Intraoperative Eye Care: A DNP Project

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Abstract

Corneal abrasions, while rare, are the most common optic injury that occurs in anesthesia practice, and they account for approximately 2-3% of all anesthesia malpractice suits. Corneal abrasions also cause intense discomfort and stress to the patient, resulting in decreased patient satisfaction and increased hospital costs. With no specific protocol or documentation requirements for preventing corneal abrasions during surgical procedures, it is unclear what preventive efforts and guidance are being utilized by anesthesia providers at the partnering facility. The purpose of this quality improvement project was to assess CRNAs' knowledge, preferences, and practices regarding eye care and corneal abrasion prevention and whether or not they perceived a corneal abrasion quick reference guide as a useful tool for their practice to prevent and treat perioperative corneal abrasions. This project was a pre and post intervention design using a single PDSA cycle. The intervention, a quick reference guide developed by the team using the most up to date literature on perioperative corneal abrasion prevention, was distributed through emails. Pre and post surveys, developed using Qualtrics survey software, assessed attitudes, knowledge, and practices about perioperative corneal abrasions before and after utilization of the quick reference guide. CRNAs perceived themselves as having greater ability to assess the risk factors, diagnose, and treat corneal abrasions after reviewing the quick reference guide. Future studies involving greater numbers of participants and longer trial periods would provide a better understanding of anesthesia provider perceptions of perioperative corneal abrasions. An EPIC macro is another potential avenue to investigate as an effective corneal abrasion prevention technique.

Keywords: anesthesia, corneal abrasion, surgical patients, anesthesia providers

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Section I. Introduction

Background

Modern developments in delivery of anesthesia have provided an avenue of endless opportunities for the medical field, often enabling clinicians to perform life-saving procedures that would have never been possible before. Availability of modern anesthesia has allowed patients to bypass the agonizing pain of surgery and facilitated births while also keeping patients safe. Longer, more complicated surgeries have been accomplished safely due to the access to anesthesia (Robinson & Toldeo, 2012). However, rendering a person unconscious and altering their autonomic responses comes with its vulnerabilities and risks. A common risk associated with anesthesia is the potential for occurrence of perioperative eye injuries. Although information exists regarding the prevention of perioperative eye injuries, standards of care regarding these injuries often lack clarity or are overlooked.

Perioperative eye injuries account for 2-3% of legal suits against anesthesia providers and are the most common ocular complication in nonocular surgery (Kaye et al., 2019; Malafa et al., 2016). However, outdated literature and lack of standardized protocols and documentation leave places for improvement when it comes to preventing perioperative eye injury. The American Association of Nurse Anesthesiology (AANA) as well as the American Society of Anesthesiologists (ASA) include standards that specifically mention assessing oxygen, ventilation, circulation, temperature, and patient position to prevent injury during surgical procedures, but they lack specificity in regard to perioperative eye injuries (AANA, 2019; ASA, 2020). The Anesthesia Patient Safety Foundation (APSF) states that mitigating clinical deterioration during the perioperative period is a priority and also has a video detailing the

prevention of perioperative visual loss. The group has also published several letters to the editor regarding the need for more specific eye care standards during anesthesia (APSF, 2021).

The most common perioperative eye injuries are corneal abrasions. Corneal abrasions are superficial injuries to the epithelial layer of the cornea that cause pain, photophobia, excessive tearing, headache, and blurry vision which normally heal within 72 hours. However, they can cause patients extensive, unanticipated discomfort in addition to their post-operative pain (Kaye et al., 2019; Malafa et al., 2016). One fifth of these injuries occur from mechanical trauma due to objects such as oxygen masks, badges, and surgical drapes as well as chemical injuries from substances such as antiseptics. In addition, patients who are still under the lingering effects of anesthesia may mistakenly scratch their eyes with their own hands postoperatively (Kaye et al., 2019). Other factors that add to the risk of corneal abrasions are foreign bodies, contact lenses, and dry eyes (Kaye et al., 2019). During general anesthesia, contraction of the orbicularis oculi muscle is inhibited, putting patients at increased risk for corneal abrasions due to insufficient closing of the eyelid and subsequent drying of the cornea (Kaye et al., 2019). General anesthesia also inhibits blink reflexes, tear production, and what is known as Bell's phenomenon. Bell's phenomenon is the upward and outward movement of the globe when the eyes close. The cornea stays more exposed during a threat without this reflex intact, contributing to injury. Each of these factors may contribute to increasing the risk of corneal abrasion.

As it aligns with the focus on preventing clinical deterioration and adequate perioperative monitoring by anesthesia groups, preventing corneal abrasions addresses the tenets of the Quadruple Aim (Bodenheimer & Sinsky, 2014). Patients who experience perioperative corneal abrasions may have additional pain, thus eliminating corneal abrasions would improve patient experiences and facilitate healing. Patients would also have better outcomes without requiring

extra hospital time and treatments such as antibiotics for unnecessary eye injuries. In addition, preventing corneal abrasions has the potential to lower healthcare costs, as eye injury claims account for 2-3% of all malpractice claims against anesthesia providers (Gild et al., 1992). Finally, clinicians may have improved clinical experiences because they spend less time correcting needless problems for patients and have more time to dedicate to their practice of anesthesia.

Organizational Needs Statement

Perioperative corneal abrasions have the potential to occur in all environments where anesthesia is delivered but, despite this, standards of care regarding prevention are not clearly defined. At the partnering institution this is an issue because many surgeries are performed under general anesthesia. In addition, anesthesia providers vary in their preventative activities due to having no specific protocols regarding prevention of perioperative corneal abrasions. Occurrence of corneal abrasions could result in longer hospital stays, lower satisfaction scores, and unnecessary costs for the organization.

According to the project chair, the partnering organization has only two policies that directly address prevention of eye injuries, including corneal abrasions (M. McAuliffe, personal communication, August 31, 2021). One policy is in regard to the monitoring of intensive care unit patients when they are administered neuromuscular blockers. It states to use lubricant and eye drops to prevent corneal abrasions but does not specify how often or how much. The second pertains to placing patients in prone position, and instructs the provider to do an eye assessment, clean the eyes, apply eye ointment, and use eye pads and/or tape before proning to prevent corneal abrasions. This procedure also instructs the providers to assess the condition of the eye every 2 to 4 hours. However, these policies are directed towards ICU care.

Although there are no national or state benchmarks available, it is important to note that the Centers for Medicare & Medicaid Services (CMS) has chosen to include post-anesthesia corneal abrasion diagnoses in their quality measures inventory tool. The CMS uses this tool to promote quality healthcare and inform stakeholders, to manage its measure portfolio, and to guide measure development (CMS, 2021). These measures could affect the partner organization by determining their funding.

This need intersects with the goals of the AANA, APSF, and ASA, as they all stress the importance of patient monitoring and positioning to prevent harm. It also has the potential to help address the Quadruple Aim by reducing health care costs, improving patient experience and outcomes by preventing unnecessary pain and injury, and reducing clinician workload and lawsuits.

Problem Statement

Corneal abrasions, while rare, are the most common optic injury that occurs in anesthesia practice, and they account for approximately 2-3% of all anesthesia malpractice suits. With no specific protocol or documentation requirements for preventing corneal abrasions during surgical procedures, it is unclear what preventive efforts and guidance are being utilized by anesthesia providers at the partnering facility.

Purpose Statement

The purpose of this quality improvement project was to assess CRNAs' knowledge, preferences, and practices regarding eye care and corneal abrasion prevention and whether or not they perceived a corneal abrasion quick reference guide as a useful tool for their practice to prevent and treat perioperative corneal abrasions.

Section II. Evidence

Description of Search Strategies

The purpose of this literature review was to examine current evidence and recommendations addressing perioperative corneal abrasion prevention. The goal was to find information on what prevented corneal abrasions during the perioperative period, as well as educational interventions that aided in decreasing corneal abrasion occurrences. The PICOT question used to guide this search strategy was: In the operating room, how does corneal abrasion prevention education for CRNAS affect the prevalence of corneal abrasions in patients receiving anesthesia during the perioperative period?

A literature review was conducted using the databases PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL). In addition, the search engine Google Scholar was used to obtain results. Boolean operators were used to combine key words and concepts. The search strategy used to query PubMed was ((corneal injury OR corneal abrasion OR eye injury OR ocular injury) AND (surgery OR surgical procedures OR intraoperative OR perioperative OR operating room)) AND (nurse anesthetist OR anesthesia OR anesthesia OR anesthesiology OR anesthesiologist)). This search strategy pulled in the MeSH terms “Corneal injuries,” “Eye injuries,” “Operating Rooms,” “Surgery, Operative,” “Intraoperative Period,” “Intraoperative Care,” “Intraoperative Complications,” “Intraoperative Monitoring,” “Anesthetists,” “Anesthesia”, “Anesthesia Recovery,” “Anesthesiology,” and “Anesthesiologists.”

