Perioperative Corneal Abrasion: An Exploration of Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention

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Abstract

Corneal abrasions are the most common ophthalmic complication that occur during general anesthesia, resulting in 2-3% of anesthesia malpractice suits. However, no studies were found in current literature that addressed assessment of anesthesia providers' knowledge, preferences, and practices for prevention of corneal abrasions. This quality improvement (QI) project assessed seven Certified Registered Nurse Anesthetists' (CRNA) knowledge of, preferences for, and practice of corneal abrasion prevention, as well as their perceptions of the adequacy of a quick access reference guide as a useful tool for their practice. The CRNAs were asked to complete a pre-implementation survey, utilize an electronic and paper copy of a newly created quick access reference guide over a two-week period, and then complete a post-implementation survey. Analysis of the data reflected a positive improvement in CRNAs' confidence regarding corneal abrasion diagnosis, prevention, and treatment. Limitations of this study include a short time frame and small sample size. A larger sample size and extended duration of time for the study to take place would strengthen results and help identify best practice methods for corneal abrasion prevention.

Keywords: corneal abrasion, prevention, quick access reference guide, certified registered nurse anesthetist

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Section I. Introduction

Background

Intraoperative eye care is a crucial component of perioperative care provided to sedated and intubated surgical patients by anesthesia care providers This helps prevent the occurrence of undesirable ophthalmic issues. On the one extreme is postoperative vision loss (POVL), an overarching disorder that encompasses multiple categories including ischemic optic neuropathy (ION), central retinal artery thrombosis (CRAT), and cortical blindness (CB); and the less extreme and more frequent type of perioperative external ocular injury, consists of a corneal abrasion or scleral injury. POVL associated with the operative period is rare, although it does occasionally occur. The more frequent type of operative ocular injury is a corneal abrasion, which is also easily preventable. According to a study performed by Grixti et al. (2013), "corneal abrasion is the most common ophthalmologic complication that occurs during general anesthesia for non-ocular surgery" (p. 109).

A corneal abrasion is a mechanical injury affecting the cornea of the eye. Corneal abrasions are reported as very painful by patients and can even lead to vision loss, although according to Bittner and colleagues (2017), "while long-term complications of corneal abrasions are uncommon, the injury is unexpected, painful, and anxiety inducing for the patient which causes immediate discomfort and concern for the patient" (p. 1209). According to Ahmed et al. (2015), "corneal abrasions result from nonpenetrating defects to the epithelium of the cornea. Patients can present with a foreign body sensation, severe pain, and sensitivity to light (photophobia), acute enough to require time away from work" (p. 363). Malafa and associates (2016) reported that "treatment for a complication as such requires pain control, antimicrobial

prophylaxis, and close monitoring. Pain improves significantly after 24 hours and should be resolved by 48 hours" (p. 790e).

Pertinent risk factors of corneal abrasions for patients undergoing anesthesia include advanced age, general anesthesia, positioning, and the use of oxygen masks (Ahmed et. al, 2015). Prevention is the most effective way to decrease the incidence of corneal abrasions. The use of protective goggles, removing contact lenses, and not rubbing the eyes when irritated are measures patients can implement themselves, during non-surgical periods, to decrease corneal abrasions. Under anesthesia, taping the eye shut provides protection that is equivalent or superior to other interventions and has fewer side effects (Grixti et. al, 2013). Other preventions include the use of lubricants, bio-occlusive gauze or, in some severe cases, suturing of the eye.

Patients can experience corneal abrasions secondary to a variety of incidents that may occur while they are under anesthesia. Some of these include the certified registered nurse anesthetist (CRNA) assessing for a lash reflex once the patient is sedated, the CRNA's badge or stethoscope swiping the patient's eye when leaning over them, the surgical team placing instruments up at the head of the bed on top of the patient, or anesthetic masks and IV tubing rubbing across the patient's face. These are all preventable when the CRNA takes the proper precautions while providing care to the anesthetized patient.

While many corneal abrasions heal in 2 to 3 days without sequela, possible secondary complications include corneal ulcer, recurrent erosions, and traumatic iritis (Ahmed et al., 2015). Standard treatment of corneal abrasions consists of irrigating the eye initially, then instilling artificial tears, followed with antibiotic ointment. Pain can be treated with topical anesthetics or oral NSAIDs dependent upon severity of the injury. If the corneal abrasion is due to a foreign body, it must be removed. If it is not properly removed, long-term risks include repeated

mechanical damage to the cornea, chronic scarring, the presence of rust rings that can delay healing, and subsequent vision loss. Foreign objects can be removed by irrigating the cornea with normal saline or the use of a topical anesthetic in conjunction with a cotton swab (Malafa et al., 2016). The best approach to managing corneal abrasions, however, is to keep them from occurring in the first place.

Although corneal abrasions are easily preventable, they do still occur while patients are receiving anesthesia. The true incidence of corneal abrasions is unknown but estimated to be less than one percent of cases (Papp et al., 2019). While healing time may be short, corneal abrasions can be what patients will remember most about their postoperative procedure. There are multiple prevention methods anesthesia providers can offer, and it is up to the anesthesia provider to select from these to ensure the patient's safety and keep them free from corneal abrasions.

Organizational Needs Statement

Prevention of corneal abrasions during the perioperative period is an issue for anesthesia providers not only because of their responsibility for the safety of their patients but also due to the risk of litigation when negative outcomes occur. Focused searches of the websites of several major anesthesia groups, however, revealed no definitive guidelines for prevention of corneal abrasions. Although the American Association of Nurse Anesthesiology (AANA) has standards of care for the perioperative period, they include no specific standard for perioperative eye care. The American Society of Anesthesiologists (ASA) also offers no specific guidelines or standard of care for corneal abrasion prevention. The organization does include a section on patient safety, but it does not include preventative measures anesthesia providers can take to avoid corneal abrasions in their patients. Additionally, the project chair, who is familiar with anesthesia practice guidelines from years of practice as a CRNA, was unaware of specific guidelines

addressing perioperative eye care from either the AANA or the ASA (M. McAuliffe, personal communication, September 26, 2021).

Although there are no specific guidelines provided by the major anesthesia organizations, all anesthesia providers, are expected to provide safe care for the eyes of their patients. These preventative methods generally consist of taping the eyes after the patient is sedated and paralyzed but prior to intubation, with the type of tape and method of taping varying between providers. There are also goggles providers can place over the patient's eyes if there is concern for instruments being placed near their face and head. Lastly anesthesia providers can place lubricating jelly or ointment under the tape or goggles to prevent dry eyes that can result in a corneal abrasion during long surgical procedures.

The partnering organization in this project, a Level 1 trauma center located in North Carolina, performs a large quantity and variety of surgeries daily, many of which involve general anesthesia. At of the initiation of this project, the facility had no specific policy for anesthesia providers to follow regarding prevention of corneal abrasion during the perioperative period. This is important because it is up to the anesthesia provider to prevent the occurrence of corneal abrasions. With no specific hospital policy, the care the patient receives may vary by which provider is delivering care.

Problem Statement

Corneal abrasions are the most common optic injury that occurs during general anesthesia, and they account for approximately 2-3% of all anesthesia malpractice suits. Like most institutions, the partnering facility does not require a standardized approach to perioperative eye care.

Purpose Statement

The purpose of this quality improvement (QI) project was to assess CRNA knowledge, preferences, and practice for corneal abrasion prevention as well as their perception of adequacy of a quick reference guide as a useful tool for their practice as it pertains to eye protection.

Section II. Evidence

Description of Search Strategies

The purpose of this literature review was to examine current evidence and recommendations addressing intraoperative eye care. The PICOT question used to guide the 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 search of current literature was conducted using the databases PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) as well as the search engine Google Scholar. Boolean operators were used to combine keyword and concepts. The search strategy used to query PubMed was (*((intraoperative) OR (perioperative) OR (surgical period)) AND (corneal abrasion)*. This search strategy pulled in the MeSH terms corneal injuries, education, educational status, and teaching. Limits applied included publication in the most recent 5 years (2016-2021) and English language. CINAHL was searched using a combination of keywords and subject headings. 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 strategies and numbers 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.

