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Implementation of Capnography in Postoperative setting to Prevent Postoperative Respiratory complications

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Introduction

According to the Academy of Medical-Surgical Nurses, evidence-based practice (EBP) is the conscientious application of the current best evidence in making decisions regarding the care of the patients. On the other hand, the National Council of State Boards of Nursing defines EBP as the process of integrating the best research with clinical experience and the values of the patients. EBP assists nurses in evaluating research, clinical practice guidelines, and other

materials in the nursing field as this aids in applying the findings in the provision of high-quality care to the patients.

There are importances and benefits of EBP in the nursing field. First, EBP has introduced significant changes in the nursing field. This has enabled the focus of coursework to not only increase the nurses' overall knowledge but also on professional accountability. Second, the expansion of EBP has allowed nurses to place more emphasis in the nursing research. Some of the advantages of EBP include improved patient outcomes, superior nursing skills, and lower costs of healthcare. For instance, EBP focuses on raising the overall quality of healthcare, and this has resulted in improved health of the patients. Besides, application of patient-centered care approach helps in eliminating unnecessary costs for treating patients with chronic illnesses as well as reducing expenses for healthy patients. This paper will identify an essential clinical issue among postoperative care for the patients who have undergone surgical anesthesia, and provide the most appropriate recommended change of practice.

Clinical Issue

Respiratory depression is a severe complication in the postoperative period. The available clinical practice guidelines for post-anesthetic care from the American Society of Anesthesiologists (2016) only recommend the monitoring of oxygen saturation and airway patency as solutions to evaluate the postoperative respiratory function and this is not sufficient enough for anesthesiologists to provide timely assessment of the patients. The pulse oximetry commonly used in clinical settings has reduced sensitivity in the detection of hypercarbia and hypoventilation especially in cases involving administration of supplemental oxygen.

The clinical question used is “In post-operative patients, is the implementation of capnography more effective in preventing respiratory complications as compared to pulse oximetry for a 5-day period?” PICOT is a synonym for patient, intervention, comparison, and outcome. In this case, the patient/population is postoperative patients with respiratory complications, intervention is capnography monitoring, the comparison is pulse oximetry, and time is five days. There are different types of PICOT questions such as therapy, diagnosis, prognosis, and etiology. Therapy involves questions based on treatments for achieving the desired outcome. Some of this treatment options include the use of medications, change in diet, counseling, and surgical interventions. The PICOT question used in a therapy question whose treatment is based on the use of capnography which is surgical intervention. The therapy based PICOT question is employed because it allows for easy comparison of two interventions. The PICOT question compares the efficacy of capnography with pulse oximetry in PACU clinical settings. The available evidence shows that capnography is more effective than pulse oximetry because it overcomes most of the limitations associated with pulse oximetry.

Background

The reduction of postoperative complications in PACU environments is of great concern due to its impacts on mortality and morbidity as well as on healthcare costs. Respiratory complications after surgical operations is an umbrella encompassing airway obstruction, hypoventilation, and hypoxia. Failure to implement effective interventions in PACU clinical settings results in complications such as pneumonia, respiratory arrest, and reintubation (Geralemou et al., 2016). Such complications mainly arise from anesthesia, residual neuromuscular blockade, type of surgery conducted on the patient, the patient’s risk factors and breathing difficulty due to inadequate pain control. The application of capnography has garnered

more support in clinical settings due to its effectiveness in curbing respiratory depression symptoms for procedural sedation.

Significance. Research shows that approximately 14.2% of all patients encounter some postoperative pulmonary complications after surgical operations (Geralemou et al., 2016). The development of postoperative complications is widely associated with induction and anesthesia management which disrupt the normal functioning of the respiratory muscles eventually leading to hypoxia and atelectasis. Furthermore, research shows that postoperative respiratory failure extends the length of hospital stay by approximately nine days with an increased hospitalization cost of greater than $53, 000 and to make matters worse a 22% increase in mortality (Geralemou et al., 2016). One of the crucial methods of enhancing patient safety in PACU stings is through active respiratory monitoring. The subjective clinical assessment and clinical respiratory tracking suggested by the current clinical practice guidelines lack the capability of detecting and quantifying respiratory problems in real time, and sometimes patients may go untreated. The use of supplemental oxygen may mask prolonged or frequent apnea which may lead to oxygen desaturation and in such a case clinical observation are intermittent and subjective.