Limits applied included publications as early as 2016 through 2021, and English language. CINAHL was searched using a combination of keywords and subject headings identified using the keywords “corneal abrasion,” “corneal injury,” “eye injury,” “ocular injury,” “surgery,” “surgical procedures,” “intraoperative,” “perioperative,” “operating room,” “nurse

anesthetist," "anesthesia," "anaesthesia," "anesthesiology," and "anesthesiologist." Google Scholar was searched using the same search strategy as PubMed. See Appendix A for a list of keywords, MeSH terms, and subject terms utilized in searches. See Appendix B for search strategy and number of articles found and kept using structured searching. Additional evidence was identified by reviewing related and referenced articles as well as the websites and resources of anesthesia organizations. These additional searches provided information on current standards of practice pertaining to perioperative eye care by relevant anesthesia organizations, as well as current policies of the partnering organization. Six articles were selected for full text review from these search results. All were deemed pertinent to this project.

When appraising the articles, the Melnyk and Fineout-Overholt hierarchy of evidence levels pyramid was used evaluate the strength of the evidence (2019). Considering levels of evidence is a way to compare the strength of study findings based on the research methods. The strongest evidence comes from systematic reviews of randomized controlled trials which are classified as Level I, while expert opinions are classified as the weakest sources of evidence at Level VII. Upon full-text review, one systematic review of mixed study types (Level I), one case-controlled study (Level IV), two quality improvement projects (Level VI), and two expert opinion paper (Level VII) were identified as pertinent to this project. Refer to Appendix C for entries regarding each article identified as providing evidence.

Selected Literature Synthesis

A synthesis of information from the six identified sources was performed, with results used to inform this project. Common areas of focus among the articles included prevention, risk factors, and methods of education implemented in quality improvement.

Prevention

Authors of all six evidence sources identified the use of eye ointment as a method of protecting perioperative patients from experiencing corneal abrasions, though different types of lubricants were suggested (Carniciu, et al., 2017; Ely et al., 2019; Gonzalez-Birr, 2020; Kaye et al., 2019; Malafa et al., 2016; Papp et al., 2019). Multiple authors stated that studies comparing different lubricants failed to denote differences in efficacy in preventing corneal abrasions but claim preservative free ointments are better than petroleum-based ointments due to their flammability and associations with increases in reports of blurred vision (Carniciu, et al., 2017; Gonzalez-Birr, 2020; Kaye et al., 2019; Malafa et al., 2016). Though Gonzalez-Birr (2020) specifically described water free ointments as creating fewer complications than petroleum based, they continued to note preservative free ointment is the best option for corneal abrasion prevention.

Taping the eyes perioperatively was another common prevention technique explored. Ely et al. (2019) and Carniciu et al. (2017) focused on making sure the eyes were taped during induction, and that the eyes were fully closed. One study specifically noted Tegaderm/bio-occlusive dressings as the best type of tape for prevention (Papp et al., 2019). Tegaderm, Durapore, and Hy-tape were mentioned as tapes impermeable to chemicals with the potential to damage the eyes, such as chlorhexidine, and thus useful for preventing corneal abrasions (Kaye et al., 2019).

Proper tape removal was also mentioned as an additional way to prevent corneal abrasion occurrence, with Kaye et al. (2019) specifically noting peeling the tape down from top to bottom as best. Both Kaye et al. and Malafa et al., (2016) agreed taping the eyes was superior to ointment application when it came to preventing eye injury. In contrast, an additional source

identified after the formal search process was complete, Grover et al. (1998) saw no differences in corneal abrasion rates between tape only and ointment only groups, only between the control groups without any protection.

Risk factors

The risk factors across each of the selected studies were consistent, particularly for advanced age as a risk factor for perioperative corneal abrasions, though no specific age was mentioned (Gonzalez-Birr, 2020; Kaye et al., 2019; Malafa et al., 2016; Papp et al., 2019). Patient positioning was also identified as an important risk factor, specifically Trendelenburg, lateral, and prone positioning (Carniciu et al., 2017; Ely et al., 2019; Kaye et al., 2019; Malafa et al., 2016; Papp et al., 2019). Risk of perioperative corneal abrasion was also noted as increased with intraoperative hypotension (Ely et al., 2019; Malafa, et al. 2016); lagophthalmos, or incomplete closure of the eyelids (Kaye, et al., 2019; Malafa et al., 2016); and long procedures (Malafa et al., 2016; Papp, et al., 2019). Interestingly, while evidence reviewed by Malafa et al. (2016) set the classification criteria for long procedures as lasting at least 60 to 90 minutes minimum, literature reviewed by Papp et al. (2019) tended to include procedures of three and a half hours or more as long duration. Robotic cases and head and neck cases were also noted as greater perioperative corneal abrasion risks (Malafa et al., 2016; Papp et al., 2019).

Education for quality improvement

Two quality improvement initiatives explored educational interventions attempting to decrease perioperative corneal abrasions (Ely et al., 2019; Gonzalez-Birr, 2020). Ely et al. (2019) conducted a chart review of all surgical cases performed 6 months prior to and 6 months after a lecture and educational materials were delivered to all anesthesia providers, while Gonzalez-Birr (2020) used a pretest to assess CRNA's knowledge on prevention of perioperative corneal

abrasions and then delivered an educational in-service, followed by a post-test one month after the in-service.

Ely et al. (2019), focused on reducing perioperative corneal abrasion incidence, while Gonzalez-Birr (2020) focused on providers' understanding of the topic. Ely et al. used a retrospective chart review to assess a quality improvement initiative's ability to reduce perioperative corneal abrasions. The initiative included providing a lecture and educational materials to anesthesia providers. They demonstrated that the rates of perioperative corneal injury pre and post-initiative were 3.7 and 1.9 per 1000 respectively, showing a significant decrease in the rate of injury. Gonzalez-Birr (2020) had the same intention of reducing corneal abrasions through a QI project but differed in their methods, which included a quantitative quasi-experimental pre-post interventional design as well as an educational offering. They measured CRNAs' and anesthesiologists' current levels of understanding of perioperative corneal abrasion prevention practices, as well as what impact the educational offering had on their understanding. With post-intervention scores averaging only 6 percentage points higher than pre intervention scores (76% to 82%) and little change in prevention practices identified, the author determined that participating anesthesia providers already had a basic understanding of perioperative corneal abrasion prevention prior to the intervention but that any improvement in knowledge had potential benefit for patient care.

Project Framework

This project was completed by utilizing the model for improvement developed by the Institute for Health Care Improvement. The model focuses on what are we trying to accomplish, how will we know that a change is an improvement, and what change can we make that will result in improvement (Langley et al., 2009). The purpose was to assess CRNAs' knowledge,

preferences, and practices to prevent perioperative corneal abrasions and use pre and post surveys to assess whether an intervention caused a perceived increase in knowledge.

The plan, do, study, act (PDSA) cycle was used to implement and test changes. It is used to identify a plan to test a change, implement the change, observe and study the consequences, and determine necessary modifications. The active nature of this method allows for needed improvements along the way to maximize the benefits of a quality improvement project. In this project, the PDSA model helped with (P) planning an educational intervention for CRNAs about perioperative eyecare, (D) implementing the educational intervention, (S) observing and studying the changes in CRNA's actions and attitudes towards perioperative eye care, and (A) modifying the intervention accordingly (Associates in Process Improvement, 2021).

Ethical Considerations and Protection of Human Subjects

There were no known ethical considerations violated for this project. The intervention benefits were expected to apply equitably to everyone in the target population with no more than usual potential risk of harm to any participants. The primary investigator completed the Collaborative Institutional Training Initiative (CITI) modules prior to the project start, which ensured competency in ethics regarding research involving humans (https://about.citiprogram.org/).

In addition to this, a collaborative approval process through the East Carolina University (ECU) College of Nursing and the ECU University and Medical Center Institutional Research Board (UMCIRB) was completed which assessed the need for full IRB approval. Full approval was not required as this project met quality improvement project criteria. Facility approval was obtained through the research office of the partnering facility and the ECU UMCIRB. Finally, local facility approval to collect data was obtained from a site contact person whose signature

was required on the partnering organization's approval form. See Appendix D for this information.

Section III. Project Design

Project Setting

The project setting was a surgical unit of a large medical center where robotic surgeries were routinely performed. The large volume of surgical procedures performed in the unit offered ample opportunity for participants to apply information offered in the intervention. The fast pace of the setting presented a potential barrier to application of new information and techniques as eye care is ideally initiated during a busy period of anesthesia care.

Project Population

The project population consisted of CRNAs providing care to patients receiving robotic procedures at the partnering organization. CRNAs are particularly busy during this point of the perioperative phase, which presents a potential barrier to the application of new information. CRNAs in robotic settings care for patients who may be more at risk for corneal abrasions due to the positioning of the robot near the eyes and the steep Trendelenburg position that often accompanies robotic procedures.

Project Team

The project team consisted of the primary student as the team lead, three additional students as part of the team, the project chair, and the clinical site contact person. The primary student as well as the three other students worked to develop a topic, a quick reference guide as an educational intervention, and pre and post-surveys to assess the impact of the intervention. The project chair, who was also the CRNA program director, served as a mentor, guiding development of the project from start to finish. In addition to assigning the topic, they provided valuable feedback during creation of the quick reference guide and survey questions. Their expertise provided the clinical knowledge and experience necessary to appropriately address the

issue. As program director, they also ensured the opportunity to share findings with others and assured these activities fulfilled the requirement for the DNP degree.