Searches were used to identify literature focused on intraoperative eye injury prevention or therapy. Articles focused on injuries occurring before surgery were excluded. Through the search of PubMed, with limits applied, 104 articles were found matching these terms, with a total of four articles meeting established criterion. Through the search in CINAHL, with the limits

applied, 92 articles were found matching the search strategy, with a total of seven articles kept upon review of titles and abstracts. Through the search in Google Scholar, with limits applied, 20 pages of articles were examined with a total of seven articles kept for full-text review. After these articles were analyzed more carefully, five articles were assessed as pertinent and utilized to support this project. The articles were examined for their level of evidence per the Melnyk and Fineout-Overholt overview of levels of evidence (Melnyk & Fineout-Overholt, 2019). The levels of evidence in the chart were given numerical values starting with the highest level of evidence as one, moving downward to the lowest level a seven. The levels consist of systematic review (Level I), randomized controlled trial (Level II), nonrandomized controlled studies (Level III), controlled cohort studies (Level IV), uncontrolled cohort studies (Level V), case studies and case series, qualitative and descriptive studies, EBP implementation and QI projects (Level VI), and expert opinion (Level VII). Upon full-text review, one systematic review (Level I), one controlled cohort study (Level IV), one QI project (Level VI) and two expert opinion papers (Level VII) were identified as pertinent to this project. See Appendix C: Literature Matrix for a breakdown of the articles utilized to support and develop this QI project.

Selected Literature Synthesis

Risk Factors

Multiple authors have identified an increased incidence of corneal abrasion associated with the following risk factors: advanced age, patient positioning, long procedures, head and neck surgery, pre-existing ocular injury or dry eyes, and intraoperative hypotension (Carniciu et al, 2017; Gonzalez-Birr, 2020; Kaye et al, 2019; Malafa et al., 2016; Papp et al., 2019). Breaking down the categories of these risk factors, Malafa et al. (2016) classified long duration procedures to be between 60 and 90 minutes, whereas Papp et al. (2019) classified them as

procedures lasting longer than three and half hours. Other authors did not specify length of time, but Gonzalez-Birr (2020) synthesized the literature and found the length of procedure played more of a role than age in intraoperative corneal abrasions, based on retrospective review and analysis of over 60,000 records from 1988 to 1992.

The intraoperative patient positions identified to be associated with increased risk of corneal abrasion include lateral, prone, and Trendelenburg (without a degree of tilt mentioned) according to Malafa et al. (2013) and Kaye et al (2019). These two authors also included lagophthalmos as a risk factor. Lagophthalmos is the inability to fully close the eyelid due to lack of contraction from the orbicularis oris muscle. Contraction of the orbicularis oris muscle is diminished under general anesthesia, in part due to neuromuscular blockade and the use of volatile anesthetics which cause this phenomenon to occur. Carniciu et al. (2017) additionally included diabetes as a factor associated with increased risk of corneal abrasion.

Prevention

Similarities in prevention of corneal abrasions were noted across the literature. Multiple authors noted that there are no established standards of care for perioperative corneal abrasion prevention. Prevention methods of corneal abrasion that were noted in the literature include the taping of the eyes, lubricants versus eye ointments to moisten the eyes, and whether or not to use preservative free or paraffin ointments (Carniciu et al., 2017; Gonzalez-Birr, 2020; Kaye et al., 2019; Malafa et al., 2016; Papp et al., 2019). Additionally, Malafa et al. (2016) and Papp et al. (2019) both discussed how educating anesthesia providers regarding corneal abrasion prevention is an effective method as well. A review by Martin et al. (2009), included in the systematic review by Papp et al. (2019) assessed the incidence of corneal abrasions among surgical patients prior to and after a provider education and reminder program. The investigation, which included

data from over 100,000 cases, revealed that the rate of corneal abrasion occurrence was 1.51 per 1,000 prior to the interventions and dropped to 0.79 per 1,000 after the interventions. An additional study included in Papp et al. (2019)'s review (Vetter, 2012) suggested a problem-solving checklist including an ocular protection protocol be implemented in the education process. The protocol included gel, water-based eye lubricants, and an occlusive dressing. The occurrence of corneal abrasions decreased from 1.2 per 1000 to 0.09 per 1000 after the intervention was implemented.

Gonzalez-Birr (2020) examined multiple studies in their QI project. This literature review consisted of studies that covered controversial evidence that paraffin-based ointments and aqueous solutions as a prevention method share no significance in difference in the prevention of perioperative corneal abrasions. Paraffin-based ointments have been associated with blurred vision, allergic reactions, photophobia, and foreign body sensation (Gonzalez-Birr, 2020; Malafa et al., 2016). Malafa et al. (2016) also found that preservative free methylcellulose-based ointment is the preferred choice of topical lubricant in corneal abrasion prevention.

According to Carniciu et al. (2017), "all of these methods have historically received a level of support in the literature, but the anaesthesia community recommends no single practice as the standard of care. The lack of standardisation and documentation of perioperative eye protection methods precludes us from determining if inadequate eyelid closure exacerbate[s] tear film breakdown in anaesthetised patients who sustained CA [corneal abrasion]" (p. 251).

Treatment

The final area of similarities between the selected sources consisted of suggested treatment. The treatment of corneal abrasion varies somewhat, although all interventions appear interwoven. Malafa et al. (2016), Papp et al. (2019), Kaye et. al. (2019), and Gonzalez-Birr

(2020) all support the use of artificial tears and ophthalmic antibiotic eyedrops. Malafa et al. include ophthalmic non-steroidal anti-inflammatories (NSAIDs) for pain relief whereas Kaye et al. suggest the use of oral NSAIDs. Additionally, Malafa et al. and Kaye at al. recommend routine use of eye patches but suggest the use of eye patching should be based on the severity of the corneal abrasion.

For many years the treatment of corneal abrasion did not include topical analgesia or anesthesia, due to fear of increasing the wound healing timeframe. More recent studies have demonstrated use of topical analgesia/anesthesia does not hinder recovery time of corneal abrasions, and use of these therapies is now considered when needed, based upon the severity of injury. According to Malafa et al. (2016), "Previous treatment guidelines made effective analgesia challenging; however, updated recommendations, specifically regarding eye patching and topical anesthetic use, have improved pain control during this initial period of heightened sensitivity" (p. 794e). This review identified two randomized control trials, one containing 47 patients (Ting et al. 2009) and the other containing 116 patients (Waldman et al. 2014), comparing the use of topical anesthetics and placebos in corneal abrasion therapy. Both studies found topical anesthetics efficacious in decreasing pain, without increasing wound healing time. The concern with topical anesthetics lies with their adverse effects, which include the potential of corneal abrasions progressing to ulceration or a worsening infection.

Project Framework

The model for improvement applied in this pilot project used the plan-do-study-act (PDSA) cycle (Langley, 2009). A single PDSA cycle was applied by planning to test the change, carrying out the test, observing and learning from consequences, and lastly determining modifications to be made to further corneal abrasion prevention if there were a follow-up PDSA

cycle. The PDSA cycle makes implementing changes easier by performing all activities in a stepwise order to better analyze where adjustments can be made. Another benefit of the PDSA cycle, according to the Institute for Healthcare Improvement (IHI), includes accelerating improvement instead of replacing models that are already in place. The way in which this improvement is accelerated is by forming a team, setting an aim, establishing measures, selecting changes, testing changes, implementing changes, and lastly spreading changes (IHI, 2021).

Ethical Considerations and Protection of Human Subjects

The intervention investigated was designed to be equally applied and beneficial to all within the target population. The intervention was focused on assessing CRNAs' knowledge before and after having access to a quick access reference guide addressing prevention of corneal abrasion perioperatively. There was no more than usual potential for harm present under normal working conditions. Evidence-based information was provided to practicing CRNAs to support their current practice and they chose whether or not they wished to implement changes. All care information provided fell within accepted CRNA scope of practice and organizational standards. Some additional time or emotional distress from utilizing a new tool or new knowledge was possible.

