

## Perioperative Corneal Abrasions:

### Systems-based review and analysis

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### Case Presentation

A 64-year-old male underwent uncomplicated laparoscopic repair of a right inguinal hernia. While in the post-anesthesia care unit shortly after the procedure, he mentioned that his right eye was suddenly in severe pain, prompting an urgent ophthalmology consultation. During the consult, the patient reported no other symptoms aside from his severe right eye pain. An undilated bedside ocular examination was remarkable for a moderate sized, linear, horizontal corneal epithelial defect in the central cornea. The visual acuity was the same in both eyes, the anterior chamber was deep and quiet, and the pupil exam was unremarkable. The patient was diagnosed with a perioperative corneal abrasion, given a prescription for erythromycin ointment in that eye with instructions to use three times a day for five days, and instructed to follow up in the eye clinic in three to 5 days. His epithelial defect had completely healed without sequelae when he returned for follow up.

### Discussion

In review of our institution's recent ophthalmology consults, it was noted that there had been six consults during office hours for perioperative corneal abrasion within the past six months. While the incidence remained relatively low (0.05% of all anesthesia cases), this represented a significant increase compared with the previous six month period, when no such consults were made. Additionally, ophthalmology house staff reported receiving several identical consults after hours, though we were unable to quantify exactly how many. Given this increased incidence, the Department of Ophthalmology began a joint effort with the Department of Anesthesia with the two-fold goal of determining the root cause(s) of this problem and decreasing its incidence.

Two different case series published in the journal *Anesthesiology* report the incidence of perioperative corneal abrasion as 0.034% and 0.17%, respectively (Roth 1996, Cucchiara 1988). Risk factors, based on retrospective review, include lateral or prone intraoperative patient positioning, longer surgery, head and neck procedures, and surgery performed on Monday (Roth 1996, Cucchiara 1988, Moos 2006).

In our experience, two different types of perioperative abrasions predominate. The first type is the classic corneal abrasion; this occurs with mechanical trauma to the cornea, and results in abrasions of varying shapes and sizes depending on the nature of the insult. The second type occurs due to exposure of the cornea during or after surgery, and produces a horizontal fusiform or linear staining pattern in the interpalpebral area.

Various mechanisms have been posited which may contribute to perioperative corneal abrasions. Analgesia and anesthesia inherently mask the natural pain response, preventing the patient from sensing and reacting to the noxious stimulus of ongoing corneal exposure. Lagophthalmos (incomplete eyelid closure) has been reported to occur in over half of

patients under general anesthesia, increasing corneal exposure and surface drying (Batra 1977). This is exacerbated by the fact that general anesthetic agents also abolish Bell's phenomenon, further risking corneal exposure. Also, general anesthetics cause a significant decrease in tear production (Krupin 1977). In addition to exposure, the cornea may be traumatized by inadvertent pressure, or by chemicals such as the sterile prep. Finally, direct mechanical trauma may occur from myriad means, including the oxygen facemask, laryngoscope, sterile drape, nasal cannula, low-hanging identification badges, or patient attempts to rub the eyes with a pulse-oximetered finger. The exact mechanism of injury in these cases remains unknown more often than not (Gild 1992).

## Prevention

There are several reasons why the prevention of perioperative corneal abrasions is important. From a patient perspective, they are significantly painful injuries. It is our experience that patients with these injuries will frequently describe the pain of the abrasion as more severe than the pain from their operative site. They often recall the pain of the abrasion vividly as part of their immediate postoperative memory. Patients are often concerned they were mishandled in some way. Ophthalmologic evaluation may result in a delay in discharge, and most patients end up with the expense and inconvenience of an ophthalmology consultation, extra medication and a follow-up eye visit. Finally, there is a small risk of corneal ulcer or recurrent erosion.

The health care system also stands to benefit by reducing the incidence of perioperative corneal abrasions. Ophthalmology consults have an associated cost. At our facility, they also necessitate a provider leaving his or her other responsibilities and patients in order to perform the urgent consult. The topical medication and bandage contact lenses that are often dispensed also have a cost. In addition, from a medicolegal perspective, ocular injuries are reported to account for between three and 8% of anesthesia malpractice claims, with 35% stemming from perioperative corneal abrasions (Gild 1992, Jordan 2001).

An oft-employed preventative strategy involves the preoperative application of lubricating ointment to the eyes following induction of anesthesia. Interestingly, this practice has not been shown to decrease incidence of corneal abrasions, as documented by a large, prospective trial (Cucchiara 1988).

Current best-practice recommendations include a review of eye problems between the provider and patient prior to surgery, as well as removal of contact lenses pre-operatively. Eyes should be closed and securely taped immediately after induction of anesthesia. During long procedures, the eyes should be periodically checked to make sure that they are staying closed.

## Plan of Action

As stated above, the noted increase in incidence of perioperative abrasions at our facility led to a joint effort at reduction by the ophthalmology and anesthesia departments. The anesthesia department held a case conference, attended by all department members, devoted entirely to this issue. Each of the recent six cases was presented by the anesthesia provider who participated in the patient's care. An ophthalmology resident then presented a brief discussion on corneal abrasions, followed by perioperative-specific information

on incidence, mechanisms, prevention, treatment, and suggestions for improvement. The ensuing discussion led to several strategies for solving the problem:

- A detailed search of recent coding and billing statements will help determine exactly the current incidence of this injury.
- A formal incidence-tracking mechanism will be implemented, including previously-unmonitored off-hours perioperative abrasions. This will be regularly shared between departments; every six months, the Department of Ophthalmology consult service will send a list of the perioperative cornea abrasion consults to the Department of Anesthesia for review.
- Frequent intraoperative reassessments will be performed by anesthesia providers, to verify that the eyes remain both taped and closed.
- It was also recommended that this information be presented to the care team of the post-anesthesia care unit, as postoperative patients remain at risk for corneal abrasion due to lingering effects of anesthesia combined with increased mobility.
- After discussion within the Department of Ophthalmology, it was recommended that anesthesia providers tape the lids horizontally instead of vertically. The rationale behind this was that in a patient with a relatively prominent brow or malar eminence, a vertical piece of tape secured by these two points might not easily sit flush against the globe, leaving it more easily dislodged during surgery.

## References

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