The clinical site contact person and the CRNA faculty clinical contact person made collecting data on the unit possible by facilitating communication between the participating CRNAs and the student conducting the project. The site contact person agreed to the project and signed the letter of acknowledgement approving data collection on the unit for the organizational approval process. The CRNA faculty clinical contact person, who had existing working relationships with many CRNAs on the unit, recruited potential participants, shared their emails with the student team lead, and served as the backup for any questions. The course director provided direction for the research and literature review to ensure the most applicable evidence was utilized in development of the project, developed a timeline and deadlines for project activities, and editorial support for the writing process.

Methods and Measurement

The purpose of this quality improvement project was to assess anesthesia providers' perceptions of adequacy of a newly developed Perioperative Corneal Abrasion Prevention Guide. This issue was chosen because corneal abrasions are the most common perioperative injury. In addition, the partnering institution had no protocols for anesthesia providers specifically addressing eye care to prevent perioperative corneal abrasions.

This project was a pre and post-intervention design using a single PDSA cycle. The intervention used was a quick reference guide developed by the team with the most up to date literature on perioperative corneal abrasion prevention (Appendix E). Anesthesia providers at the partnering organization were emailed an invitation to participate with a link to a pre-intervention Qualtrics survey and the attached intervention with requests that they complete the pre

intervention survey prior to reviewing and using the guide (Appendix F). After two weeks of utilization, data was gathered using Qualtrics surveys to study whether the intervention increased knowledge on corneal abrasion prevention or changed the practice of anesthesia providers working at the partnering organization (Appendix G). The general outcome measures included ordinal, interval, ratio, and free response levels of measurement.

For the *plan* portion of the project, the quick reference Perioperative Corneal Abrasion Prevention Guide, based upon most current literature, was developed as the intervention (Appendix E). The quick reference guide contained information on risk factors, pathophysiology, treatment, and prevention of corneal abrasions. An algorithm for treatment was included as a graphic on the guide as well.

Pre and post-intervention surveys using Qualtrics were also developed to assess the intervention's impact on anesthesia providers at the partnering organization. These surveys contained questions about participants' perceptions of the adequacy of their currently used perioperative corneal abrasion prevention techniques and preparedness for corneal abrasion prevention (See Appendix G)

In the *do* phase of the PDSA cycle, CRNAs were recruited to participate by the clinical CRNA faculty person. The volunteers were emailed the pre intervention survey and the newly created quick reference guide as well as a voiceover presentation describing the project and information within the guide. They were also thanked for offering to participate. For two weeks, the participating CRNAs were asked to utilize the guide in their practice to aid in preventing corneal abrasions. After the two-week period, the post-intervention survey was emailed to the participants for completion. The post-intervention survey included questions addressing their

attitudes and knowledge regarding perioperative corneal abrasion prevention and treatment to evaluate for change as well as their perceptions of the usefulness of the quick reference guide.

For the *study* part of the project, the findings were analyzed using Excel, addressing the purpose of the project, which was to assess CRNAs' knowledge, preferences, and practices regarding eye care and corneal abrasion prevention and whether they perceived the corneal abrasion quick reference guide as a useful tool for their practice to prevent corneal abrasions.

For the *act* portion of the project, we considered how findings would inform a larger project. In addition, sharing the information with others through the PowerPoint presentation and making the paper available to other providers and organizations.

Section IV. Results and Findings

Results

The purpose of this quality improvement project was to assess CRNAs' knowledge, preferences, and practices regarding eye care and corneal abrasion prevention and whether they perceived a corneal abrasion quick reference guide as a useful tool for their practice to prevent and treat perioperative corneal abrasions. Pre surveys with eleven questions were sent to five participating CRNAs who frequently work in robotic cases at the participating organization. The surveys were intended to assess the current understanding of perioperative corneal abrasion prevention, as well as the current prevailing practices. These surveys were sent on April 22nd, 2022, via email, along with a PowerPoint with instructions on how to use the quick reference guide. Participants were asked to employ the quick reference guide starting on April 25th, 2022. A reminder email to complete the presurvey was sent on April 29th, 2022. Originally, the data collection was to occur for two weeks. However, in an effort to combat low participation, post surveys were sent two weeks later than planned on May 20th, 2022. In total, four out of five CRNAs responded to the pre survey by May 20th, 2022, which is also when the post survey was sent to the participants. This post survey was intended to assess the implications the quick reference guide had on the participating CRNAs' practice. A reminder email to complete it was sent on May 27th, 2022, and reminder texts were individually delivered via cell phone on May 12th. In total, two out of five participating CRNAs responded to the twelve question post survey. Thank you emails were then delivered on May 13th, 2022. All data was collected using Qualtrics and analyzed using Excel.

Data Presentation

Pre survey results found that 50% of respondents had either themselves or known a colleague who had been involved in a case with a patient who had received a corneal abrasion. The causes of the corneal abrasions in those cases were stated as “extensive prone case” and “not sure.” Current methods for routine eye care were also assessed. One respondent used eye goggles, Tegaderm, paper tape, lubricant, and one-inch clear tape, and the other three only used clear one inch tape. When methods used for patients perceived as at higher risk of corneal abrasions were assessed, one respondent used eye goggles, Tegaderm, paper tape, lubricant, and one-inch clear tape, two responded with eye goggles and tape, and one respondent still only used clear one-inch tape.

In addition to these interventions, vigilance on transport to PACU and lubricant for cases more than 4 hours long were stated as additional perioperative corneal abrasion prevention methods. Three CRNAs said they taped the eyes before securing the airway, and one said after they secured the airway. The respondents listed robotic surgeries, ear nose and throat (ENT) surgeries, head and neck surgeries, back surgeries, and steep Trendelenburg position as surgeries, positions, and demographic/comorbidities that put patients at higher risk for corneal abrasions. Two respondents said they routinely assessed eyes only during position changes, one said during emergence, and one said none at all. Three respondents said they were somewhat confident in their ability to identify patients at risk for corneal abrasion, and one said they were fairly confident. One respondent said they were somewhat confident, two said they were fairly confident, and one said they were highly confident in their abilities to prevent corneal abrasions. Finally, two respondents stated they were slightly confident, one said somewhat confident, and one said fairly confident, when it came to diagnosing and treating corneal abrasions.

Post survey results showed that neither of the two respondents were involved in a case with a corneal abrasion over the four weeks that the quick reference guide was employed. When asked how many surgeries the participants were involved in that could be identified as high-risk for corneal abrasions, one respondent said 0, the other said 1-5. Both participants said they found the quick reference guide to be useful in their practice but did not comment further. Although confidence levels improved in assessing, treating, and identifying risk of corneal abrasions, the physical reference guide was only regarded as "neutral" by both respondents when it came to future utilization. One respondent claimed they made changes to their practice after employing the quick reference guide, and one said they made no changes to their practice. Both respondents also claimed that an Epic shortcut that allowed for streamlined documentation of eye care strategies utilized during the case would be beneficial.

When it came to the comparison of pre and post survey results, confidence levels were assessed for ability to identify patients at risk for corneal abrasions, ability to take appropriate measures to prevent corneal abrasions, and ability to assess, diagnose, and treat corneal abrasions. Per Figure 1, one participant went from somewhat and fairly confident, to fairly and highly confident, displaying an increase in perceived ability to identify risk factors for corneal abrasions.

Per Figure 2, participants went from somewhat confident, to fairly and highly confident post the quick reference guide, showing an increase of ability to take appropriate measures to prevent corneal abrasions.

Finally, the confidence in the ability to assess, diagnose, and treat corneal abrasions was compared and responses went from slightly, somewhat, and fairly confident pre intervention, to fairly confident post intervention.