The primary investigator completed the Collaborative Institutional Training Initiative (CITI) modules to prepare for the formal project approval process (www.citiprogram.org). An initial organizational approval process through the East Carolina University (ECU) College of Nursing and ECU Medical Center Institutional Review Board (UMCIRB) determined the project met classification criteria as a QI project and was therefore exempt from full IRB review. Approval was also granted via a process completed through the partnering organization in conjunction with the ECU UMCIRB. See Appendix D.

Section III. Project Design

Project Setting

The partnering organization, located in eastern North Carolina, is an outpatient surgical center with 10 operating rooms that support a high volume of elective outpatient procedures. It is located near, but separate from, a major medical facility. The large volume of procedures performed as well as existing relationships between the CRNA program and the organization helped facilitate this project. Barriers associated with this setting included the fast pace of the environment and not all procedures requiring anesthesia.

Project Population

The target population for this project included the CRNAs delivering care in this outpatient surgical center. There are seven CRNAs in the participating organization primarily working in the SurgiCenter. CRNAs at the main facility may be required to assist if the surgical center is short staffed or if the main entity is overstaffed. Facilitators of this project were familiarity of potential participants with the ECU CRNA program, willingness to participate, and interest in the project.

Project Team

The project team consisted of the primary Student Registered Nurse Anesthetist (SRNA), as the team lead, as well as three additional SRNAs as part of the team, the project chair, a clinical CRNA faculty member who assisted in recruiting participants, and the clinical site contact person who works there and signed the acknowledgement of data collection to be done in the department. The student group worked together to develop a quick reference guide as an educational intervention and to create pre- and post-surveys prepared through Qualtrics for collection of data during implementation of each individual's project. The primary SRNA used

the tool and pre- and post-survey questions to implement the project, which included developing and sharing the quick access reference guide, collection of data with survey questions, analyze of data using Microsoft Excel, and sharing of the results. The primary student worked with the clinical CRNA faculty member to distribute the information guide and pre-intervention survey. After the intervention period, the primary SRNA collected follow up data via the post-intervention survey and then analyzed the findings.

The project chair acted as a mentor to assist in developing a topic. The project chair also delivered valuable feedback during the development of the quick reference guide and survey questions. Revisions were made according to this feedback. The clinical CRNA faculty member, who had an ongoing relationship with the clinical site contact person, facilitated clinical placement of the primary SRNA within the facility and recruited participants, which made collecting data on the unit possible. The site contact person also signed the letter of acknowledgement that data would be collected on the unit. The two facilitated communication between the CRNAs and student conducting the project and helped deliver the quick reference guide and pre- and post-surveys to the proper study participants.

A course director helped to keep a timeline for the project and provided deadlines when appropriate. The course director also guided the direction for the research and literature review portion of the paper to ensure accuracy and efficacy of information included. The program director oversaw the entirety of the DNP project and ensured the opportunity to share findings to fulfill the requirement for the DNP degree.

Methods and Measurement

The purpose of this QI pilot project was to assess anesthesia providers' knowledge of perioperative corneal abrasion prevention and perceptions of adequacy of a newly developed

Perioperative Corneal Abrasion Prevention Guide. A quick-reference Perioperative Corneal Abrasion Prevention Guide (Appendix E) centered upon evidence-based research was developed. This intervention was provided to the participating CRNAs in both electronic and paper format (Appendix F) at the beginning of the project.

Initially an email was sent out with a Qualtrics pre-survey (See Appendix G) asking participants about their perceptions of the adequacy of their currently used perioperative corneal abrasion prevention techniques and preparedness for corneal abrasion prevention. The participants were asked to complete the survey with the initial email. A voice over PowerPoint presentation and the Corneal Abrasion Prevention guide were included in the original email for the CRNAs to reference and review as well. The first day the primary SRNA was at this location, a hard copy of the Corneal Abrasion Prevention Guide was handed to each of the participants and any questions were answered along with recognition of any feedback the CRNAs wanted to provide. After two weeks of utilization of the guide, a follow up Qualtrics survey (See Appendix G) was provided via email to assess participants' knowledge of perioperative corneal abrasions and perceptions of adequacy of the tool.

The *plan* phase of the PDSA included assessing the literature, synthesizing the literature, and forming a quick access reference guide based on the most current evidence available. Risk factors, pathophysiology, treatment, and prevention of corneal abrasions as well as a treatment algorithm were included on the guide. An algorithm, synthesized from this information, was included for treatment as a graphic on the guide as well.

For the *do* phase of the PDSA, an email containing the pre-survey, a voiceover PowerPoint discussing corneal abrasion, the Corneal Abrasion Prevention Guide, and a note of appreciation was sent to participating CRNAs by the primary student. The survey-included

ordinal, interval, ratio, and free response levels of measurement. The CRNAs were instructed to utilize and review the voice over PowerPoint and the Corneal Abrasion Prevention Guide for two weeks before completing the post-survey. The post-survey was sent out after the two week period of use of the PowerPoint and Corneal Abrasion Prevention Guide which was used to evaluate if there were any changes in the knowledge or perspectives of perioperative corneal abrasion prevention by the CRNAs after the two-week trial period.

The *study* phase began with gathering the information from the two Qualtrics surveys. The pre- and post-survey responses were then compared to determine if there was an increase or change in knowledge, perception, or practice related to perioperative corneal abrasion prevention by the participating CRNAs.

The *act* phase included applying findings to determine adjustments and modifications that could be made to further corneal abrasion prevention within the facility. Results were synthesized into a poster which was presented to the CRNA faculty and students, as well as participants if they chose to attend. Finally, the completed paper and accompanying poster were uploaded to the The Scholarship, ECU's digital repository for scholarly work.

Section IV. Results and Findings

Results

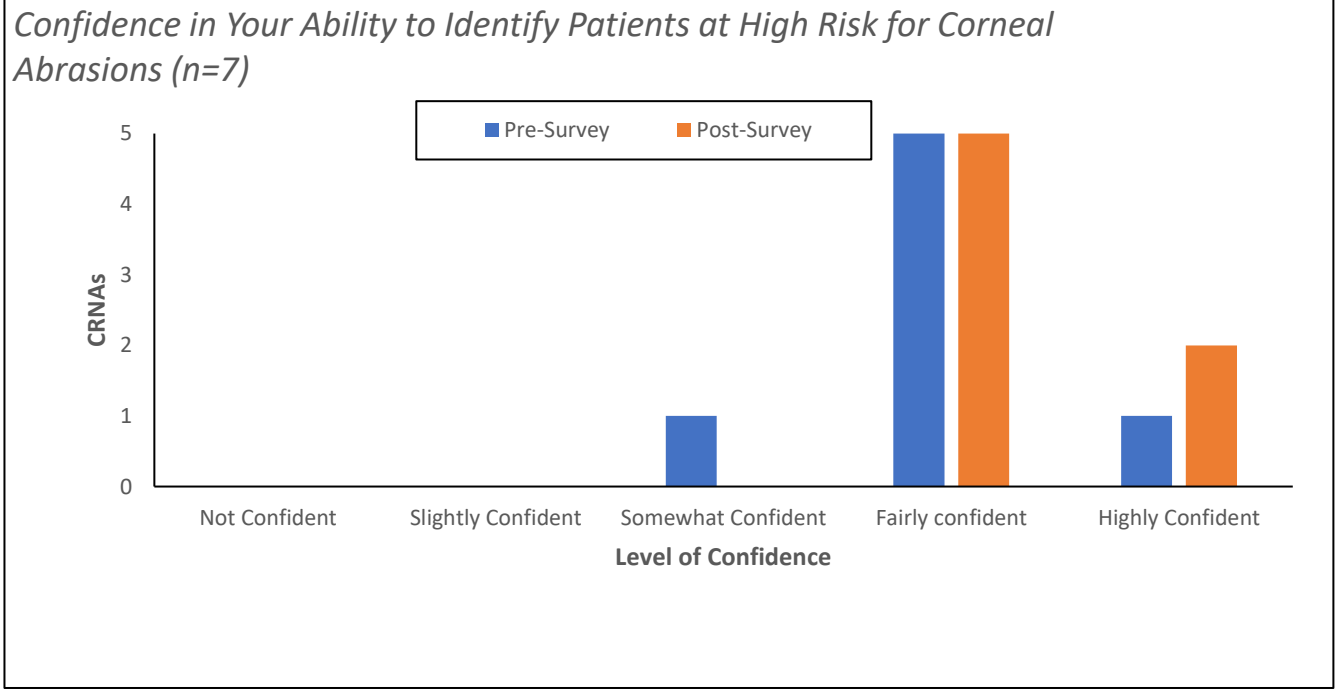
The purpose of this QI project was to assess CRNA knowledge, preferences, and practice for corneal abrasion prevention as well as their perceptions of adequacy of a quick reference guide as a useful tool for their practice as it pertains to eye protection. Pre- and post-data were collected through confidential Qualtrics survey links sent out to the participants at the beginning of the project implementation and two weeks after the participants received the quick access reference guide, both in print and electronically. Seven participants responded to the pre-survey in the first week after it was sent out to participants. After two weeks of implementation, a thank you email containing a link to the post-survey was sent. As only four participants responded in the first week post implementation, a two-week grace period was allowed for the remaining participants to complete the post-survey questionnaire. After the initial planned two-week response period had passed, one final remainder email was sent during an additional two-week grace period thanking participants and asking them to complete the post-survey questionnaire if they had not. During the project period, seven pre-survey and seven post-survey responses were collected.

