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Steep Trendelenburg Associated Postoperative Vision Loss Prevention Education

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Introduction of the Problem

Postoperative vision loss (POVL) is a rare, but devastating and permanent complication that has been reported following robot-assisted laparoscopic surgeries in which prolonged steep Trendelenburg positioning is required. POVL typically occurs when there is a reduction in ocular perfusion that leads to ischemic optic neuropathy and blindness (Adisa, Onakpoya, Adenekan, & Awe, 2016; Alwon & Hewer, 2016). In recent years, a 307-bed rural hospital in central Illinois established a robot-assisted surgical program. However, active interventions to reduce POVL risk were lacking related to a knowledge gap by the anesthesia providers. The scope of change for this doctoral project included identifying evidence-based practices that reduce POVL risk, presenting information to the anesthesia providers, and implementing appropriate interventions into their anesthesia practices.

Literature Review

A comprehensive literature review was performed to identify steep Trendelenburg associated POVL pathophysiology, risk factors, prevention strategies, and anesthesia considerations. Multiple sources identified that the risk for POVL was increased when there was a sustained elevation in intraocular pressure (IOP) (Adisa et al., 2016; Blecha et al., 2017; Grosso et al., 2013; Hoshikawa et al., 2014). Some causes of increased IOP include the prolonged head down position and the pneumoperitoneum required for laparoscopic visualization (Adisa et al,. 2016; Blecha et al., 2017; Borahay et al., 2013; Grosso et al., 2013). The increase in IOP is thought to lead to a disruption of blood supply to the optic nerve, resulting in ischemic optic neuropathy (Alwon & Hewer, 2016; Demasi et al., 2017).

The anesthesia technique performed by the anesthesia provider can influence IOP, thereby reducing the risk of POVL. Using a total intravenous anesthetic (TIVA) with propofol,

remifentanil, and dexmedetomidine lowers IOP compared to the volatile agents sevoflurane, desflurane, or isoflurane (Joo, Koh, K. Lee, & J. Lee, 2016; Kitamura et al., 2018; Montazeri, Dehghan, & Akbari, 2015; Seo et al., 2018; Yoo et al., 2014). Further, using a deep neuromuscular blockade with lower insufflation pressures reduces the IOP (Yoo et al., 2015). To directly decrease the IOP, Cosopt ophthalmic drops, which contain a topical anhydrase inhibitor and a beta-adrenergic receptor blocking agent, can reduce the aqueous humor that is produced within the eye (Alwon & Hewer, 2016; Molloy & Cong, 2014; Molloy, Cong, & Watson, 2016). Lastly, level supine interventions can bring the IOP back to an acceptable measurement once the critical threshold is reached (Freshcoln & Diehl, 2014). A level supine intervention involves placing the ocular level above the heart for five minutes to allow for a re-stabilization of the IOP.

Patient risk factors for POVL identified in the literature include comorbidities that compromise vascular flow or increase IOP, such as hypertension, diabetes, atherosclerotic vascular disease (Freshcoln & Diehl, 2014), smoking, renal failure, narrow-angle glaucoma, and collagen vascular disorders (Alexander et al., 2018). Additionally, age above 62 years has shown a correlation to failed autoregulatory mechanisms and increased IOP (Blecha et al., 2017; Molloy, Cong, & Watson, 2016). Since the rise in IOP is time dependent, lengthy procedures in steep Trendelenburg position increase POVL risk (Molloy, Cong, & Watson, 2016).

Project Methods

The purpose of this non-experimental project was to fill the knowledge gaps of anesthesia providers on ways to reduce POVL risk at a 307-bed rural hospital. Previously, no active POVL risk reducing interventions were in place. Following an extensive literature search, a cognitive aid that included POVL prevention strategies was developed by the author in collaboration with the lead stakeholder. The stakeholder was able to provide input on the cognitive aid content and

had final approval. The cognitive aid was altered to meet the specific needs and abilities of the stakeholder's facility and included patient risk factors, an observation tool to measure intraocular pressure, and pharmacologic and non-pharmacologic intervention strategies. All information was provided at an anesthesia-specific meeting via a PowerPoint presentation. This project was subjected to IRB review and registration and was considered exempt.

Evaluation

Following the educational session with the anesthesia providers, a five-point Likert-scale survey (1=Strongly Disagree, 5=Strongly Agree) created by the author and approved by the lead stakeholder was distributed to evaluate the effectiveness of the presentation and to solicit providers' perceptions of their plans to incorporate the teachings into their practice. A total of 14 anesthesia providers attended the meeting in which POVL risk reduction information was presented. Responses of the participants were averaged for each item and are shown compared to the Strongly Agree (5) option on the tool. On the post-presentation survey, participants indicated an increased understanding of POVL pathophysiology (5/5), characteristics of the at-risk population (5/5), proper use of the intraocular pressure observation scale (4.9/5), and strategies to decrease IOP (5/5). Participants also reported that they planned to incorporate the information from the educational session into their practice (4.9/5).

A POVL Checklist developed by the author and approved by the lead stakeholder was placed on the anesthesia machine in the operating room where robot-assisted procedures are performed. The POVL Checklist was to be completed by an anesthesia provider any time they cared for a patient in steep Trendelenburg positioning for greater than three hours. Providers were to indicate if any IOP-reducing interventions were used during the case. All completed POVL Checklists (n=4) were collected following a two-month period. It is unclear if the

completed POVL Checklists were submitted by attendees of the presentation since the POVL Checklist was anonymous and did not expressly ask the question. The interventions used were Cosopt ophthalmic drops (2), dexmedetomidine infusion (1), and level supine intervention (1). All four participants who completed the POVL Checklist indicated that the cognitive aid was available and easy to find on the anesthesia machine. Only one of the four providers who completed the checklist indicated that the observational scale was utilized to assess for increased IOP.

A limitation to this project was the small sample size. There are 21 anesthesia providers employed by the group, but only 14 attended the presentation. Copies of the PowerPoint presentation were provided for those not in attendance. Further, the facility does not perform a large number of lengthy robot-assisted procedures, thereby reducing the number of opportunities to implement POVL risk-reducing strategies. If the project were to be repeated, it would be recommended to wait a longer amount of time to collect the POVL Checklists so that a more accurate representation of information could be gathered.

Impact on Practice

The immediate impact on practice at the organization was an increase in the anesthesia providers' knowledge of POVL as evidenced by positive feedback on the post-presentation surveys. Patients undergoing robot-assisted procedures who required prolonged steep Trendelenburg positioning had the immediate benefit of IOP-reducing interventions, thus decreasing their POVL risk. The predicted long-term impact is that the cognitive aid will continue to be used. It is connected to the anesthesia machine so that it is easy to find and readily available.

Conclusions

Postoperative vision loss (POVL) is a rare, but catastrophic complication that has been reported following robot-assisted laparoscopic surgeries that require prolonged steep Trendelenburg positioning. There are multiple anesthesia techniques and interventions available to decrease intraocular pressure, thereby reducing POVL risk. The primary stakeholders of this project now have a cognitive aid with evidence-based interventions to lower POVL risk. The cognitive aid will need to be reviewed and updated periodically as more evidence is published on the topic.

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