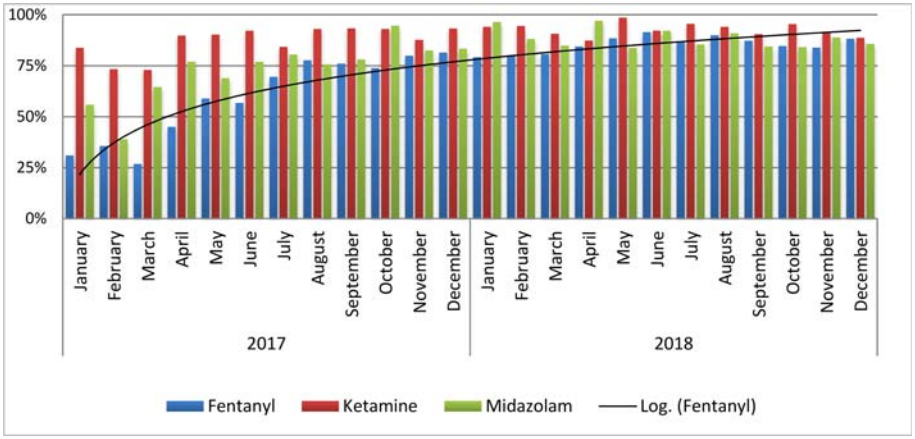

Figure 1. Capnography monitoring in patients receiving either Fentanyl, Ketamine or Midazolam.

hospital stay and associated hospital-acquired infections.

Oxygenation and ventilation must be measured in both intubated and spontaneously breathing patients. While clinical indicators like chest rise or the plethysmography-derived respiratory rate can be used, monitoring the capnographic waveform for hypopnoeic and bradypnoeic patterns provides the clinician with a quick, accurate indication of acute adverse respiratory events.[4] In two randomized trials, patients monitored with capnography in addition to standard of care, experienced significantly fewer episodes of hypoxia than those monitored without capnography.[3,5] Hamad Medical Corporation Ambulance Service (HMCAS) in Qatar introduced a new clinical practice guideline (CPG) for safe sedation and monitoring in August 2017, mandating the routine use of capnography for all sedated patients. Safe sedation is achieved when the patient's oxygenation, ventilation, or haemodynamic status is not negatively impacted by the sedation procedure.

Methods: The study aimed to describe trends in the use of capnography and other monitoring modalities for patients receiving Ketamine, Fentanyl, or Midazolam. Retrospective quantitative analysis of an existing HMCAS medical records database linked to a Business Intelligence (BI) tool enabled direct analysis on the tool and via a linked Microsoft Excel® spreadsheet, reviewing all emergency cases from 1st January 2017 to 31st December 2018. Frequency analysis and measures of central tendency was applied to the relevant clinical variables. All patient and practitioner identifiable data fields were redacted and not reported on.

Results: Oxygen saturation (SpO_2) and blood pressure monitoring was used on all patients (n = 5157, 100%), 4-lead ECG was placed on 3710 (72%) patients, while capnography was used on 4096 patients (79%, range = 39% to 99%). Capnography usage steadily improved over the 24-month period, especially for patients receiving Fentanyl (Figure 1).

Conclusion: There was a significant improvement in the use of capnography during monitoring of patients that received Fentanyl, Ketamine, or Midazolam, with the most significant improvement for patients receiving Fentanyl alone. Further studies are required to determine the impact of this

improvement on actual adverse event frequency.

Keywords: sedation, monitoring, safety, capnography, sedation analgesia, multi-parameter monitoring

Ethical approval

This study was classified as an audit project by the HMC Medical Research Center (MRC-01-19-212) and has been approved by the Ambulance Service Research Oversight Committee.

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