The data collected involved CRNAs' perceptions about corneal abrasions. There were multiple questions in both the pre- and post-survey with quantifiable responses analyzed using Microsoft Excel. Receiving seven responses for both the pre- and post-survey made it easy to compare, using bar charts, changes in answers reported by the CRNAs before and after utilization of the quick access reference guide, which was shared as a physical handout as well as in electronic format.

Data Presentation

The responses collected from participants were helpful in determining the perceived efficacy of the quick access reference guide by the CRNAs. Of the questions provided in the pre- and post-survey questionnaire, several allowed for comparison by asking the same question before and after implementation. A question asking CRNAs to "please rate your confidence in your ability to identify patients at high risk for corneal abrasions" resulted in seven responses both pre- and post-survey. In pre-survey responses one participant reported that they were *somewhat confident* in their ability to identify patients at high risk for corneal abrasions, five were *fairly confident*, and one was *highly confident*. After implementation of the quick access reference guide, all CRNAs reported they were *fairly* or *highly confident* to this query, as seen in Figure 1, demonstrating an increase in CRNAs' confidence after the two-week period with the quick access reference guide.

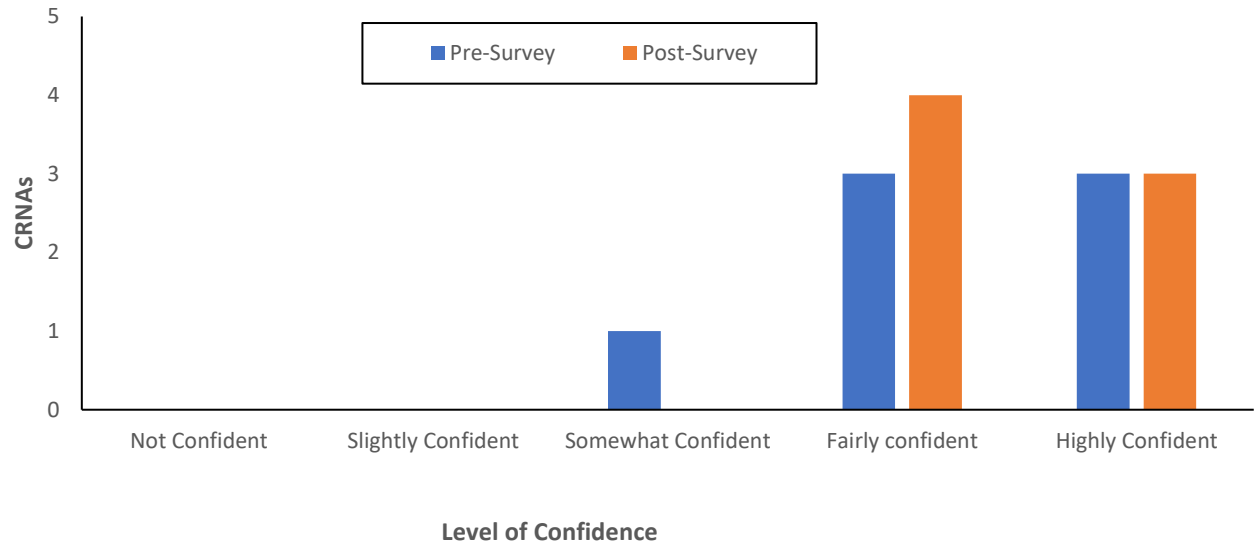
Figure 1



A second question addressed the CRNAs' confidence in "their ability to take appropriate measures to prevent corneal abrasions" both before and after implementation. The data displayed in Figure 2 demonstrates an increase in CRNAs' confidence in their ability to take appropriate measures to prevent corneal abrasions. As displayed in pre-survey responses, one participant reported that they were *somewhat confident*, three reported being *fairly confident*, and three reported *highly confident*. After the two-week implementation period there was a slight increase in the CRNAs' confidence as there was not much change between pre- and post-survey results.

Figure 2

Confidence in Ability to Take Appropriate Measures to Prevent Corneal Abrasions (n=7)

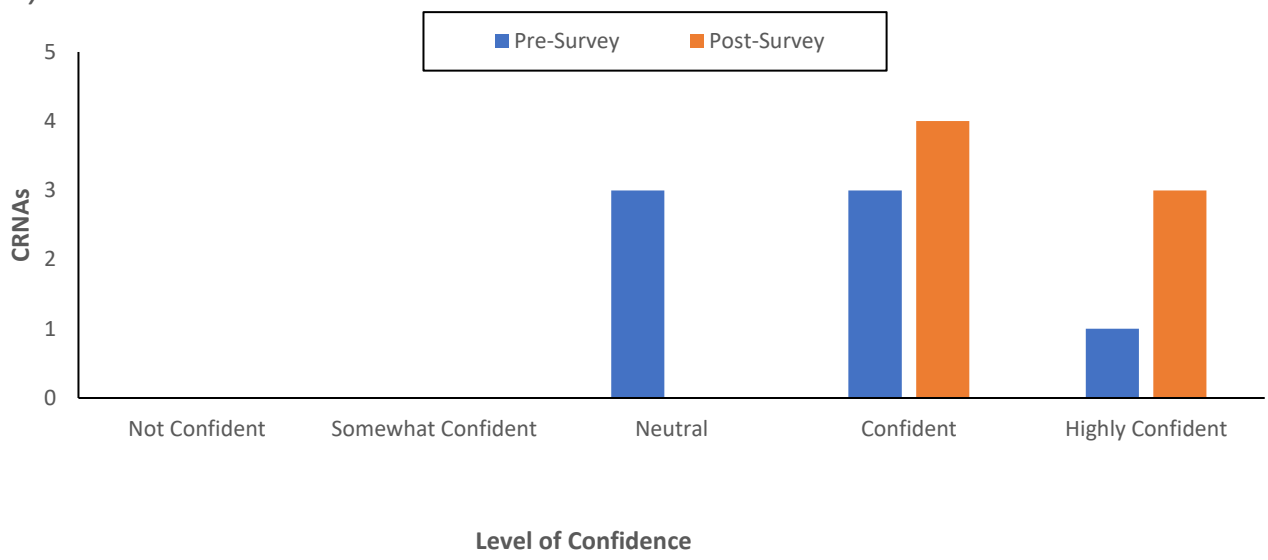


Additionally, a third question was utilized in both the pre- and post-intervention surveys that asked the CRNAs to "please rate your confidence in your ability to assess, diagnose, and treat corneal abrasions." In Figure 3, which is similar to the other figures, the data displays a positive increase in the CRNAs' confidence in their ability to assess, diagnose, and treat corneal abrasions. In pre-survey implementation responses, three participants reported being *neutral*,

three reported being *confident*, while only one reported being *highly confident*. Post-implementation responses demonstrate an encouraging increase in CRNAs' confidence to assess, diagnose, and treat corneal abrasions with all participants reporting either being *confident* or *highly confident*.