Figure 1

How confident are you in identifying patients at high risk for corneal abrasions? (Pre: n=4)

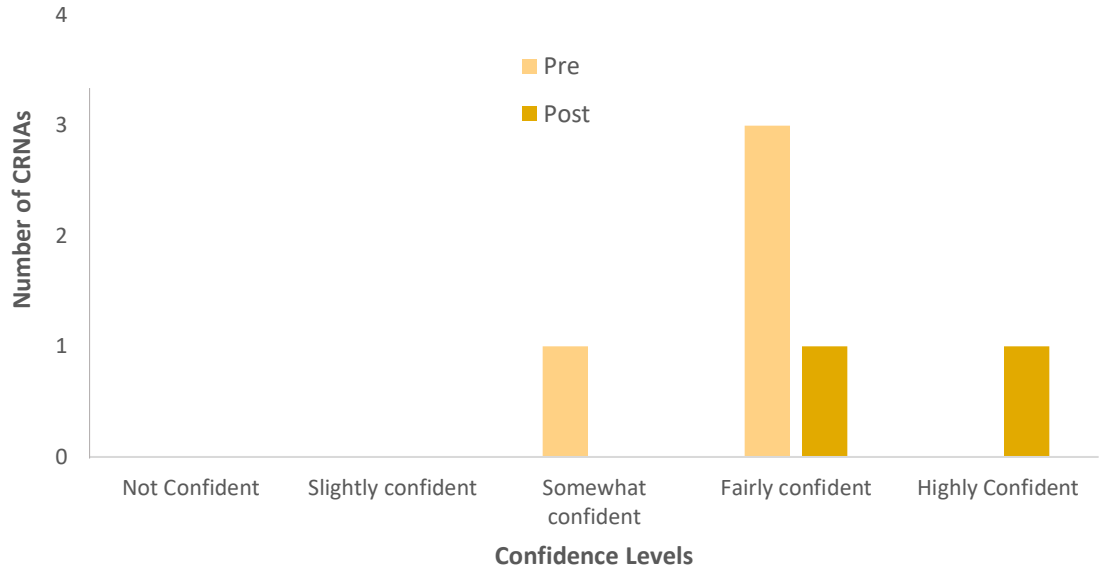
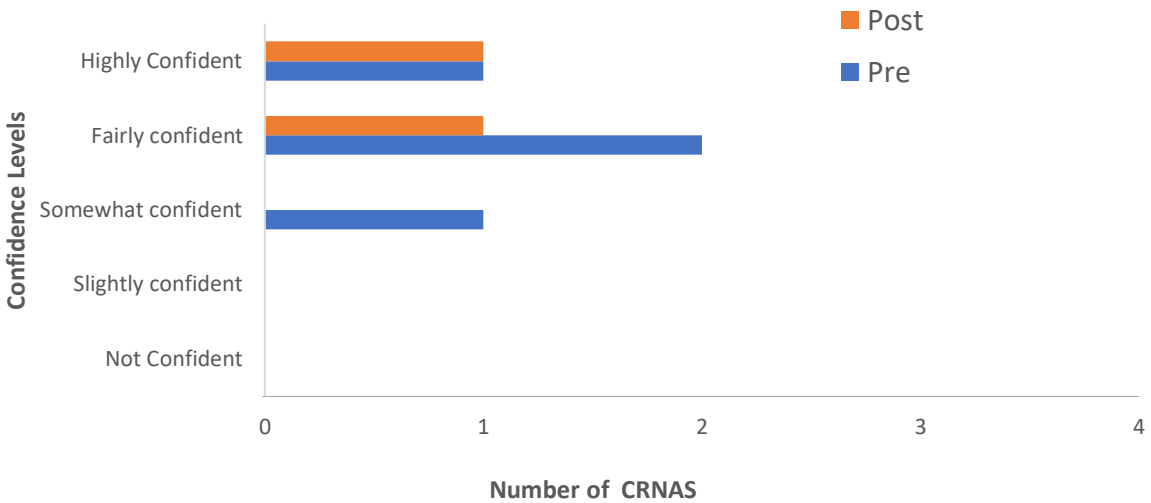


Figure 2

After having access to this reference handout, please rate your confidence in your ability to take appropriate measures to prevent corneal abrasions? (Pre: n=4) (Post: n=2)



Analysis

When the question was posed: "Have you, or do you know a colleague, that has personally been involved in the care of a patient who had a corneal abrasion?" two participants said "yes," and two participants said "no." Half is a high percentage when it comes to corneal abrasion occurrence. Although obtained using a small sample size, it's important to note that the occurrence of perioperative corneal abrasions is indeed a problem that exists at the participating organization, as well as any setting where general surgery is performed. The comments also stated that the abrasions came from an extensive prone case, and "not sure." This indicates a need at the participating organization for identifying patients at risk for corneal abrasions, and what causes them. The quick reference guide's aim was to help inform participants of this information.

A clear stand out was observed with clear one-inch tape, which is a very effective method for preventing corneal abrasions according to the evidence identified in the current literature. In addition to clear tape, when corneal abrasion risk was perceived as high by the CRNA, three out of four participants added eye goggles to their care. The responding CRNAs stated vigilance on transport to PACU and lubricant for cases more than 4 hours long were additional measures that were taken to prevent corneal abrasions that were not specifically listed in the survey question. This is important to note because perhaps PACU transport is where a significant number of these preventable corneal abrasions occurred.

Robotic, ENT, steep Trendelenburg, head and neck, and back surgery were all listed as cases, positions, or comorbidities that increase the risk of corneal abrasion occurrence. As not all participants initially reported high confidence in their ability to recognize high risk procedures, there is potential for improvement in their knowledge and practice. In addition, two participants only checked eyes during position changes, one during emergence, and one never at all. This

displays an opportunity to increase vigilance for assessing and detecting corneal abrasions perioperatively. Ideally, the eyes would be checked every 15 minutes.

When comparing pre survey and post survey results, an increase in perceived ability to identify risk factors for corneal abrasions, ability to take appropriate measures to prevent corneal abrasions, and ability to assess, diagnose, and treat corneal abrasions was observed. Although confidence levels in assessing, diagnosing, and treating corneal abrasions increased, there was only a slight difference noted. Responses went from slightly, somewhat, and fairly confident, to all fairly confident post intervention. Perceived confidence in treating corneal abrasions is still somewhat lacking, which is perhaps somewhat due to the care system in place, as CRNAs are not as involved post PACU transport and may not have many opportunities to engage in treatment of corneal abrasions.

Although reported confidence levels increased in assessing, treating, and identifying risk of corneal abrasions, the physical reference guide was regarded as neutral when it came to future utilization. Ongoing access to the physical handout may not be entirely necessary once the information is reviewed and understood. In addition, one person made changes to their practice, but one did not. Clear eye tape was already being used preintervention and the literature shows that it is highly effective. This is perhaps the reason there was little change pre and post intervention. However, both participants agreed that an EPIC shortcut would be useful in practice. This could help develop further lead research on this topic, by potentially engaging in trialing an Epic shortcut that could lead to better vigilance when it came to preventing perioperative corneal abrasions.

Section V. Implications

Financial and Nonfinancial Analysis

Some sort of corneal abrasion prevention strategy is already employed by most CRNAs. However, with an increase in awareness of risk factors and the best methods of prevention, hospitals can potentially save thousands of dollars in delivering unnecessary care.

Eye injury claims account for 2-3% of all malpractice claims against anesthesia providers (Gild et al.,1992). In addition, there is financial strain on the facility to manage eye injuries, including ophthalmology consults and longer hospital stays. An average hospital stay is $11,700 (Charaba, 2022), which results in extraneous cost to the patient and the health care facility due to a preventable injury.

The benefit of the project to the organization would be increased awareness for preventing corneal abrasions and associated complications. The increased awareness may lead to higher patient satisfaction levels due to less post operative injury, as well as financial savings to the patient and organization. An average hospital stay ranges from $2000-$10,000 per day, and avoiding unnecessary inpatient stays also avoids this financial burden (Charaba, 2022). Cost to the organization is related to purchasing, printing, and stocking the quick reference guide as well as distributing it to anesthesia providers. There are 26 operating rooms at the partnering organization. To print and laminate 26 copies of the quick reference guide for each operating room would cost approximately $185.

Implications of Project

Though post survey participants reported further utilization of the quick reference guide in their practice as “neutral,” the potential for participants to use it in the future exists. Ideally the project increased awareness for the risk factors involved with perioperative corneal abrasions and

encouraged providers to prioritize prevention techniques during their care. Overall, this may have also helped to achieve the goals of the AANA, ASA, APSF; and addressed the tenets of the Quadruple Aim by strengthening methods for patient safety during anesthesia care and ensuring a positive patient care experience.

In the literature, corneal abrasions can be prevented with vigilance and a variety of methods. This project may reduce occurrence of corneal abrasions in patients by making providers more aware of the risk factors as well as prevention techniques. In addition to the discomfort that accompanies a corneal abrasion, infections and unexpectedly extended hospital stays could be avoided by employing this project. One implication for nursing care includes a renewed sense of vigilance for corneal abrasions. Regardless of the technique used, vigilance and more frequent assessments of the eyes while under anesthesia can lead to improved outcomes. Potential impacts for the healthcare system include increased patient satisfaction as well as an overall positive and trusting outlook on anesthesia care in general. If patients feel secure within the hospitals they receive care in, they are more likely to trust them again to meet their healthcare needs in the future.

Sustainability

If the organization were to implement this intervention as a larger QI project, they could afford to continue what was done in this project. It is essentially presenting and making available a simple quick reference guide. Printing the guides is relatively inexpensive and creating and distributing the Qualtrics surveys incurred no cost. To gain access to participants, the project could be mentioned during a monthly staff meeting, creating almost zero extra time commitment during the work hours. However, challenges exist in getting CRNAs to sustain use. Incentives for the absence of corneal abrasions in patients could be a potential solution to this problem.

Dissemination Plan

A project poster was created and presented in person and with a virtual option for students and faculty of the nurse anesthesia program. Project participants were also invited to attend. The final version of this paper has been posted in The Scholarship, the East Carolina University digital repository.

