Treatment for beta blocker poisoning: A Systematic Review

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Nil to declare.

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Short Report Submission to Emergency Medicine Australasia

Title: End-tidal capnography provides reliable ventilatory monitoring for non-intubated patients presenting after sedative overdose to the Emergency Department

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Report

Introduction:

Drug or substance overdose accounts for one percent of presentations to Australian Emergency Departments (ED), but seven percent of Category 1 presentations^{1,2}. During 2016-2017, sedative drug exposures accounted for 58% of Australian Hospital poisoning admissions.³

Sedated patients at risk of respiratory failure or airway obstruction require one-to-one nursing in a high-acuity clinical area. Monitoring of ventilation using pulse oximetry (SpO₂) and respiratory rate in non-intubated, sedated patients provided with supplemental oxygen to maintain SpO₂ does not reliably allow detection of hypercarbia. Adequate SpO₂ may be maintained despite significant hypoventilation with impaired CO₂ elimination⁴.

End-tidal (ETCO₂) capnography provides a real-time visual measure of ventilation, but capnography's utility in monitoring ventilation in ED patients sedated due to overdose has not been studied. We studied the ability of capnography to provide continuous ETCO₂ monitoring in ED patients sedated secondary to poisoning.

Methods:

An observational study was undertaken from December 2016-July 2017 within a metropolitan tertiary ED with a specialist toxicology service and annual presentation rate of 90000. The study was approved by the hospital Human Research Ethics Committee, with waiver of patient consent (unobtainable due to sedation).

A convenience sample of patients aged >16 years presenting with a Glasgow Coma Scale of <14 following sedative overdose were monitored by a study investigator for 60 minutes using continuous ECG, non-invasive BP, SpO₂, and ETCO₂ via a portable capnography monitor (CapnoTrue ASP™ sidestream capnograph by BluePoint Medical). Adverse events were recorded using the SIVA Adverse Events Sedated Reporting Tool⁵. Baseline demographic and physiological data were recorded.

Primary study outcome was percentage of total observation time capnography provided continuous measurement of ETCO_2 as indicated by presence of a numerical ETCO_2 value and waveform. This was assessed incrementally over 120 time points (every 30s). Any loss of capnography signal was recorded in 30s increments and rounded up.

Secondary outcomes included incidence of minor and major adverse events, total number of equipment failures, and proportion of episodes of hypoxia ($\text{SpO}_2 < 90\%$) preceded by capnography change. Oxygen desaturation ($75\text{-}90\%$) $< 60\text{s}$, and temporary airway obstruction (requiring intervention), were classified as minor adverse events. Apnoeic episodes (presence of ETCO_2 trace, but loss of waveform for $> 15\text{s}$), response to apnoea (self-resolved, staff intervention), type of intervention, SpO_2 at time of apnoea plus lowest subsequent SpO_2 and associated capnography change were recorded. Oxygen desaturation $\text{SpO}_2 < 75\%$, O_2 desaturation $\text{SpO}_2 < 90\%$ for $> 60\text{s}$ and cardiac arrest were classified as major adverse events. If any major adverse criteria were met that had not been recognised, the study investigator was required to alert the attending medical or nursing staff.

Results:

Twenty-nine patients (average age 41 years) were enrolled. Fifteen (52%) were female. Median presentation GCS was 10 (range 3-12). Mixed ingestions occurred in 15 (52%) of cases. Agents ingested included benzodiazepines (18 cases, 62%), anti-psychotics (38%), opioids (14%), anti-convulsants (14%) and gamma-hydroxybutyrate (10%).

Capnography provided a continuous trace for 99% of total monitored study time. Two patients did not maintain a continuous ETCO_2 trace, however in both cases ETCO_2 was available for $> 99\%$ of monitoring time.

Capnography detected 15 episodes of apnoea. In 12/15 episodes (80%) apnoea self-resolved without intervention, and without meeting any major adverse event criteria. Three patients required an airway intervention in response to apnoea (two tactile stimulation preceded by verbal stimulus, and one also required airway repositioning and Guedel airway placement).

There were ten episodes of minor hypoxia, eight resolved spontaneously, one required oral airway placement and airway repositioning, and one airway repositioning. A change in capnography (either apnoea 15-60 seconds or change in ETCO_2 of $> 10\text{mmHg}$) was observed in 7/10 episodes (70%) prior to minor hypoxia detected by $\text{SpO}_2 < 90\%$. A SpO_2 measurement $< 90\%$ occurred in three cases without changes in ETCO_2 . All lasted < 60 seconds and resolved with SpO_2 probe adjustment. No patients attempted to remove ETCO_2 monitoring. No major adverse events occurred. There were no instances of capnography device failure.

Conclusion:

In this population of sedated ED patients, capnography provided real-time monitoring of ventilatory function for 99% of monitored study time and detected all episodes of hypoxia detected by SpO_2 . Changes in ETCO_2 preceded minor hypoxia in 70% of cases, enabling clinicians to intervene and limit subsequent hypoxia. Capnography's ability to provide a

continuous reliable measurement of ETCO_2 , and to signal measurement interruption has the potential to reduce patient-nurse ratios, while maintaining safe monitoring.

This was a convenience sample, single-institute study with a relatively small sample size, and low adverse-event rate. Findings may lack external validity. A single bedside study investigator model may have produced recording error and increased attending staff monitoring vigilance. Further study is required to confirm if adding capnography to current physiological monitoring will allow sedated patients to be safely monitored in lower acuity settings.

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