Figure 3

Confidence in Ability to Assess, Diagnose, and Treat Corneal Abrasions (n=7)



Other pre- and post-implementation survey questions utilized straightforward *yes* or *no* type formats. When asked "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" six of the participants responded *yes*, whereas only one responded *no*.

In a select all that apply question asking "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" there were five

responses of unknown etiology, with two reported the patient was *rubbing their eyes on emergence/recovery* and two reported *manual trauma from equipment*.

Prevention methods in the pre-survey questions were all rather similar with CRNAs reporting taking the same preventative approaches for both high risk and routine procedures. These prevention methods included *eye goggles/shield, Tegaderm, clear 1-inch tape, paper tape, eye lubricant,* or *any combination of the methods*.

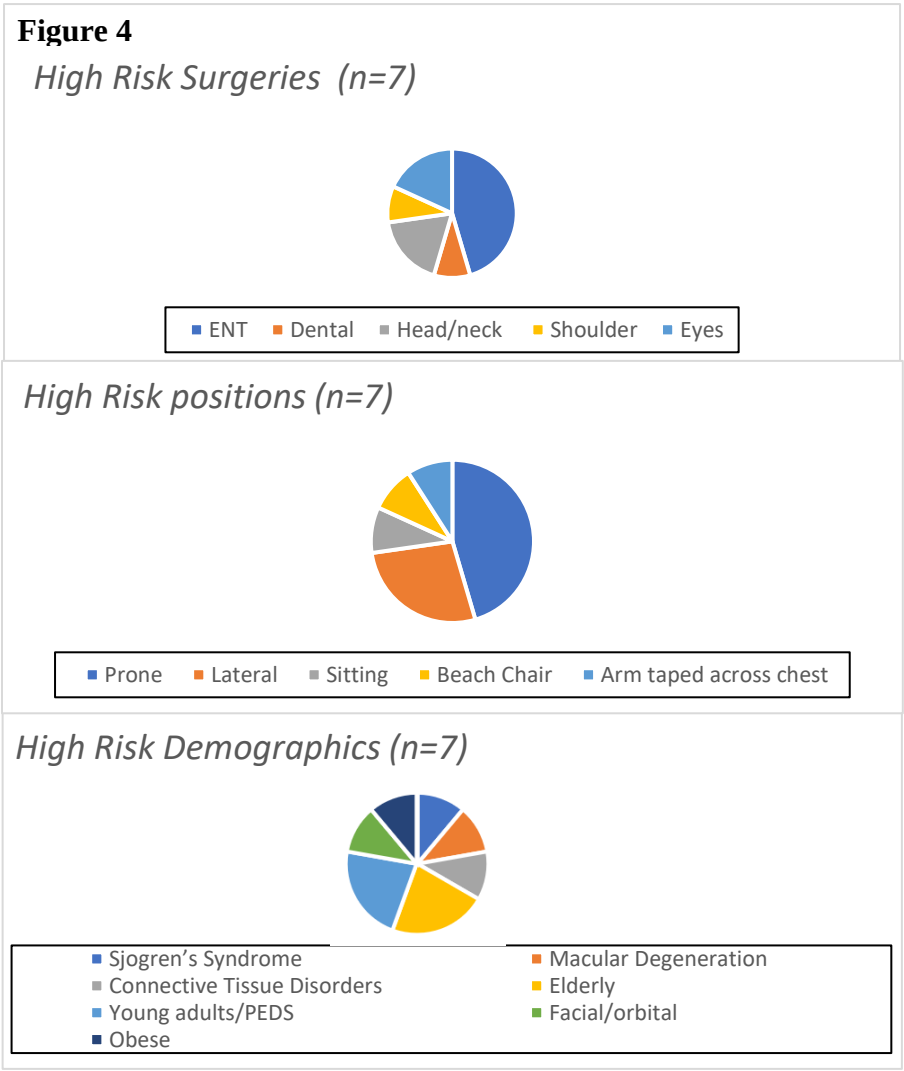
When answering the pre-implementation questions included "when do you routinely tape the eyes during a standard induction?" Six participants responded that they *tape the eyes before securing the airway*, and one reported *taping the eyes after securing the airway*.

When asked "During general anesthesia, how often do you routinely assess the eyes for protection from corneal abrasions" four participants responded with *during position changes* while two responded *every 15 minutes*. This item led to a question from participating CRNAs via email. The email exchange occurred between a participant explaining they routinely check the eyes *every 15 minutes*, *during position changes,* and *during emergence*¸ but there was no option to record more than one answer for this specific question. The email can be found in Appendix H.

When assessing the CRNAs' two-week timeframe between pre- and post-surveys, all seven expressed they had not been involved in any corneal abrasions during that time. The information varied as to how many cases each individual identified as high risk in the two-week timeframe. Four participants reported they *did not perceive the corneal abrasion quick access reference guide as useful for their practice* while two reported *yes, it was useful* and one reporting *yes, handy guide in the room.*

One of the most informative results came from an open-ended question asking" what types of surgery, patient positioning, and patient demographic/co-morbid conditions would you consider as high risk for perioperative corneal abrasions. To allow for comparison, the multiple responses from all participants are summarized visually in Figure 4.

Figure 4



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When asked how likely they were to utilize the corneal abrasion quick access reference guide, two reported *likely* while the five other responses ranged from *neutral* to *unlikely* to *highly unlikely*. When asked if any of the participants have made any changes after the two-week period, seven responded that they had *not made any changes*. Similarly, none provided additional eye protection strategies beyond those listed in the survey. Of note, five participants reported that it would *not be beneficial to them to have documentation shortcuts built into the organization's EPIC system* as the SurgiCenter still uses paper charts. There is already a section for documenting eye care on their current paper charting system.

Finally, no barriers to the use of the corneal abrasion quick reference guide and or implementation of eye protection strategies were reported.

Analysis

Analysis of the CRNA responses for the three comparative questions showed a positive trend in CRNAs' perceptions of their abilities after receiving the quick access reference guide.

The first question analyzed, "please rate your confidence in your ability to identify patients at high risk for corneal abrasions" showed a slight improvement in CRNAs' reported perceptions of their confidence, as seen in Figure 1, with one participant responding *somewhat confident* and most *fairly confident* pre-implementation but all responding either *fairly* or *highly confident* on the post-implementation survey.

The second question analyzed “please rate your confidence in your ability to take appropriate measures to prevent corneal abrasions” had a similar increase in perceptions of the CRNAs who participated. The data displayed in Figure 2 show a slight increase in CRNAs’ perceptions of confidence after the implementation and utilization phase of the quick access reference guide, with one participant replying *somewhat confident* on the pre-survey but all responding as *fairly* or *highly confident* on the post-survey.

The analysis of the question “please rate your confidence in your ability to assess, diagnose, and treat corneal abrasions,” displayed a positive effect from the quick access reference guide. As seen in Figure 3, in the pre-survey three participants gave a *neutral* response in their abilities to assess, diagnose, and treat corneal abrasions, while in the post-survey questionnaire, all respondents reported *confident* or *highly confident* in their abilities to assess, diagnose and treat corneal abrasions.

This data collected indicates the implemented quick access guide had a positive effect in current providers by enhancing their perception of their ability to assess, diagnose, and treat patients who experience corneal abrasions. The data collected for this QI project supports the use of current evidence-based practices that were brought together in one quick reference guide.