Section VI. Conclusion

Limitations

Limitations to this project include loss of participants to follow up for completion of the post survey and short time frame for the project. Five participants were initially enrolled in the study, with only four completing the pre survey and only two completing the post survey even after several reminders in different formats. In the future, developing a way to secure and keep participants for data collection would yield a larger sample size. The inclusion of CRNAs in more operating rooms and even multiple facilities as eligible for participation could enable the acquisition of more generalizable data.

Productivity demands may have altered participants' ability to thoroughly engage with the intervention and possibly affected post implementation results. Significant time constraints may accompany goals to get as many patients' surgeries completed as possible, potentially leaving little time for reading and understanding new information during the workday. In addition to this, barriers to implementing a future project could include governance committees that employ time consuming approval processes for testing out further interventions.

Recommendations for Future Implementation and/or Additional Study

There are a multitude of ways the topic can be studied further. One of the limitations is the lack of generalizability with a small sample size from only one hospital. A larger scale study could be replicated with more hospitals and anesthesia providers and potentially result in statistically significant data. Incentives for participation could be devised to further enhance participation.

One subject worth investigating further is the use of an EPIC shortcut that would enable streamlined documentation for eye protection strategies utilized during a case. Upon discussing

the project with information technology, it would take about 15 minutes to add an “eye protection” section with selections such as “clear tape,” “paper tape,” “Tegaderm,” “lubricant,” and “goggles” to the existing charting macro that the participating organization uses. Analyzing the data gathered from an Epic shortcut may be a quick and timely way to assess changes in eye protection practices of CRNAs and is worth further investigation.

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Appendix A

Literature concepts table

	Concept 1: Corneal Abrasions	Concept 2: Operating Room	Concept 3: CRNAs
Keywords (these are the "normal" words you would use anywhere)	Corneal Abrasion Corneal injury Eye injury Ocular Injury	Surgery Surgical Procedures Intraoperative Perioperative Operating Room	Nurse Anesthetist Anesthesia Anaesthesia Anesthesiology Anesthesiologist
PubMed MeSH (subject heading specific to PubMed)	"corneal injuries"[MeSH Terms] "eye injuries"[MeSH Terms]	"Operating Rooms" [MeSH Terms] "Surgery, Operative" [MeSH Terms] "Intraoperative Period" [MeSH Terms] "Intraoperative Care" [MeSH Terms] "Intraoperative Complications" [MeSH Terms] "Intraoperative Monitoring" [MeSH Terms]	"Anesthetists" [MeSH Terms] "Anesthesia" [MeSH Terms] "Anesthesia Recovery" [MeSH Terms] "Anesthesiology" [MeSH Terms] "Anesthesiologists" [MeSH Terms]
CINAHL Subject Terms (Subject headings specific to CINAHL)	(MH "Corneal Injuries") (MH "Eye Injuries")	(MH "Operating Rooms") (MH "Surgery, Operative") (MH "Intraoperative Period") (MH "Intraoperative Care") (MH "Intraoperative Complications") (MH "Intraoperative Monitoring")	(MH "Nurse Anesthetists") (MH "Anesthetists") (MH "Anesthesia") (MH "Anesthesia Recovery") (MH "Anesthesiology") (MH "Anesthesiologists")

		(MH "Perioperative Care")	

Appendix B

Literature search log

Search date	Database or search engine	Search strategy	Limits applied	Number of citations found/kept	Rationale for inclusion/exclusion of items
9/21/21	PubMed	((corneal injury OR corneal abrasion OR eye injury OR ocular injury) AND (surgery OR surgical procedures OR intraoperative OR perioperative OR operating room)) AND (nurse anesthetist OR anesthesia OR anaesthesia OR anesthesiology OR anesthesiologist)	English 2016-current	Found 200/ Kept 13	Intraoperative focus, Eye Injuries happening before surgery not applicable, excluded results talking about surgery specifically on the eyes
9/21/21	CINAHL	((MH "Corneal Injuries") OR "corneal abrasions" OR "corneal injury" OR (MH "Eye Injuries") OR "eye injury" OR "ocular injury") AND ((MH "Operating Rooms") OR "operating room" OR "surgery" OR (MH "Surgery, Operative") OR "surgical procedures" OR (MH "Intraoperative Period") OR (MH "Intraoperative Care") OR (MH "Intraoperative Complications") OR (MH "Intraoperative Monitoring") OR "intraoperative" OR (MH "Perioperative Care") OR	English 2016-2021	Found 62/ 3 Kept	Intraoperative focus, Eye Injuries happening before surgery not applicable, excluded results talking about surgery specifically on the eyes

		"perioperative") AND ((MH "Nurse Anesthetists") OR (MH "Anesthetists") OR "nurse anesthetist" OR (MH "Anesthesia") OR "anesthesia" OR "anaesthesia" OR (MH "Anesthesia Recovery") OR (MH "Anesthesiology") OR "anesthesiology" OR (MH "Anesthesiologists"))			
9/21/21	Google Scholar	(Corneal Abrasion) AND (Perioperative) AND (Anesthetist) AND (Education)	English 2016-Current	5610 found/ 15 kept (reviewed 10 pages of results)	Intraoperative focus, Eye Injuries happening before surgery not applicable, excluded results talking about surgery specifically on the eyes

Appendix C

Literature Matrix

Year	Author, Title, Journal	Purpose & Conceptual Framework or Model	Design and Level of Evidence	Setting	Sample	Tool/s and/or Intervention/s	Results
2016	Malafa, M. M., Coleman, J. E., Bowman, R. W., & Rohrich, R. J. (2016). Perioperative corneal abrasion: Updated guidelines for prevention and management. *Plastic and Reconstructive Surgery*, *137*(5), 790e–798e. https://doi.org/10.1097/PRS.0000000000002108	To review the pathophysiology of perioperative corneal abrasions and suggest updated guidelines for prevention.	Level VII (Expert Opinion)	Perioperative Settings	Literature Review	Experts reviewed the literature then came up with recommendations based on the findings.	Perioperative corneal abrasions can be prevented by understanding the pathophysiology, recognizing the risk factors (position, age, length of procedure, lagophthalmos, etc.), and appropriate treatment (tape, lubricant), symptom monitoring, and ophthalmologic referral if indicated.
2017	Carniciu, A. L., Fazzari, M. J., Tabibian, P., Batta, P., Gentile, R. C., Grendell, J. H., Braithwaite, C. E., & Barzideh, N. (2017).	To identify risk factors associated with perioperative corneal abrasions at a hospital in New York.	Level IV (case-controlled study)	Single Hospital in Mineola, New York	37 patients with perioperative corneal abrasions, 101 control	Chart review, age-stratified logistic regression model.	Longer duration of surgery and pre-existing ocular disease were found to be the strongest indicators of

	Corneal abrasion following anaesthesia for non-ocular surgical procedures: A case-controlled study. *Journal of Perioperative Practice*, *27*(11), 247–253. https://doi.org/10.1177/175045891702701102				subjects who underwent anesthesia with no corneal abrasion injury		perioperative corneal abrasions. Body positioning, diabetes, and surgical site did not strongly correlate with perioperative corneal injury.
2019	Papp, A. M., Justin, G. A., Vernau, C. T., Aden, J. K., Fitzgerald, B. M., Kraus, G. P., & Legault, G. L. (2019). Perioperative corneal abrasions after nonocular surgery: A systematic review. *Cornea*, *38*(7), 927–932. https://doi.org/10.1097/ICO.0000000000001972	To perform a systematic review of the literature evaluating the risk factors, prevention measures, and treatments for perioperative corneal injuries for nonocular surgery No framework or model noted	Level 1 (systematic review of mixed study types)	Perioperative Setting	16 articles total, included two types of studies: primary epidemiological studies that looked at the rates of perioperative corneal injuries after nonocular surgery and trials that either studied preventative steps or treatments.	Statistical analysis was used to show trends in perioperative corneal abrasions	Standardized ocular protection, reporting, and education initiatives were found to maximally decrease rates of perioperative corneal abrasions after nonocular surgery. However, no gold standard currently exists for intraoperative ocular protection.

