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The Use of Point of Care Ultrasound to Assess Gastric Contents and Determine Aspiration Risk in the Obese Patient Presenting for Elective Surgery

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Executive Summary

Introduction of the Problem

Pulmonary aspiration of gastric content is a potentially fatal complication of anesthesia that occurs at a rate of 1:3,000-4,000 elective surgeries requiring general anesthesia (Neilipovitz and Crosby, 2007). Risk factors for aspiration include a full stomach, diabetes, chronic kidney disease, pregnancy, gastroparesis, or the use of medications associated with delayed gastric emptying (Sharma, Jacob, Mahankali, and Ravindra, 2018). Obese patients with a BMI \geq 35 represent a demographic at risk for aspiration while undergoing general anesthesia (Kruisselbrink et al., 2017), and the use of point of care ultrasound (POCUS) may reduce the incidence of aspiration events (Gagey et al., 2018).

A novel imaging tool the nurse anesthetist has at their disposal is POCUS, which can be used to accurately assess gastric content (Perlas, Davis, Khan, Mitsakakis, and Chan, 2011). A community hospital in Jacksonville, Illinois requested research on POCUS in the assessment of gastric content to improve airway management decision-making. An educational lecture supplemented with a PowerPoint presentation and a hands-on tutorial was developed and implemented for the clinical facility.

Literature Review

Twenty-one studies were reviewed for this project. POCUS is a reliable, non-invasive, portable, valid, learnable, rapid, and cost-effective tool implemented in anesthesia practice (Cieslak et al., 2020). In addition, POCUS can offer valuable assessment information that can be used to guide anesthesia management. A systematic review performed by Van de Putte and Perlas (2014) revealed that clinicians could reliably and reproducibly assess gastric content with

POCUS. POCUS use in the preoperative setting may improve patient satisfaction (Chon, Ma, and Mun-Price, 2017), improve OR efficiency, and improve patient outcomes, including reducing anesthesia-related aspiration events (Kruisselbrink et al., 2019).

The anesthesia provider may qualitatively evaluate the ultrasound results by applying a Perlas grade. According to Perlas (2011), a grade 0 antrum will appear contracted without an appreciable lumen. A grade 1 antrum will appear distended with hypoechoic fluid that appears black. Perlas grades 0 and 1 are associated with low risk for aspiration. A grade 2 antrum will appear distended with fluid in both the supine and RLDC positions and is associated with a high aspiration risk. Solid content is not classified according to the Perlas scale, but the identification of solid content automatically indicates a high aspiration risk.

Perlas et al. (2011) performed an observational analysis of 200 fasted patients undergoing elective surgery. The antrum was visualized in 100% of the 200 patients examined with ultrasound. A full stomach was identified in 3.5% of the patients. The authors observed that a grade 0, grade 1, and grade 2 antrum corresponded to 0 mL, 16 mL, and 180 mL, respectively. Additionally, Van de Putte and Perlas (2014) studied POCUS's feasibility in fasted obese patients presenting for elective surgery. Sixty patients with a BMI of 35 kg/m² or greater were included. The antrum was identified in 95% of the patients. POCUS results demonstrated 39.6%, 54.7%, and 5.7% of patients presented with grade 0, 1, and 2 antrums, respectively. None of these fasted patients presented with solid gastric content.

Project Methods

A non-experimental educational quality improvement intervention was designed to inform anesthesia providers on the use of point-of-care ultrasound (POCUS) in assessing gastric

content and perioperative aspiration risk. An exhaustive literature review served as the evidentiary foundation for this project. Prior to meeting with the anesthesia providers, a baseline survey was administered to assess the knowledge base and opinions regarding how POCUS can be used to scan gastric content and determine aspiration risk.

A focused lecture on gastric content assessment was developed. A PowerPoint lasting approximately 15 minutes included visual aids and key educational points. No patient information or imaging was included. Following the lecture, a hands-on tutorial was demonstrated for the anesthesia providers. In addition, anesthesia providers had the opportunity to scan a live model, the author of this project as a volunteer. The educational intervention was staggered among anesthesia staff to comply with COVID-19 social distancing requirements and accommodate the operating room schedule. A second survey identical to the baseline survey was administered following the educational intervention, assessing knowledge gains and changes in opinions regarding POCUS.

Purpose and goals. This project aimed to improve the knowledge base of anesthesia providers such that patient care and outcomes may be improved by preventing aspiration events in adult obese patients presenting for elective surgery.