Section V. Implications

Financial and Nonfinancial Analysis

This QI project addressed a potentially preventable perioperative complication by increasing the knowledge and awareness of corneal abrasions by CRNAs providing intraoperative care. According to Fraser (2010) there are no studies addressing the economic issues of corneal abrasions nor their costs to a hospital system. This includes cost of medications for individuals who have experienced a corneal abrasion. If more focus was on preventing corneal abrasions and a focused epic shortcut was created to allow for extra documentation, CRNAs may concentrate more on prevention. This could further decrease hospital costs and potentially save the anesthesia department a substantial sum of money per year. Following the algorithm in the quick access reference guide, early treatment implemented by the anesthesia department within the first 24 hours could also decrease overall hospital costs by not requiring an ophthalmology consult and extending the treatment course for the patient.

A conversation with a CRNA about the potential for an Epic shortcut was mentioned earlier in one of the post-survey questions. In the brief conversation, an email exchange occurred between the CRNA and an information technology support team member inquiring about the possibility of adding a shortcut in the positioning section of the chart. The technology support member responded to the CRNA with a screenshot and the following “The actual build is super easy. Took less than 15 minutes for me to mock-up in the support environment. I just need to send this request to the Anesthesia governance for their approval since the regional facilities also the uses the same positioning macro. I will wait for your approval on this screenshot before I reach out to them!” The screenshot shared is included in Appendix I.

The benefit to the organization of future implementation of this QI project could be an increased CRNA awareness of corneal abrasion prevention and a decrease in overall costs for the hospital in treating corneal abrasions that occur intraoperatively. The increased knowledge and awareness of the anesthesia providers could improve patient satisfaction and boost patient surveys, furthering reimbursement for the hospital. The increase in awareness could decrease the level of discomfort the patient experiences from a corneal abrasion and decrease their length of hospital stay. Cost to the organization is related to the education and implementation of a corneal abrasion quick access reference guide being provided in all the rooms. If this QI project was implemented by the organization, the guide created for this project could be printed, laminated, and placed in each of the operating rooms for a reasonable cost, as the organization has printing and lamination capabilities.

Resources utilized in this QI project included the participants' time and the corneal abrasion quick access reference guide supplied by the primary student to the CRNAs. The time required for participants to read the supplied information and take the pre- and post-surveys could be considered a cost. Time required for applying the knowledge was minimal as the CRNAs already secure the eyes in some manner to prevent corneal abrasions in everyday practice.

Implications of Project

The pre- and post-survey questionnaire results demonstrated that CRNAs did not change their practice before and after implementation of the quick access reference guide. Per the responses obtained, although some of their perceptions in their level of confidence did increase, as stated in the results section, their practices did not change. Hopefully this project increased CRNAs' awareness of corneal abrasions, informed them of the frequency of occurrence, and

provided the most up to date way to prevent and treat one postoperatively, should it occur. Although the AANA and ASA do not include specific standards for perioperative eye care, this project, and others like it, may lead the way for standards to be promulgated in the future to enhance patient care experiences and satisfaction.

Implications for Patients

This QI project has the potential to improve patient outcomes by decreasing occurrence of corneal abrasions. Corneal abrasions can cause temporary pain and discomfort, and can lead to worse outcomes including, but not limited to, cortical blindness, postoperative vision loss, and ischemic optic neuropathy. Proper management and care can decrease these outcomes, which are associated with extended hospital stays and higher hospital costs. By improving eye protective measures taken in the perioperative period by CRNAs and other anesthesia providers, patient outcomes, safety, and satisfaction can be enhanced.

Implications for Nursing Practice

Implications of this project for nursing care may include providers wanting to make a difference and implementing a shortcut in EPIC charting. It is apparent from the information presented previously and in Appendix I, that one team member and a CRNA may already be putting this into effect. This can lead to providers being hypervigilant in the care of eyes and additional support for providers who may not have thought about this potential adverse outcome. Even CRNAs who are not usually open to change may find this information useful and may find the quick access reference guide beneficial.

Implications for Healthcare System

Implications for the healthcare system include decreasing costs incurred by the anesthesia department and hospital associated with perioperative corneal abrasions, and patient satisfaction

scores could increase, which could be associated with an overall increase in image for the healthcare system. Improving factors such as these can help lead to or support maintenance of hospital Magnet status, which is designated for hospitals who have shown a commitment to providing outstanding healthcare services.

Sustainability

As mentioned previously, it does appear that the technology support team could create the shortcut in the positioning section of the anesthesia record. Due to the minor time it took to mockup the sample, it would appear rather easy to create a short one-step key to remind CRNAs of the importance of preventing corneal abrasions. A limitation preventing this from occurring quickly might be the anesthesia governance team as mentioned in the email between the CRNA and support team member, as they would have to approve the change. The anesthesia providers would need to be open to this electronic shortcut and take the time to select the box for the interventions they implement.

Dissemination Plan

Dissemination of the results of this project included a poster presentation for other students and faculty members of the CRNA program as well as CRNAs who participated in the project, which was offered via both live and in virtual format. Additionally, this project paper and the project poster created to guide the presentation were placed in The Scholarship, East Carolina University's digital archive of scholarly work for public use.

The findings or structure of this project may be helpful for future students to use as a template for their own scholarly work.

Section VI. Conclusion

Limitations

Limitations of this project include the small sample size, the increased length of time it took some participants to respond to the post-survey questionnaire, and the overall short timeframe of the project. One limitation individualized to the project at the SurgiCenter was the paper charting, which included an area to circle interventions taken to provide safe and effective eye prevention. The sample size was limited to the core seven staff members at the SurgiCenter who work there daily. Although a reminder email was sent out for participants to complete the pre-survey at the end of the first week of implementation, daily reminders for those who did not complete the pre-survey right away may have increased participation. Production pressure at the SurgiCenter is another potential limitation of the facility. This could lead to altering providers' abilities to implement any new or different techniques for eye protection in the attempt to prevent corneal abrasions.

Recommendations for Future Implementation by Others

Recommendations for others in performing a project similar to corneal abrasion prevention would include investigating if the Epic shortcut was indeed implemented and then following up with CRNAs as to their perceptions of this shortcut and if they found it useful. The other imperative information would be if the CRNAs found this useful and learned any techniques or approaches they had not considered prior to checking the hotkey in the positioning section. Recognition and input from current anesthesia providers would allow for a more direct starting point in a focused and effective intervention in the future. If the shortcut was implemented, then building upon that shortcut may be their goal. If the shortcut was not implemented, then having it established may be their goal. A meeting with the entire participation group for a quick introductory phase would be helpful upon implementation of the

project instead of meeting one on one. This meeting could facilitate a more streamlined process of delivering any handouts, answering any questions, and putting a face to the student or team implementing this project.

Recommendations for Further Study

Further investigation of corneal abrasions and techniques implemented by the staff may help guide in the further reduction of corneal abrasions at this facility. With an already low number of corneal abrasions documented there, any corneal abrasion recognized or diagnosed could be evaluated for the root cause in an attempt to further education and hopefully stop the same error in the future. With the potential of an eye protection prevention charting shortcut in the works, if a shortcut is incorporated into the charting system one could study charts for patients who did experience corneal abrasions and identify what prevention interventions were taken, according to the chart, to determine if one or some interventions are better than others based on patient outcomes.

After implementation and data collection, conversations began between active members of the anesthesia team at the participating organization and the project team. This exchange escalated to a conversation with the information technology team which resulted in a new EPIC shortcut for documenting eye care intraoperatively. Two separate areas were added for the anesthesia provider to document when and how they protected the eyes during the procedure. The first area is in the positioning tab to indicate what type of protection was used; *clear tape, paper tape, Tegaderm, lubricant,* or *goggles.* The second section is in the airway note where the provider documents when the eyes were protected, either *before or after securing the airway* and with what type of protection device. Lastly, perceived acceptance and value of this QI project by members of the organization was demonstrated a second time when the Chief anesthesiologist of

the partnering organization asked for a copy of the quick access reference guide to use at their discretion, to either disperse to the anesthesia team or bring forward at a department meeting.