2019	Ely, A. L., Goerlitz-Jessen, M., Scott, I. U., Lehman, E., Ali, T., Kerchner, D., & Liang, D. (2019). An ophthalmology resident-led quality improvement initiative to decrease the incidence of perioperative corneal injury. *Journal of Academic Ophthalmology*, *11*(02). https://doi.org/10.1055/s-0039-3400545	To evaluate the effectiveness of an educational program on reducing the incidence of perioperative corneal abrasion Penn State Hershey Medical Center. No framework noted.	Level VI (QI)	Penn State Milton S. Hershey Medical Center operating rooms	9745 cases pre-initiative, 9,991 cases post-initiative	Retrospective chart review, lecture, and distribution of a corneal abrasion prevention algorithm to anesthesia providers.	A QI project consisting of educating anesthesia providers on perioperative corneal injury awareness, understanding of risk factors, and included an algorithm designed to prevent perioperative corneal injury was successful in reducing the rate of perioperative injuries.
2019	Kaye, A. D., Renschler, J. S., Cramer, K. D., Anyama, B. O., Anyama, E. C., Gayle, J. A., Armstead-Williams, C. M., Mosieri, C. N., Saus, J. A., & Cornett, E. M. (2019). Postoperative management of corneal abrasions and clinical implications: A	To review the etiology and treatment of corneal abrasions in the context of anesthesia practice	Level VII (Expert Opinion)	Perioperative Settings	Literature Review	Experts reviewed the literature then came up with recommendations based on the findings.	Prevention should include identifying patients at risk, eyes taped after intubation and removing monitors from patient's dominant hand post surgery. Corneal abrasions are normally found in the PACU with

	comprehensive review. *Current Pain and Headache Reports*, *23*(7), 48. https://doi.org/10.1007/s11916-019-0784-y						complaints of blurred vision, photophobia, and eye pain. If noted, optical ophthalmic erythromycin ointment is the first antibiotic choice and NSAIDs should be first in pain management.
2020	Gonzalez-Birr, A. (2020). *Perioperative corneal abrasion: An exploration of educational intervention effectiveness and impact on prevention practices* (Publication No. 27837882). [Scholarly Project, Georgetown University]. ProQuest Dissertations & Theses Global.	To determine anesthesia providers' understanding of perioperative corneal abrasion prevention, and what impact an education intervention has on their understanding. No framework noted.	Level VI (QI)	Two mid-Atlantic teaching hospitals in the United States	40 Anesthesia providers (board certified anesthesiologists and currently practicing CRNAs	Quantitative quasi-experimental pre-post interventional design	Anesthesia providers have a basic understanding of how to prevent perioperative corneal abrasions. The educational in-service did not have a significant association with improved understanding or preventions methods, but post test scores did improve. Continued prevention education is warranted.

Note. CINAHL = Cumulative Index to Nursing and Allied Health Literature; MH = Mesh Heading; CRNA = Certified Registered Nurse Anesthetist; Key to Levels of Evidence: I: Systematic review/meta-analysis of randomized controlled trials (RCTs); II: RCTs; III: Nonrandomized controlled trials; IV: Controlled cohort studies; V: Uncontrolled cohort studies; VI: Descriptive or qualitative study, case studies, EBP implementation and Quality Improvement projects (QI) ; VII: Expert opinion from individuals or groups. Adapted from *Evidence-based practice in nursing and healthcare: A guide to best practice* (4th ed.), by B. M. Melnyk and E. Fineout-Overholt, 2019, p. 131.

Appendix D

Department Approval Forms

Click "download PDF" to save a copy of this page for your records.
Note: The IRB Office does not maintain copies of your responses.

Below is a summary of your responses

Download PDF

Quality Improvement/Program Evaluation Self-Certification Tool

Purpose:
Projects that do not meet the federal definition of human research pursuant to 45 CFR 46 do not require IRB review. This tool was developed to assist in the determination of when a project falls outside of the IRB's purview.

Instructions:
Please complete the requested project information, as this document may be used for documentation that IRB review is not required. Select the appropriate answers to each question in the order they appear below. Additional questions may appear based on your answers. If you do not receive a STOP HERE message, the form may be printed as certification that the project is "not research", and does not require IRB review. The IRB will not review your responses as part of the self-certification process. For projects being done at Vidant Health, site support will be required. Please email [redacted] to obtain site support from [redacted].

Name of Project Leader:

Savannah Samuel

Project Title:

Perioperative Corneal Abrasion: An exploration or Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention

Brief description of Project/Goals:

Does the project involve "no more than minimal risk" procedures (meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests)?

- (●) Yes
- ( ) No

Is the project intended to improve or evaluate the practice or process within a particular institution or a specific program, and falls under well-accepted care practices/guidelines?

- (●) Yes
- ( ) No

Based on your responses, the project appears to constitute QI and/or Program Evaluation and IRB review is not required because, in accordance with federal regulations, your project does not constitute research as defined under 45 CFR 46.102(d). If the project results are disseminated, they should be characterized as QI and/or Program Evaluation findings. Finally, if the project changes in any way that might affect the intent or design, please complete this self-certification again to ensure that IRB review is still not required. Click the button below to view a printable version of this form to save with your files, as it serves as documentation that IRB review is not required for this project. 11/9/2021

Center for Research & Grants

Quality Assurance/Quality Improvement Project vs. Human Research Study (Requiring IRB approval) Determination Form

This worksheet is a guide to help the submitter to determine if a project or study is a quality assurance/quality improvement (QA/QI) project or research study and is involving human subjects or their individually identifiable information and requires IRB approval as defined by the Health and Human Services (HHS) or Food and Drug Administration (FDA). Once completed, please email the form to the Center for Research and Grants (CRG) . A CRG team member will contact you with the results of their review and may request additional information to assist with their determination. The determination will be made in conjunction with the UMCIRB office.

Please contact the CRG with any questions at 252-847-1177 or

For more guidance about whether the activity meets the definition of Human Subjects Research see https://rede.ecu.edu/umcirb/irb-faqs/definitions/ or https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html#c1

Project Title: Intraoperative Eye Care: A DNP Project		
Funding Source: None		
Project Leader Name: Savannah Samuel/ Maura McAuliff	☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ■ R.N. ☐ Other(specify):	
Job Title: ECU SRNA/ECU CRNA Faculty	**Phone:**	**Email:**
	Primary Contact (If different from Project Leader): Savannah Samuel	
	Phone: 9	**Email:** samuels20@students.ecu.edu

Key Personnel/ Project Team members:

Name and Degree:	Department: (Affiliation if other than Vidant)	Email:
Savannah Samuel, SRNA	ECU Nurse Anesthesia Program	samuels20@students.ecu.edu

QI/QA Assessment Checklist:

Consideration	Question	Yes	No
PURPOSE	Is the PRIMARY purpose of the project/study to: • IMPROVE care right now for the next patient? OR • IMPROVE operations outcomes, efficiency, cost, patient/staff satisfaction, etc.?	✔	
RATIONALE 1	The project/study falls under well-accepted care practices/guidelines or is there sufficient evidence for this mode or approach to support implementing this activity or to create practice change, based on: • literature • consensus statements, or consensus among clinician team	✔	
RATIONALE 2	The project/study would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "Yes" to this statement does not preclude publication of a quality activity.)	✔	
METHODS 1	Are the proposed methods flexible and customizable, and do they incorporate rapid evaluation, feedback and incremental changes?	✔	
METHODS 2	Are patients/subjects randomized into different intervention groups in order to enhance confidence in differences that might be obscured by nonrandom selection? (Control group, Randomization, Fixed protocol Methods)		✔
METHODS 3	Will there be delayed or ineffective feedback of data from monitoring the implementation of changes? (For example to avoid biasing the interpretation of data)		✔
METHODS 4	Is the Protocol fixed with fixed goal, methodology, population, and time period?		✔
RISK	The project/study involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	✔	
PARTICIPANTS	Will the project/study only involve patients/subjects who are ordinarily seen, cared for, or work in the setting where the activity will take place?	✔	
FUNDING	Is the project/study funded by any of the following? • An outside organization with an interest in the results • A manufacturer with an interest in the outcome of the project relevant to its products • A non-profit foundation that typically funds research, or by internal research accounts		✔

If all of the check marks are inside the shaded gray boxes, then the project/study is very likely QI and not human subject research. Projects that are not human subject research do not need review by the IRB.

In order to assess whether your project meets the definition of human subject research requiring IRB review or may qualify as a quality improvement/assurance activity, please provide the following information:

1. **Project Summary: In the space provided below, please provide a summary of the purpose and procedures.**

   Purpose: The purpose of this quality improvement project is to assess CRNAs' preferences and practices regarding eye care and corneal abrasion prevention and whether or not they perceived the corneal abrasion quick reference guide as a useful tool for their practice to prevent CAs. Procedures: A quick reference guide based upon national guidelines will be utilized to guide anesthesia providers' perioperative eye care. Anesthesia providers who work in robotic cases at Vidant Medical Center will be asked several questions (through Qualtrics) about their perceptions of the adequacy of their current eye care practices during surgical anesthesia. A PowerPoint presentation about the use of the quick reference guide Interoperative Corneal Abrasion Prevention will then be made available to them, and they will be asked to use the quick reference guide for two weeks. Upon completion of the two-week utilization period, Qualtrics survey software will be used to gather anesthesia providers' perceptions of acceptability and adequacy of the corneal abrasion quick reference guide. No patient information will be recorded or maintained during this project.

2. **If the Primary purpose of your project/study is for QA/QI, have you obtained approval from the operational leader within your department or health system** [Please specify here whom and obtain their signature in the signature section below]:

   ☐ **Yes**
   ☐ **No** [Contact the appropriate operational leader for approval.]