Setting. This project was implemented at a community hospital in Jacksonville, Illinois. The hospital is licensed for 93 patient beds and is part of a larger healthcare network.

Institutional review board. This project was granted institutional review board (IRB) exempt status and designated a quality improvement project by Southern Illinois University at Edwardsville School of Nursing on May 7, 2021. This project utilized depersonalized survey

response data from anesthesia providers. No patient interaction or collection of patient information occurred. Participation in this project was voluntary.

Evaluation

Age, years of practice, and anesthesia provider type were collected to link pre and post-knowledge assessments. Additionally, the likeliness to change practice was also evaluated according to a 4-point Likert scale. The Likert scale selections included the following: not likely at all, not very likely, somewhat likely, and very likely. Participation in both the initial and post-intervention assessments was voluntary. Upon completion of the assessments, trend, qualitative, and frequency analyses were performed with respect to knowledge improvement. Data gathering proved problematic as only four anesthesia providers out of 10 completed the pre and post-intervention assessments.

The post-test results following the educational intervention were promising. All survey participants showed an improvement in score from pre to post-test. The average score improved from $M = 74.3\%$, $SD = 3.5\%$ to $M = 95.7\%$, $SD = 5.7\%$. However, the project suffered from a low participation rate as only four out of ten anesthesia providers and one pre-op registered nurse completed both the pre and post-test assessments. Anesthesia providers were not persuaded by the educational intervention. Two anesthesia providers indicated prior to the educational intervention that they were very likely, and two anesthesia providers indicated that they were somewhat likely to incorporate the use of POCUS gastric scanning into practice. These values did not change from pre to post-test. Notably, very likely was the maximum willingness to incorporate the tool a survey participant could have indicated.

The implementation of this knowledge improvement project at a community hospital in central Illinois was a successful endeavor. Knowledge was improved as evidenced by the post-test knowledge assessment scores, which demonstrated an improvement from baseline. Additionally, providers indicated an increased willingness to utilize POCUS in their anesthesia practice following their participation in this project. The use of POCUS in the preoperative assessment of gastric content and its influence on airway management decision-making was well recognized. The staff agreed that it has a place in modern anesthesia practice.

Impact on Practice

The use of POCUS to assess and evaluate the gastric content of the obese patient presenting for elective surgery is well documented in the literature. In addition, the literature shows that anesthesia providers can be trained to utilize POCUS in this fashion, and the literature supports its use in airway management decision-making. For example, a case may not need to be delayed because the patient ate 4 hours ago if scanning results reveal an empty stomach. POCUS improves patient satisfaction, anesthesia provider satisfaction, surgeon satisfaction and keeps the OR running without delay.

Additionally, the use of POCUS to assess gastric content can improve patient safety by identifying patients with a full stomach. For example, a patient may have undiagnosed delayed gastric emptying, occult diabetes, or occult renal disease, all of which increase the risk of a full stomach and aspiration under anesthesia. Additionally, the anesthesia provider is sometimes intangibly alerted to the potential that the patient may not be truthful about their NPO status. Suppose a simple scan reveals a full stomach. In that case, the surgery may proceed with more conservative airway management measures, such as rapid sequence induction with cricoid pressure or case delay until the ultrasound scan reveals an empty stomach.

This project will be sustained by its ability to generalize results. The project can be applied to other patient populations with delayed gastric emptying such as gastroparesis, diabetes, chronic kidney disease, and pregnancy. Further projects may be developed around these patient populations. The project may be carried forward to assess the impact on reducing aspiration events. This project may also be implemented at other facilities on larger scales. This project will lead to improved patient care by assessing and mitigating aspiration risk in obese patients presenting for elective surgery.

Conclusion

The use of POCUS to assess gastric content and gauge aspiration risk in preoperative patients presenting for elective surgery represents a robust field of study. POCUS is a fast and cheap tool that can yield valuable information to the anesthesia provider in terms of airway management decision-making. Additionally, gastric scanning is a skill that can be developed quickly. A barrier to the widespread adoption of this tool is that many anesthesia departments only have one or two ultrasound machines that may be dedicated to vascular access or peripheral nerve blocks. However, the advent of highly mobile and affordable devices such as the Butterfly™ and similar devices that pair an ultrasound probe to a smart device can increase the availability of this tool.

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