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Appendix A

Concept Chart

	Concept 1: Corneal Abrasion	**Concept 2: Perioperative**	**Concept 3: Education**
Keywords (these are the “normal” words you would use anywhere)	Corneal Abrasion Eye Injury Ocular injury Eye Injuries	Intraoperative Perioperative	Education Ocular Care Eye injury Education Nurse Anesthesia
PubMed MeSH (subject heading specific to PubMed)	"corneal injuries"[MeSH Terms]	No MeSH terms, intraoperative gave good results	"education"[MeSH “educational status"[MeSH Terms] “education"[MeSH Terms]“teaching” [MeSH]
CINAHL Subject Terms (Subject headings specific to CINAHL)	(MH “Eye injuries”)	No Subject Terms, intraoperative gave good results	(MH “Education, Nurse Anesthesia”)

Appendix B

Search Strategy

Search date	Database or search engine	Search strategy	Limits applied	Number of citations found/kept	Rationale for inclusion/exclusion of items
9/23	PubMed	((intraoperative) OR (perioperative) OR (surgical period)) AND (corneal abrasion)	5 years English	104 Found/4 Kept	Intraoperative focus. Eye injuries happening before surgery not applicable. Excluded results talking about surgery specifically on the eyes.
9/23	CINAHL	("eye injuries" OR "corneal abrasion" OR (MH "Eye Care") OR "eye care" OR (MH "Corneal Injuries") OR "corneal injury") AND ((MH "Intraoperative Care") OR "intraoperative" OR (MH "Perioperative Care") OR "perioperative" OR "surgery" OR "surgical complications" OR (MH "Intraoperative Complications") OR "surgical period")) AND ((MH "Anesthesia") OR "anesthesia" OR (MH "Education, Nurse Anesthesia") OR (MH "Intraoperative Complications") OR "anesthesia complications"))	5 years English Peer Reviews	92 Found/7 Kept	Intraoperative focus. Eye injuries happening before surgery not applicable. Excluded results talking about surgery specifically on the eyes.
9/23	Google Scholar	((intraoperative) AND (corneal abrasion)) AND (nurse anesthetist)	5 years	20pages /7 Kept	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	"The authors review the pathophysiology of perioperative corneal abrasion and propose updated evidence-based guidelines for improved patient care" (p. 790e). No framework or model noted.	Level VII (expert opinion)	Perioperative	Literature review	"Effective treatment requires (1) pain control, (2) infection prevention, and (3) daily symptom monitoring. Pain is greatest in the initial 24 hours after injury, when nerve fibers are exposed at the base of the wound. Previous treatment guidelines made effective analgesia challenging; however, updated recommendations, specifically regarding eye patching and topical anesthetic use, have improved pain control during this initial period of heightened sensitivity" (p. 794e).	"Understanding the pathophysiology of perioperative corneal abrasion is the first step in preventing this unfortunate complication. The surgical team should appreciate the surgery and patient-specific risk factors that predispose to ocular surface injury and apply appropriate preventative measures. When a perioperative abrasion occurs, discomfort and morbidity are minimized with appropriate treatment, symptom monitoring, and ophthalmologic referral when indicated" (p. 796e).
2017	Carniciu, A. L., Fazzari, M. J., Tabibian, P., Batta, P., Gentile, R. C., Grendell, J. H., Braithwaite, C. E., & Barzideh, N. (2017). Corneal abrasion following anaesthesia for non-ocular surgical procedures: A	"The aim of this study was to identify risk factors associated with perioperative corneal abrasion at a single hospital in Mineola,	Level IV (case-controlled study)	Single hospital in Mineola New York	37 patients with perioperative corneal abrasion, 101 control subjects who did not experience a	"A chart review was conducted of patients with perioperative corneal abrasion following non-ocular surgery and age-matched controls between June 2011 and November	"Thirty-seven perioperative CA cases following non-ocular surgery were identified over the 2.5-year study period. All thirty-seven cases had unilateral eye

	case-controlled study. *Journal of perioperative practice*, *27*(11), 247–253. https://doi.org/10.1177/175045891702701102	New York (United States)" (p. 247).			corneal abrasion under anesthesia.	2013. An age-stratified logistic regression model evaluated the association between corneal abrasion and potentially predisposing variables" (p. 247).	involvement. The incidence of corneal abrasion was 0.07% among the 54,622 total surgical cases performed during the study period. All patients with corneal abrasion were seen and diagnosed by the consulting board certified ophthalmologist within 24 hours of symptom onset and treatment was initiated immediately" (p. 249).
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 international literature evaluating the risk factors, preventative steps, and treatments for perioperative corneal injuries for nonocular surgery" (p. 297). No framework or model noted.	Level I (systematic review of mixed studies)	Perioperative	16 articles were evaluated for the quality and level of evidence presented	Multiple studies discussed preventative measures and treatments. Grover et al completed a randomized controlled trial in which different forms of ocular protection were randomly assigned to an eye protection group. Martin et al completed a trial with an educational intervention in which a web-based reporting tool and lecture series were given to anesthesia providers with rates of corneal abrasions tracked throughout the phases of intervention. Vetter et al also completed a trial with an educational intervention in which a problem-solving checklist	The studies evaluated identified various risk factors. Most studies, however, indicated that longer procedures, general anesthesia, and advanced age, were the most commonly associated risk factors to increased rates of corneal abrasions in nonocular surgeries. Research has indicated that fundamental changes occur in the protein content of the tear film layer after just 1 hour of general anesthesia, increasing the incidence of corneal abrasions. Research has also indicated that tear film lipid layer

						and a standardized ocular protection protocol were implemented. Anderson et al conducts a systematic review of various studies that look into different means of intraoperative ocular protection.	composition decreases with age, increasing breakup time and decreasing lipid layer stability. Both studies directly support the biggest risk factors identified in this systematic review, longer procedures under general anesthesia in patients of advanced age, validating the most commonly identified factors.
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 Comprehensive Review. *Current pain and headache reports*, *23*(7), 48. https://doi.org/10.1007/s11916-019-0784-y	"Total patient care is of extreme importance during the administration of anesthesia. Proper care of the eye is necessary during all anesthetic administrations, especially during the administration of general anesthesia or monitored anesthesia care. By paying attention to details, the likelihood of an occurrence of eye injuries is reduced" (p. 1).	Level VII (expert opinion)	Perioperative	Literature Review	Reviewing the literature and implementing recommendations for prevention based off of the results and findings.	"Though perioperative eye injuries are rare during general anesthesia, they do account for 2–3% of claims against anesthesiologists. Ocular injuries may occur during general anesthesia even when tape has been utilized for eye closure. Corneal abrasions are the most common injuries that have been attributed to direct trauma to the eye, exposure keratopathy, or chemical injury. Using a hydrogel patch during general anesthesia is also associated with more frequent corneal injury than previously thought" (p. 1).

2020	Gonzalez-Birr, A. (2020). *Perioperative Corneal Abrasion: An Exploration of Educational Intervention Effectiveness and Impact on Prevention Practices.* (Order No. 27837882). [Doctoral Dissertation, Georgetown University.] ProQuest Dissertations Publishing, 2020. 27837882.	"The primary purpose of this study is to determine anesthesia providers' current level of understanding of perioperative corneal abrasion prevention practices. The secondary purpose is to determine what impact an educational in-service has on the anesthesia provider's understanding of perioperative corneal abrasion prevention practices" (p. 2). No framework or model noted.	Level VI (QI)	Two hospitals in close proximity to each other	Furthermore, only 40 anesthesia providers participated, and most of the participants were CRNAs.	"This study was conducted using a quantitative quasi-experimental pre-post interventional design" (p. 15).	"This study determined that anesthesia providers have a basic understanding of perioperative corneal abrasion prevention methods, however there is room for improvement as evidenced by the pre-test scores. The educational intervention used in this study did not have a significant association with improved understanding of perioperative corneal abrasion prevention understanding ($p = 0.171$) or a significant impact on anesthesia providers' prevention methods ($p = 0.213$-0.277) however post-test scores did improve from 76% to 82%" (p. 36).

Appendix D

Project Approval Documents

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 [redacted] CRG.Quality@[redacted] 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 [redacted] office.