Please note:

- By submitting your proposed project/study for QA/QI determination you are certifying that if the project/ study is established to qualify as QA/QI project, you and your Department would be comfortable with the following statement in any publications regarding this project: "This project was reviewed and determined to qualify as quality improvement by the Vidant Health Center for Research and Grants."
- If you are submitting a Poster to Media Services for printing, you will need to also submit this Quality Improvement Worksheet or proof of your IRB Application and IRB Approval.
- If the CRG determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research," "exempt research," or "expedited research."
- If you would like the CRG to verify that a project/study is not human subject research, please provide this form completed with the summary of your activity and any additional information to the CRG at and the following will be completed and returned to you for your records.

NHSR vs. HSR Determination:

☒ **Not Human Subject Research:** The VH CRG has determined that based on the description of the project/study, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the CRG at that time to ensure those changes do not elevate the project to human research that would need IRB approval.
☐ **Human Subject Research:** This project/study requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

Approval Signatures:

☐ **Operational Mgr/Leader:** [redacted] **Date:** 3-1-2022

☐ **CRG Reviewer:** [redacted] **Date:** 3/14/22

☒ **UMC IRB Office Staff Reviewer:** [redacted] **Date:** 3/15/22

Attestation of Understanding

My signature below indicates that I fully understand that HIPAA Privacy standards as they apply to Quality Projects involving Protected Health Information and patient medical records as outlined below.

Under HIPAA's minimum necessary provisions, Health must make reasonable efforts to limit PHI to the minimum necessary to accomplish the purpose of the use, disclosure or request.

Under HIPAA, a Covered Entity can disclose PHI to another CE (i.e. BSOM) for the following subset of health care operations activities of the recipient CE without needing patient consent:

- Conducting quality assessment and improvement activities
- Developing clinical guidelines
- Conducting patient safety activities as defined in applicable regulations
- Conducting population-based activities relating to improving health or reducing health care cost

[redacted]ealthcare data utilized in this project should not be shared outside of the CE without a fully executed data use/sharing agreement. Health leadership reserves the opportunity to review all articles for dissemination/ publication for which Vidant healthcare data has been utilized.

[redacted] 02/13/2022

Project Leader Signature **Date**

Appendix E

Quick Reference Guide

ECU

Intraoperative Corneal Abrasion Prevention

Maura McAuliffe PhD, CRNA, FAAN, Project Chair
Christopher Chukala BSN, RN, SRNA
Justin Grady BSN, RN, SRNA
Luke Matthews BSN, RN, SRNA
Savannah Samuel BSN, RN, SRNA

Risk Factors:

- Advanced Age[1,2,3,6]
- SRNA as provider[1,5]
- Head and neck surgery[2,5]
- Graves' disease/exophthalmos[2,5]
- Lateral/prone/trendelenburg position[1,2]
- Prolonged surgery duration > 3.5 hours[6]
- Robotic surgery cases[6]
- Diabetes[1]
- Low ASA status[1]

Incidence/Litigation

- One of the most common malpractice cases (4%)
- 2% of all malpractice claims
- Incidence of CAs 0.64% overall[6]
- CAs account for 35% of all ocular injury claims and awards for ocular injuries are 4% higher than any other claim[6]

Sources of CAs:

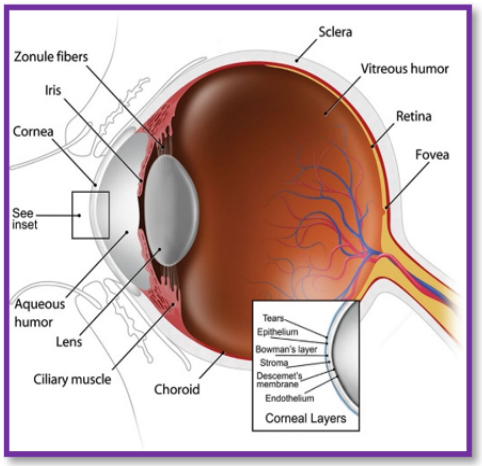
- Identification badges[1,4]
- Stethoscopes[1]
- Laryngoscopes[1,4]
- Oxygen facemasks[1,2,4]
- Pulse oximeter probe on dominant hand[1,2,4]
- Watch band[2,4]
- Surgical drapes[2,4]
- Bair hugger[2]

Pathophysiology

- Corneal abrasions are superficial injuries to the epithelial layer of the cornea that cause pain, photophobia, excessive tearing, headache, and blurry vision.
- They normally heal within 72 hours but cause patients extensive, unanticipated discomfort in addition to their post-operative pain[2,4]
- One fifth of these injuries occur from mechanical trauma such as scratching the eyes post-surgery or from objects such as oxygen masks, badges, and surgical drapes as well as chemical injuries from substances such as antiseptics[2]. Other factors that add to the risk of corneal abrasions are foreign bodies, contact lens, and dry eyes[2].
- During general anesthesia, contraction of the orbicularis oculi muscle is inhibited therefore putting patients at increased risk for corneal abrasions due to insufficient closing of the eyelid and subsequent drying of the cornea[2].
- General anesthesia also inhibits blink reflexes, tear production, and what is known as Bell's phenomenon.
    - Bell's phenomenon is the upward and outward movement of the globe when the eyes close. The cornea stays more exposed during a threat without this reflex intact, contributing to injury.

Assessment and Diagnosis

- Initial assessment and treatments can be completed by an anesthesiologist
- Abrupt onset of eye pain, blurry vision, photophobia, excessive tearing, foreign body sensation within 2 hours of procedure[2,4]
- R/o foreign body: evert eyelids to assess for any foreign body. If foreign body present irrigate with topical anesthetic[2,4]
- Assess visual acuity, EOMs, pupil reactivity[4]
- Definitive diagnosis: fluorescein staining reveals yellow green staining of basement membrane in presence of corneal abrasion[2,4]



Intraoperative Corneal Abrasion Prevention

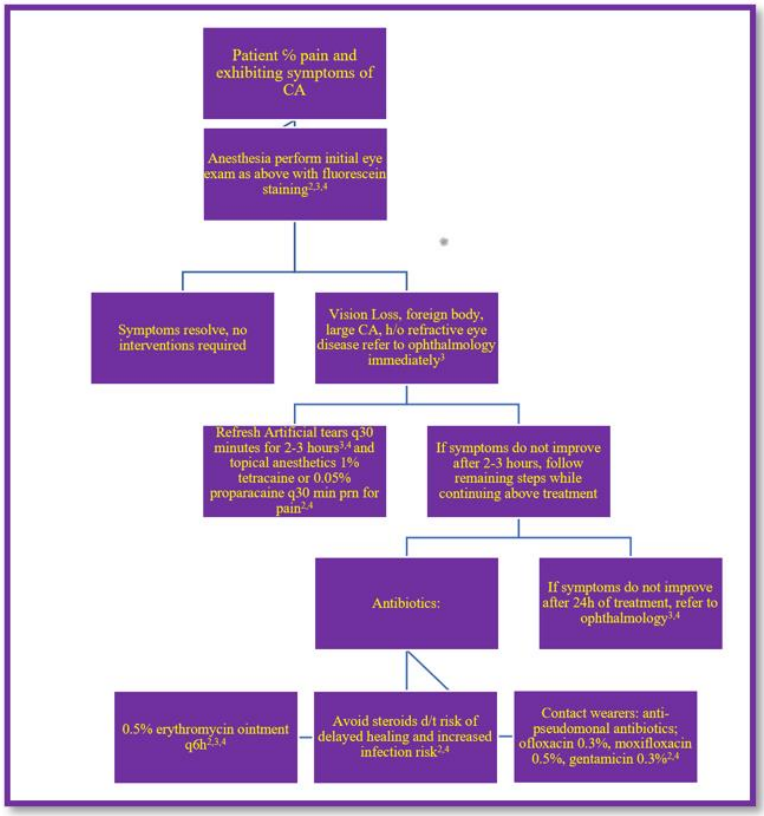
Maura McAuliffe PhD, CRNA, FAAN, Project Chair
Christopher Chukala BSN, RN, SRNA
Justin Grady BSN, RN, SRNA
Luke Matthews BSN, RN, SRNA
Savannah Samuel BSN, RN, SRNA

How do you tape your patients' eyes shut? Horizontal vs Vertical?

Interventions

- Secure eyelids with tape immediately after loss of lid reflex on induction and prior to securing the airway (Sundar)
  - The tape should be placed horizontally across the entire lid line. (Sundar, Grixti)
  - Use of Tegaderm to secure eyes in high risk cases[1,4] Tegaderm is water-tight and can prevent chemical injury with surgical prep solutions on the face[2]
- Use preservative-free 4% methylcellulose-based ointment to lubricate the eyes when taping is undesirable[1,4]
- Paraffin based lubricant can absorb highly soluble anesthetics like Halothane and cause irritation[1]
- Petroleum ointments are flammable - avoid with high FiO2 and electrocautery near the face[2]
- Remove tape from upper to lower lid to reduce risk of mechanical trauma[2]

Stepwise Treatment Protocol



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Appendix F

Emails to Participants

Initial Pre Survey and Video Email

Dear [redacted] Medical Center CRNAs,

Thank you for considering participation in my quality improvement project titled "Assessing the Adequacy of a Newly Developed Corneal Abrasion Prevention Guide in High-Risk Cases (Spinal Surgeries) at A Large Academic Medical Center." The purpose of this quality improvement project is to assess CRNAs' preferences and practices regarding eye care and corneal abrasion prevention and whether or not they perceive the corneal abrasion quick reference guide as a useful tool in your practice to prevent corneal abrasions.