The implementation of capnography in PACU settings is significant due to various reasons. First, capnography can indicate the changes that occur in the elimination of CO2 from the lungs. Second, the technique indirectly shows the production of CO2 in the human body tissues and how circulatory system transports the gas to the lungs. Therefore, the introduction of this technique in PACU environments is essential because it will constitute a useful method of monitoring the production of carbon dioxide, alveolar ventilation, pulmonary perfusion, and respiratory patterns.

Solution. Evidence suggests that using capnography is a more effective intervention to detect respiratory depression promptly. Implementation of capnography into postoperative assessment will provide accurate information to healthcare providers that the patients' respiratory status promptly. A systematic review by Lam et al. (2017) summarizes the currents studies regarding the effectiveness of continuous pulse oximetry and capnography monitoring for postoperative respiratory depression in PACU. The findings of this research show that pulse oximetry has the capability of accurately detecting hypoxemia. However, continual capnography monitoring shows an early warning of the onset of postoperative distress before oxygen desaturation especially in cases involving administration of supplemental oxygen. Capnography provides a reflection of ventilation whereas pulse oximetry reflects oxygenation. As a result, the research recommends measuring both parameters because it provides a complete picture of the patient's respiratory status. In a study conducted by Richardson et al. (2016) to evaluate the impacts of capnography in monitoring end-tidal CO2, the study findings showed that the use of capnography led to fewer hypoxemia episodes in the patients. The study evaluates the effectiveness of capnography in reducing postoperative complications when implemented in clinical settings. The use of capnography presents one of the adjunct non-invasive tools that are safe to the PACU patients and aids in the identification of early symptoms of respiratory complications (Gutierrez et al., 2015)

According to a research conducted by Ajizian (2016), capnography technique presents the standard of care for general anesthesia patients. Besides, the method is an emerging standard of care for ICU (Intensive care unit) patients and other patients in non-OR clinical settings such as PSA (procedural sedation and analgesia) and PACU (Ajizian, 2016). In the PACU settings, capnography is recommended for continuous monitoring of patients with postoperative

complications such as tracheal intubation and those using the supraglottic device for maintaining the airways (Ajizian, 2016). Furthermore, capnography has proved useful in monitoring patients at risks of respiratory compromise and those receiving patient-controlled narcotic analgesic.

Iowa Model of EBP

Creation. The Iowa model was initially developed by Marita G. Titler and the leadership of the Research Committee at the University of Iowa Hospitals and Clinics (UIHC). The primary aim of this model is to provide guidelines to the clinicians in the utilization of evidence in improving the outcomes of healthcare. The model has been extensively applied in the academic and clinical environments. From the time the model was publicized in 1994, more than 1200 requests have been made for using the model in presentations, graduate and undergraduate courses, EBP programs, publications, grant proposals, and clinical research (Rycroft-Malone & Bucknall, 2010). The Iowa model emphasizes on the need of considering the entire system of healthcare from the practitioner, to the client, to the researcher by applying research within this context to offer guidelines to the practice decisions. The Iowa model helps us in focusing on problem-focused triggers and knowledge, leading the nursing staff to pose questions regarding whether the present practice can be improved via the application of the current research findings (Titler, 2006).

History. The available evidence shows that the first version of Iowa model was developed in 1994 to mark the culmination of Research committee leadership at the University of Iowa Hospitals and Clinics (UIHC). The UIHC had to support and promoting the application of EBP since 1986 under the umbrella of research utilization. The research committee developed the original Iowa model flow diagram to illustrate the process to be adopted by UIHC nurses in research utilization. The research committee members then published the original flow diagram

together with accompanying narrative in the Nursing Research. After this publication, the authors received requests from various researchers to use the model in clinical research and practice (Rycroft-Malone & Bucknall, 2010). In the development of Iowa model, the research committee members sought nurses' feedback, research utilization experts like Linda Cronenwett, and other nursing leaders. The original model was revised and updated in 1998 with the aim of aligning it with the current EBP literature and quality improvement procedures, and the revised model was published in 2001. The available evidence shows that the model has been applied to UIHC and other clinical settings for more than 20 years (Rycroft-Malone & Bucknall, 2010).

