

Incorporating Capnography Monitoring in Patient-Controlled Analgesia (PCA) Post-Operative Care

Pamela S. Lindemann, MA, RRT, RCP

INTRODUCTION

A capnograph monitors a patient's respiration rate and end-tidal CO₂ (EtCO₂) levels to provide the earliest indicator of an adverse breathing event. The benefits of using a capnograph in Medical/Surgical units and Critical and Post-Anesthesia Care areas are well documented. However, clinicians have only recently started to recognize the importance of using a capnograph – rather than a pulse oximeter – for patients on patient-controlled analgesia (PCA) pumps for pain management post-operatively.

Although PCA pumps have built-in safety features to prevent an opioid overdose, in some cases, the opioids may suppress respiration. Multiple studies have shown that the EtCO₂ measurement from a capnograph provides information regarding patient ventilation issues earlier than other monitoring modalities such as pulse oximetry and visual monitoring.^{1,2} The Joint Commission, in an effort to reduce risks associated with PCA use, recognized this distinction as early as 2004 when it released a Sentinel Event Alert recommending ventilation monitoring for patients receiving opiates for pain.³

Pulse oximeters, which have become the standard of care in anesthesia, are poor proxies for determining adequacy of ventilation early in PCA patients. Pulse oximeters may detect an adequate level of arterial oxygen (SpO₂ measurements at or above 90), when in reality, the patient's breathing is dangerously depressed. Pulse oximetry does not detect important early indicators of respiratory depression, such as changes in respiratory rate, hypoventilation, pauses in breathing, or exhaled carbon dioxide levels; nor does it necessarily recognize declining ventilation in patients on supplemental oxygen until slow breathing progresses to apnea. In addition, pulse oximeters are slow to alarm, while a capnograph will alarm in less than 30 seconds, providing early warning that a patient could be in serious respiratory trouble.

OVERVIEW

Riverside Medical Center is a 312-bed hospital in Kankakee, IL. The hospital has 40 portable capnograph units and EtCO₂ monitoring capabilities on ventilators in its intensive care unit (ICU). Capnography is an important topic of discussion at Riverside, and as the respiratory manager of a staff of 30 respiratory therapists, I am aware of multiple instances at our facility where the use of capnography on patients undergoing PCA and/or bi-level positive airway pressure (BiPAP) treatment has reduced complications.

This hasn't always been the case.

Several years ago, we rewrote our PCA and BiPAP treatment protocols to include mandatory use of capnography. We now also have an extensive RN and RT capnography training program in place as a result of several misses, particularly with PCA patients. We know now that near misses due to over-sedation are more common than previously thought, and not just with high-risk patients. Not everyone metabolizes drugs the same way and a pulse oximeter will not tell you everything you need to know about how well your patient is breathing. With the use of capnography, we have seen first-hand how near misses can be averted.

ABOUT THE AUTHOR

Pamela S. Lindemann, MA, RRT, RCP



Ms. Lindemann is the respiratory manager for Riverside Medical Center and Miller Health Care in Kankakee, IL. She has been a respiratory therapist for more than 20 years and has a Master's degree in Organizational Leadership. Riverside HealthCare is a fully integrated healthcare system that has been named a Top 100 hospital for four years.

CASE EXAMPLE

One of the cases that precipitated our protocol and training changes involved a 59-year-old male with end-stage chronic obstructive pulmonary disease (COPD) who was being monitored on the Med/Surg floor following a lung resection. The patient had required a high level of oxygen to keep his saturation up and had been in the ICU on continuous BiPAP for a few days post-operatively. The patient continued to progress until he only required BiPAP at night. During this time, a pulse oximeter was used to continuously monitor the patient. He also had a PCA pump to manage his pain.

Having grown weary of wearing the BiPAP mask, the patient declined to wear it on the night before the incident occurred. The nurse and the respiratory therapist charted his saturation levels several times throughout the night; the patient did not drop below 94%. They signed off from their shift the next morning. Their report noted that the patient had had an uneventful night. However, when the dayshift respiratory therapist entered the patient's room around 8:30 a.m., she could not wake him. She performed a stat arterial blood gas (ABG) and found that the patient's CO₂ was in the 90s.

The patient was immediately placed on the BiPAP and returned to the ICU. He came extremely close to being intubated, and his discharge from the hospital was delayed by more than two days. The patient was discharged eventually and now uses a BiPAP at night at home.

Because of this incident, Riverside Medical Center revised its protocol to mandate that any patient on a PCA pump must be monitored by a capnograph. In addition, any patient who declines prescribed BiPAP treatment, or who is being

weaned from BiPAP treatment, must undergo capnography monitoring. Since the staff started following these protocols, we have eliminated several near-misses.

CONCLUSION

The use of capnography is becoming more widespread for patients receiving PCA-administered opioids for post-operative acute pain management. Capnographs, such as Nonin Medical's LifeSense® capnograph/pulse oximeter and RespSense™ capnograph monitor, provide continuous and reliable monitoring to help identify life-threatening ventilation status changes such as respiratory depression. The units and accessories are cost effective.

The use of capnography is gaining traction as standard of care across hospital departments, including Respiratory Therapy, crash carts, Post-Acute Care Units (PAC), Post-Anesthesia Care Units (PACU), trauma rooms and the Emergency Department. The American Heart Association updated its guidelines in 2010 to recommend the use of capnography during cardiopulmonary resuscitation, and we have incorporated that into our program as well.⁴ Since 2004, The Joint Commission has recommended the use of capnography to monitor patients who are self-administering analgesia for pain.⁵ More recently, the American Society of Anesthesiologists amended its standards for Basic Anesthetic Monitoring in October 2010 (which went into effect July 1, 2011) to recommend the use of capnography during moderate or deep sedation.⁶

Review your protocols to see if capnography is included. Capnography is the standard of care and should be utilized, in addition to pulse oximetry, to keep your patients safe.

REFERENCES

1. Maddox RR, Williams CK, Oglesby H, Butler B, Colclasure B. Clinical experience with patient-controlled analgesia using continuous respiratory monitoring and a smart infusion system. *Am J Health Syst Pharm.* 2006;63(2):157-164.
2. Lightdale JR, Goldmann DA, Feldman HA, Newburg AR, DiNardo JA, Fox VL. Microstream capnography improves patient monitoring during moderate sedation: a randomized, controlled trial. *Pediatrics.* 2006;117(6):e1170-1178.
3. The Joint Commission, Sentinel Event Alert, Issue 33: Patient-controlled analgesia by proxy. December 20, 2004.
4. The Joint Commission, Sentinel Event Alert, Issue 33: Patient-controlled analgesia by proxy. December 20, 2004.
5. ASA Standards for Basic Anesthetic Monitoring, Committee of Origin: Standards and Practice Parameters (Approved by the ASA House of Delegates on October 21, 1986, and last amended on October 20, 2010 with an effective date of July 1, 2011).
6. Field JM, Hazinski MF, Sayre MR, et al. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2010;122:S640-S656.



nonin.com/capnographs

Nonin Medical, Inc.
13700 1st Avenue North
Plymouth, MN 55441-5443 • USA
Tel: +1.763.553.9968 800.356.8874
Fax: +1.763.577.5521
E-mail: info@nonin.com

Nonin Medical B.V.
Prins Hendriklaan 26
1075 BD Amsterdam • Netherlands
Tel: +31 (0)13-79 99 040
Fax: +31 (0)13-79 99 042
E-mail: infointl@nonin.com