Please contact the [redacted] CRG with any questions at 252-847-1177 or CRG.Quality@[redacted]

For more guidance about whether the activity meets the definition of Human Subjects Research see [redacted] or https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html#c1

Project Title: Perioperative Corneal Abrasion: An Exploration of Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention		
Funding Source: None		
Project Leader Name: [redacted]	☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ☒ R.N. ☐ Other(specify):	
Job Title: ECU SRNA/ECU CRNA Faculty	**Phone:** [redacted]	**Email:** [redacted]
	Primary Contact (If different from Project Leader): [redacted]	
	Phone: [redacted]	**Email:** [redacted]

Key Personnel/ Project Team members:

Name and Degree:	Department: (Affiliation if other than Vidant)	Email:
[redacted]		
[redacted]		

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 QI project is to assess CRNA knowledge, preferences, and practice for corneal abrasion prevention as well as their perception of adequacy of a quick reference guide as a useful tool for the practice as it pertains to eye protection.
   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 [redacted] 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 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]: [redacted]

   ☐ **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 [redacted] 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 [redacted] 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 [redacted] 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 [redacted] CRG at CRG.Quality@[redacted] and the following will be completed and returned to you for your records.

NHSR vs. HSR Determination:

☒ **Not Human Subject Research:** The [redacted] 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 VH 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:

VH Operational Mgr/Leader [redacted] Date: 3/3/22

VH CRG Reviewer: [redacted] Date: 3/14/22

UMCIRB Office Staff Reviewer: [redacted] Date: 3/15/2022

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, [redacted] 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 (i.e. [redacted] 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

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

[redacted]
Project Leader Signature

2/14/22
Date

College of Nursing Quality Improvement Project Verification Process

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 crg.quality@vidanthealth.com to obtain site support from Vidant Health.

Name of Project Leader:

[redacted]

Project Title:

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

Brief description of Project/Goals:

The purpose of this project is to assess CRNA's preferences for corneal abrasion prevention as well as their perception of adequacy of this quick reference guide as it pertains to eye protection.

Will the project involve testing an experimental drug, device (including medical software or assays), or biologic?

- ○ Yes
- ● No

Has the project received funding (e.g. federal, industry) to be conducted as a human subject research study?

- ○ Yes
- ● No

Is this a multi-site project (e.g. there is a coordinating or lead center, more than one site participating, and/or a study-wide protocol)?

- ○ Yes
- ● No

Is this a systematic investigation designed with the intent to contribute to generalizable knowledge (e.g. testing a hypothesis; randomization of subjects; comparison of case vs. control; observational research; comparative effectiveness research; or comparable criteria in alternative research paradigms)?

- ○ Yes
- ● No

Will the results of the project be published, presented or disseminated outside of the institution or program conducting it?

- ● Yes
- ○ No

Would the project occur regardless of whether individuals conducting it may benefit professionally from it?

- ● Yes
- ○ No

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. 11/10/2021

Appendix E

Quick Access 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:

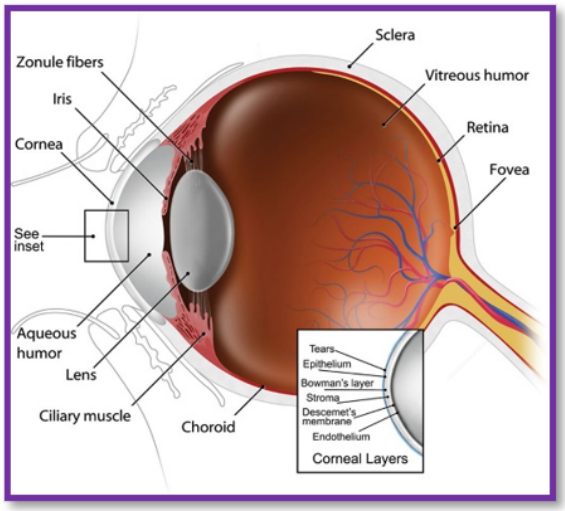
- Identification badges[1, 4]
- Stethoscopes[1]
- Laryngoscopes[1,4]
- Oxygen facemasks[1,2,4]
- Pulse oximeter probe on dominant hand[1,2,4]
- Watch band[2,4]
- Surgical drapes[2,4]
- Bair hugger[2]

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

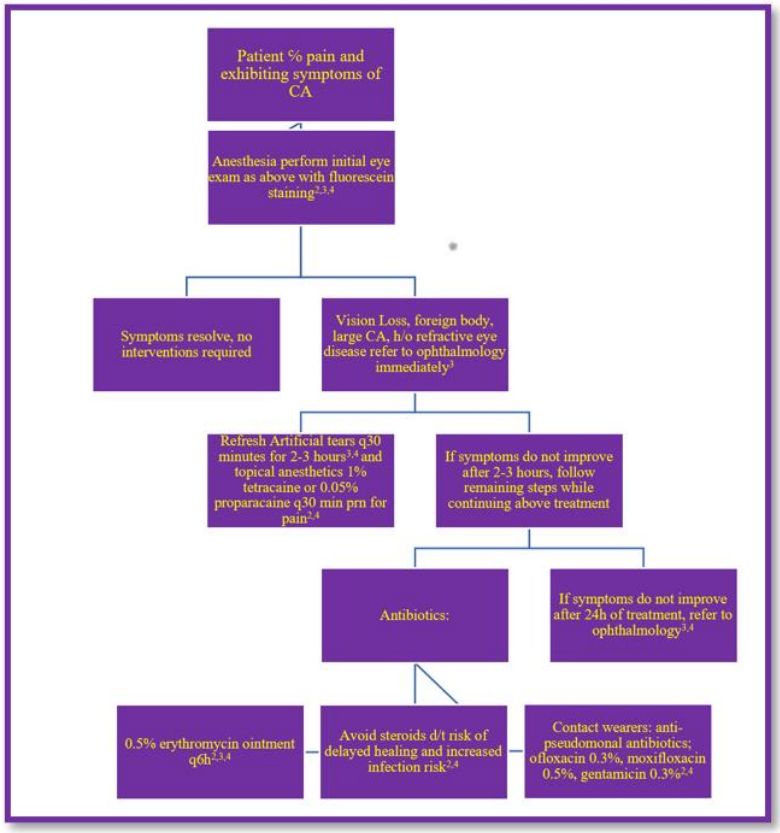
Maura McAuliffe PhD, CRNA, FAAN, Project Chair
Christopher Chukala BSN, RN, SRNA
Justin Grady BSN, RN, SRNA
Luke Matthews BSN, RN, SRNA
Savannah Samuel BSN, RN, SRNA

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 Link Email

Dear SurgiCenter CRNAs,

Thank you for considering participation in my quality improvement project titled "Perioperative Corneal Abrasion: An Exploration of Certified Registered Nurse Anesthetists' Preferences for Corneal Abrasion Prevention." 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_3C9lSHQ7NGDJI3A
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 [redacted] 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,

Christopher Chukala, SRNA

ECU Nurse Anesthesia Program

Class of 2023

chukalac19@students.ecu.edu

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

mcauliffem@ecu.edu

Pre-Survey and PowerPoint Presentation Reminder Email

Hello SurgiCenter 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_3C9lSHQ7NGDJI3A

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

Sincerely,

Christopher Chukala, SRNA

ECU Nurse Anesthesia Program

Class of 2023

chukalac19@students.ecu.edu

Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

mcauliffem@ecu.edu

Post-Survey Email to Participants

Dear SurgiCenter 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_3C9lSHQ7NGDJI3A 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_cVoT6jpnxSGEVQW

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,

Christopher Chukala, SRNA

ECU Nurse Anesthesia Program

Class of 2023

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Dr. Maura McAuliffe, PhD, CRNA, FAAN, Project Chair

mcauliffem@ecu.edu

Final Thank You Email to Participants

Dear SurgiCenter 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,

Christopher Chukala, SRNA

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Appendix G

Pre- and Post-Survey

Pre-Survey

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

Post-Survey

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)

Appendix H

Email from Participant

Email from a participant pertaining to the project and their preferences.

“I just wanted to note that on question 8 of your pre-assessment, there is no option to record more than one response, but there should be. For instance, I routinely assess eye q15 minutes AND during position changes AND at emergence.

Good luck with the project!”

Appendix I

Epic Changes