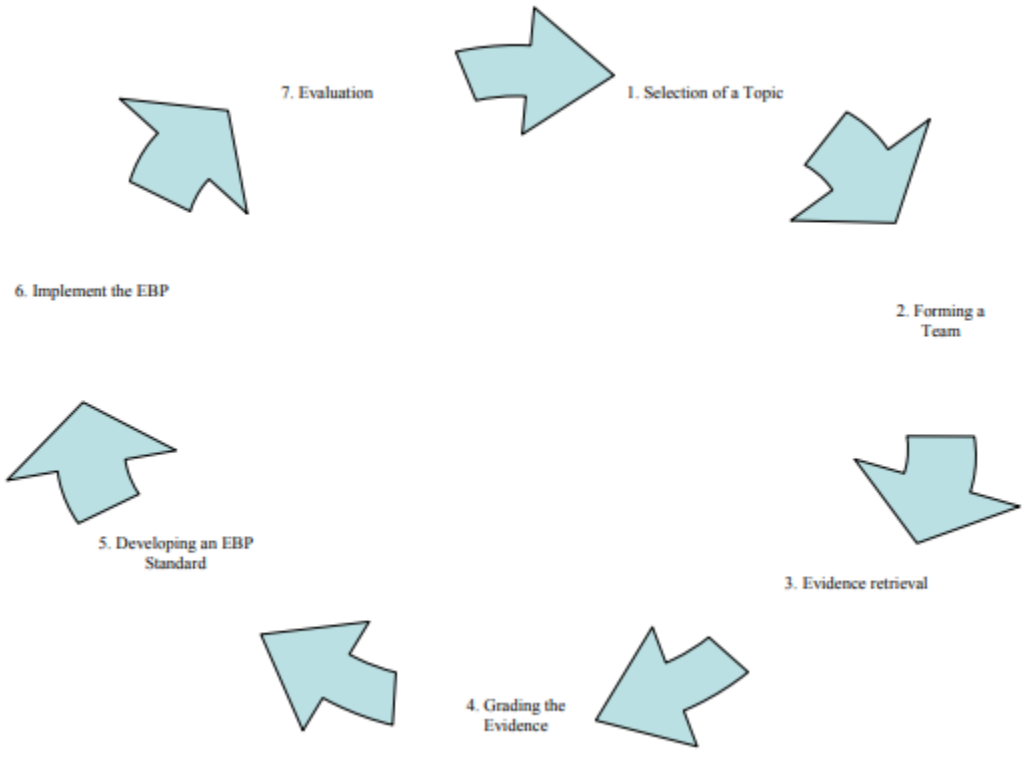
The model was initially established and used in the acute care setting. Later, the model was embraced as quality improvement in all fields at UIHC and was comprehensively discussed when regulatory agents like Joint Commission on Accreditation visited the hospital. So far the pioneers of the model have received 873 requests from hospitals, 337 requests from Colleges of Nursing, and 18 applications from long-term care, ambulatory settings, and public health agencies to use the model (Rycroft-Malone & Bucknall, 2010).

Key variables. As the practice model, the Iowa Model of EBP comprises its guideline which provides the step-by-step instruction for nurses to develop upon. There are seven critical variables within the Iowa Model of EBP to assist the implementation process of change in practice, which include: (1) Recognition of problem or knowledge-based triggers that encourage nurse to query current clinical practice and consider higher quality of practice; (2) confirming whether the focused topic is priority for this organization; (3) Collaboration with other interdisciplinary staff to form a professional team; (4) assembly of theme relevant research and literature; (5) appraisal and integration of identified research and studies for practice; (6) Pilot the change of practice based on evidence and establishment of EBP guideline; (7) Evaluation of

quality improvement among the period of implementation. Evaluation is essential because it enables the nurses to see the value and the contribution of evidence in the field. Besides, it is necessary to identify the barriers that could inhibit the progress if the change has to take place.

Model Depiction

The below shows the steps followed in the implementation of Iowa model in clinical nursing practice with the key variables included.



Application of Iowa Model

There are numerous steps followed in the implementation of the Iowa model of EBP in the clinical nursing practice. The first step involves identification of either a problem-focused trigger or a knowledge-focused trigger that helps in initiating the needed change. Problem-focused triggers include risk management issues or clinical problems whereas knowledge triggers contain new practice guidelines or research findings. The study included a problem-focused trigger which is the postoperative complications such as hypoxemia, hypoventilation, and upper airway obstruction among others which are commonly experienced in the PACU settings.