Your participation is completely voluntary, but much appreciated, as it will serve to instruct my learning as I work to obtain skills in performing a quality improvement project. Your participation will involve completing a short pre intervention survey, viewing a brief PowerPoint presentation, and utilizing a corneal abrasion (CA) quick reference guide in your practice for two weeks. At the end of the two-week implementation period, you will be asked to complete a short post intervention survey regarding the use of the corneal abrasion quick reference guide.

Each survey and the PowerPoint presentation should take less than 10 minutes to complete. The questionnaires were created and are completed using Qualtrics® survey software. The corneal abrasion quick reference guide was developed based on a current review of the literature and falls within the currently accepted practice in your work area. Your participation is voluntary and responses will be kept confidential. The results of this QI study will be shared with you upon completion.

How to Participate

1. Complete the pre intervention survey: https://ecu.az1.qualtrics.com/jfe/form/SV_2fLh2H7KDggzXTM
2. View a short PowerPoint presentation attached to this email outlining the use of the corneal abrasion quick reference guide
3. Utilize the corneal abrasion quick reference guide attached to this email in your practice for two weeks.

Again, thank you for your participation in this quality improvement project. I will be present at the Vidant Medical Center during the two-week period but you may also reach out to me or Dr. Maura McAuliffe by email if you have any questions.

Sincerely,

Savannah Samuel, SRNA
ECU Nurse Anesthesia Program
Class of 2023

Samuels20@students.ecu.edu

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair
mcauliffem@ecu.edu

Pre Survey and PowerPoint Presentation Reminder Email

Hello [redacted] Medical Center CRNAs,

I just wanted to send out a quick reminder about the ongoing DNP Project on corneal abrasion prevention. If you have already filled out the pre intervention survey and viewed the PowerPoint presentation, thank you! If you haven't had a chance yet, it's not too late to participate and would be very helpful and much appreciated. You can still access the pre intervention survey through the link below and PowerPoint presentation and the corneal abrasion quick reference guide attached to this email. After the end of the next week, I will begin sending out the post intervention surveys.

Link:
https://ecu.az1.qualtrics.com/jfe/form/SV_2fLh2H7KDggzXTM

Please let me know if you have any questions and thank you again for your participation.

Sincerely,

Savannah Samuel, SRNA
ECU Nurse Anesthesia Program
Class of 2023
Samuels20@students.ecu.edu

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair
mcauliffem@ecu.edu

Post Survey Email to Participants

Hello [redacted] Medical Center CRNAs,

Thank you to everyone who has already completed the pre intervention survey, viewed the PowerPoint presentation, and utilized the corneal abrasion quick reference guide for the last two weeks. It's now time to complete the brief post intervention survey.

If you have not filled out a pre intervention survey, I would really and truly appreciate your participation. You can still access and complete the pre intervention survey https://ecu.az1.qualtrics.com/jfe/form/SV_2fLh2H7KDggzXTM and view the PowerPoint presentation attached to this email. The corneal abrasion quick reference guide is also attached to this email for your reference.

If you have already completed the pre intervention survey, it would be great if you could also complete the post intervention survey below. The survey should take less than 5 minutes to complete.

Link:
https://ecu.az1.qualtrics.com/jfe/form/SV_0eK6MXI00zvVj02

If anyone has questions or issues with the links, please reach out to me via email. Again, thank you for your participation in this quality improvement project. You have helped me develop skills in performing a QI project in addition to developing effective skills as an anesthesia provider. I look forward to continuing to learn from you all!

Sincerely,

Savannah Samuel, SRNA
ECU Nurse Anesthesia Program
Class of 2023
Samuels20@students.ecu.edu

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair
mcauliffem@ecu.edu

Final Thank You Email to Participants

Dear [redacted] Medical Center CRNAs,

I just wanted to say thank you so much for your help in completing my DNP Project. I have collected all the data that I need to proceed with data analysis and will then be finished with my paper. Once it's complete you all will be able to read it if you would like. If you liked the corneal abrasion quick reference guide, and found it to be useful, you can continue to use it in your practice and feel free to share it with other anesthesia providers. You can find a copy attached to this email for your future use.

Thank you again! I look forward to continuing to learn from you all in the future.

Sincerely,

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mcauliffem@ecu.edu

Appendix G

Surveys

10 questions pre

1. Have you or do you know of a colleague that has personally been involved in the care of a patient who had a corneal abrasion?
    a. Yes
    b. No

2. If you or a colleague were involved in the care of a patient who had a corneal abrasion, what was the cause of the injury? Please select all that apply.
    a. Patient rubbing eyes upon emergence/recovery
    b. Tape or eye protection inadvertently removed during procedure
    c. Manual trauma from equipment such as stethoscope, ID badges, pulse ox probe, drapes, robotic surgical equipment
    d. Chemical trauma spilled into the eye such as surgical prep used in the facial area
    e. Other (comment)

3. What prevention measures do you implement for eye protection during a **standard induction** of general anesthesia (checklist)?
    a. None
    b. Eye goggles/shield
    c. Tegaderm
    d. Medipore tape
    e. Paper tape
    f. Lubricant (VMC uses "Systane" 3% mineral oil and 94% white petroleum)
    g. Tape/Tegaderm in combination with lubricant
    h. Other (comment)

4. What prevention measures do you implement for eye protection in patients and/or surgeries that you identify to be at **high risk** for corneal abrasions?
    a. None
    b. Eye goggles/shield
    c. Tegaderm
    d. Medipore tape
    e. Paper tape
    f. Eye lubricant (VMC uses "Systane" 3% mineral oil and 94% white petroleum)
    g. Tape/tegaderm in combination with lubricant
    h. Other (comment)

5. Please comment to indicate any additional prevention measures not listed above that you take to protect patients from corneal abrasion. Suggested examples: placing pulse oximeter probe on the non-dominant hand, removing stethoscope or identification badges from the immediate area prior to intubation, vigilance strategies to prevent patient from

rubbing the eyes during transport, additional foam padding around the patients eyes during high risk cases)
    a. None
    b. (Comment)

6. When do you tape the eyes during a **standard induction** of general anesthesia?
    a. Before securing the airway
    b. After securing the airway

7. What types of surgery, patient positioning, and patient demographic/co-morbid conditions would you consider as **high risk** for perioperative corneal abrasions? (open ended question with an answer box for surgery, position, and demographic/co-morbid conditions)

8. During general anesthesia, how often do you routinely assess the eyes for protection from corneal abrasions (all that apply)
    a. Never
    b. Every 15 minutes
    c. Every 30 minutes
    d. During position changes
    e. During emergence

9. Please rate your confidence in your ability to **identify patients at high risk** for corneal abrasions.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

10. Please rate your confidence in your ability to **take appropriate measures to prevent corneal abrasions**.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

11. Please rate your confidence in your ability to **assess, diagnose, and treat corneal abrasions**.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

10 questions post

1. During the past two weeks have you been involved in any surgical cases where a corneal abrasion occurred?
    a. Yes
    b. No

2. During the past two weeks, how many surgical cases did you identify as **high-risk** for corneal abrasions?
    a. 0
    b. 1-5
    c. 5-10
    d. 10-15
    e. > 15

3. How likely are you to utilize the handout in the future to implement additional eye protective strategies in your practice?
    a. Highly unlikely
    b. Unlikely
    c. Neutral
    d. Likely
    e. Highly likely

4. During the past two weeks, did you perceive the handout to be useful for your practice to prevent corneal abrasions? Please comment why if so.
    a. Yes (comment)
    b. No

5. After this intervention, have you made any changes to your practice to prevent corneal abrasions? Please comment what you may have changed.
    a. Yes (comment)
    b. No

6. Are there other eye protection strategies not listed on the reference handout that you would see as beneficial for others to know?
    a. Yes (comment)
    b. No

7. How strongly do you agree or disagree with the following statement: After viewing the video and using the handout for the past two weeks, my awareness for the potential of perioperative corneal abrasion has increased.
    a. Strongly disagree
    b. Disagree

c. Neutral
d. Agree
e. Strongly agree

8. In the future, if an Epic shortcut was created to allow for streamlined documentation of eye care strategies utilized during the case, would that be beneficial to you?
    a. Yes
    b. No

9. After having access to this reference handout, please rate your confidence in your ability to **identify patients at high risk** for corneal abrasions.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

10. After having access to this reference handout, please rate your confidence in your ability to **take appropriate measures to prevent corneal abrasions**.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

11. After having access to this reference handout, please rate your confidence in your ability to **assess, diagnose, and treat corneal abrasions**.
    a. Not confident
    b. Somewhat confident
    c. Neutral
    d. Confident
    e. Highly confident

12. Please comment on any potential barriers to the use of the reference handout and/or implementation of eye protection strategies at your facility. (Open ended)