The second step in the Iowa model involves the determination of organizational priorities. The available evidence shows that respiratory episodes are commonly experienced after surgical intervention and accounts for 1.3-6.9% of the cases reported in PACU. Comorbidities such as neuromuscular, pulmonary or cardiac dysfunction increase the risks of developing the respiratory compromise. However, all the patients are at risks of developing postoperative hypoxemia occurring in 30-50% of abdominal surgery patients, and up to 8-10% of the patients requiring mechanical ventilation and intubation (Xara et al., 2015). According to research, the prospective observational studies have reported a prevalence rate of respiratory complications ranging from 0.8 to 6.9%. There are significant variations of respiratory complications among different institutions and the condition accounts for substantial morbidity and mortality that results in increased cost of care and length of hospital stay (Ellis et al., 2017).

In this case, reduction of respiratory complication remains the priority to the healthcare organization. This will involve forming an interdisciplinary team comprising of anesthesiologists, surgeons, and PACU registered nurses, nursing anesthesia, and surgical nurses. The team members will be responsible for developing, implementing, and evaluating the clinical

practice guidelines or the EBP (Doody &Doody, 2011). Relevant literature and research should be identified and collected for evidence of supporting the change in practice from various databases such as MEDLINE, Cochrane database, CINAHL, and EMBASE. The literature identified from these databases will be appraised and synthesized to determine the quality and strength of the evidence. The Iowa model of EBP highlights piloting the change of nursing practice and establishment of EBP guidelines. Besides, the model also assists in the ongoing evaluation of the implementation of outcomes. In this case, data on reduction of postoperative respiratory depression with continuous capnography monitoring with or without pulse oximetry will be collected. This data will be compared with standard care practices involving pulse oximetry monitoring and airway patency as recommended by the clinical practice guidelines for post-anesthetic care from the American Society of Anesthesiologists (2016). The interdisciplinary team will then evaluate and analyze all documented data. The intervention will be modified appropriate based on the results of the evaluation report. Through careful observation of the steps mentioned above, the application of capnography in postoperative care will be implemented as the change of practice. There should be continuous evaluation of practice management on a routine basis to assess the efficacy of capnography, identify the relative potential issues, and ensure the goals of practice are achieved.

Barriers and Facilitators to the Implementation of the Model

There are numerous barriers which are encountered in implementing the Iowa model of EBP in the clinical nursing practice primarily in the PACU environment for patients with respiratory complications. For instance, the model requires the need for at least one individual or a governance group like the research committee which can assist in guiding the users and advising them on the requirements of the EBP process. The process requires the utilization of

mentors with comprehensive knowledge of the steps and the process in the model. This can be a significant challenge in the implementation of capnography in the PACU due to lack of people with extensive know-how on how the model should be applied, its advantages, and risks to the patients with respiratory compromise.

Despite the barriers encountered there are some factors which facilitate the use of the model. Some of these factors include an interdisciplinary perspective that is applicable in EBP implementation and assessment of the changes in practice. Other strengths of the model include integrations with quality improvement beginning with topic selection and proceeding with the use of the follow-up data and baseline in sustaining the developments in the delivery of healthcare.

Conclusion

EBP is the conscientious application of the current best evidence in making decisions regarding the care of the patients. EBP focuses on raising the overall quality of healthcare, and this has resulted in improved health of the patients. Besides, application of patient-centered care approach helps in eliminating unnecessary costs for treating patients with chronic illnesses as well as reducing expenses for healthy patients. Respiratory depression is a severe postoperative complication in clinical settings, especially in PACU environments. The pulse oximetry commonly used in clinical settings has reduced sensitivity in the detection of hypercarbia and hypoventilation especially in cases involving administration of supplemental oxygen. Therefore, the recommended practice of change in this study was the implementation of capnography in the PACU settings. The use of capnography presents one of the adjunct non-invasive tools that are safe to the PACU patients and aids in the identification of early symptoms of respiratory complications. In the PACU settings, capnography is recommended for continuous monitoring of

patients with postoperative complications such as tracheal intubation and those using the supraglottic device for maintaining the airways. The study applied Iowa model of EBP that provides guidelines to the clinicians in using evidence to improve the outcomes of healthcare. The model can be integrated with quality improvements, and this helps in attainment of positive results.

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