Hydrogel dressing for eye protection during general anaesthesia: case series

During prolonged surgical procedures, poor eye closure may result in ocular complications which may go unnoticed. Eye protective measures are not standardised in every hospital and mostly include taping of the eyelids and/or instillation with topical ophthalmic preparations into the eyes, or both, during general anaesthesia. However, these methods are not always ideal because adhesive tape is designed primarily for fixation and, therefore, can be stiff and painful to remove, while ophthalmic ointments may trigger allergic reactions. Hydrogel dressings are an alternative to tape due to their intrinsic properties; they create a moist environment due to their high water content. They reduce the incidence of corneal abrasion without any reported side-effects. We describe three cases where a hydrogel dressing was used during long surgeries and demonstrate the clinical benefits of a hydrogel sheet for eyelid closure during anaesthesia.

Li Peng
Anaesthesiologist, Department of Anaesthesiology, Jing'an District Central Hospital of Shanghai, Fudan University Shanghai, China

Jiani Huang
Anaesthesiology Nurse, Department of Anaesthesiology, Jing'an District Central Hospital of Shanghai, Fudan University Shanghai, China

Ana Maria Jorge
Clinical Affairs Manager, PAUL HARTMANN AG, Germany

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The prolonged loss of consciousness due to anaesthesia or intensive care (e.g. in comatose patients) may result in eye damage, which may go unnoticed as patients cannot express their symptoms. These complications are largely due to attenuation or complete removal of normal eye protective mechanisms, such as tear production, eyelid closure and blunting of the corneal blink reflex (Grover et al, 1998; McKevitt et al, 2022).

Ocular injuries range from temporary/mild to permanent reduction of vision and can be broadly categorised as originating from either, damage to the front of the eye (corneal abrasion, infection or direct trauma), or those secondary to ischaemia (ischaemic optic neuropathy, central retinal artery occlusion or, rarely, central retinal vein occlusion) (Roth et al, 1996; French Society for Anaesthesia and Intensive Care et al, 2017; McKevitt et al, 2022). The most common eye injury associated with anaesthesia for non-ocular surgery is corneal abrasion (Roth et al, 1996; Papp et al, 2019).

Risk factors for perioperative eye complications include a long period of exposure to anaesthesia, older patient, lagophthalmos (or incomplete eye closure), proptosis (protrusion of the eyeball from the orbit), exophthalmos (protrusion of one or both eyes anteriorly out of the orbit), intraoperative hypotension, patient positioning, history of ocular disease and preoperative anaemia (Roth et al, 1996; Lichter et al, 2015).

Poor eye management, i.e. a lack of protection of the eyes to avoid unwanted side-effects, during long surgical procedures is related to the incidence of corneal injury reported in the literature, which ranges from 90% (Grover et al, 1998), 44% (Batra and Bali, 1977), to 0.64% (Papp et al, 2019).

Different studies have shown that eye protection reduces the incidence of corneal abrasion from 44% to 0.023– 0.13% (Batra and Bali, 1977; Grover et al, 1998; Yu et al, 2010; Segal et al, 2014).

Common clinical eye protection methods include application of an antibacterial ointment, application of saline solution or tape closure of the eyes. However, complications are often reported with these procedures: sensitivity to the preservatives contained in the ointments, contamination of preservative-free solution; tapes are uncomfortable to patients, viscosity can cause patients to feel blurred vision and foreign body sensation after waking up or even corneal injuries.

We challenged this issue with the use of a hydrogel dressing (Hydrosorb comfort, PAUL HARTMANN AG) in patients having procedures exceeding 2 hours while under general anaesthesia. Hydrosorb Comfort, marketed in Europe as HydroTac Transparent Comfort, is a transparent hydrogel dressing consisting of more than 60% water, with a water vapor permeable polyurethane film-backing that is impermeable to liquids and bacteria. Glycerol contributes to the moisture of the dressing. While the application of Hydrosorb on the eyelids during anaesthesia has been practised in China for several decades as off-label use, the positive outcomes encouraged the hydrogel use in preference to other applications (Kemei, 2012; Wan et al, 2014). This is largely unknown in other regions of the world (Brandt et al, 2021).

Cases presentation

The study adhered to the ethical principles outlined in the Declaration of Helsinki, and all participants provided written informed consent, confirming their understanding of the study's aims, potential risks, and anticipated benefits. According to local regulations, formal approval from an ethics committee was not required. All cases were obtained from Jing'an District Central Hospital in Shanghai, China.

Three patient cases are presented with individuals who underwent surgery under general anaesthesia for procedures lasting longer than 2 hours. In each case, incomplete eyelid closure was observed following induction of anaesthesia.

The first patient, a 58-year-old man, presented with headache, somnolence and drowsiness. Imaging confirmed a cerebellar meningioma. He subsequently underwent navigation assisted tumour resection.

The second patient, a 23-year-old man, presented with a compressive headache and reduced vision. Imaging confirmed a pituitary tumour, and he subsequently underwent pituitary tumour resection under general anaesthesia.

The third patient, a 33-year-old man, presented with joint pain, restricted mobility, swelling, and effusion. He was diagnosed with a knee ligament injury and subsequently underwent ligament repair surgery under general anaesthesia.

No significant medical history was reported for any of the three patients, aside from irregular dietary habits.

After inducing anaesthesia, each eye was immediately covered with Hydrosorb comfort 4.5cm x 6.5cm (PAUL HARTMANN AG) after the loss of ciliary reflex and before any other medical intervention **[Figure 1]**. The anaesthesiologist confirmed loss of consciousness, by patting the patient's shoulder or calling the patient's name loudly to check for a response. The comfort version of the Hydrosorb dressing has an adhesive border which allows the hydrogel to be secured to the skin without need of further fixation. Effectiveness of the occlusion was regularly checked; the dressing is transparent so it allows visual inspection of the correct occlusion of the eyes.

After surgery, and before the patient was awake, Hydrosorb was removed from upper to lower lid to ensure the eye remained closed and protected during removal.

On the day after surgery, patients were asked to report any ocular discomfort, including eye pain, dryness, foreign body sensation, blurred vision or photophobia. Postoperative diopter measurements were performed to assess any potential impact on visual acuity. No side-effects or ophthalmic complications were identified.

Discussion

Although ophthalmologic complications associated with prolonged general anaesthesia are well documented, standard practices for eye protection during surgery receive limited attention. The decision to use simple adhesive tape or ophthalmic lubricants and ointments is left to the clinical team.

Awareness of simple preventive measures is needed in the anaesthesiology community to create better standard procedures for this issue, which seems to be disregarded in the Western medical community (Brandt et al, 2021). In 2017, the French Society for Anaesthesia and Intensive Care developed recommendations for eye protection in anaesthesia and intensive care to prevent corneal and retinal injuries, including the use of protective tape (French Society for Anaesthesia and Intensive Care et al, 2017).

Several studies have compared different methods for eyelid closure and have investigated ointments, lubricants containing an aqueous methylcellulose solution or viscous gel, protective spectacles, insertion of hydrophilic contact lenses, suturing the eyelids together, dressings containing a hydrogel or bio-occlusive dressings (Ganidagli et al, 2007; Wan et al, 2014; French Society for Anaesthesia and Intensive Care et al, 2017).

Hydrogel dressings have been used widely in China for decades as a preferred method of eye protection during prolonged surgical procedures, with consistently positive

Figure 1

Figure 1. HydroSorb (PAUL HARTMANN AG) applied to the eyelids of a patient undergoing surgery under general anaesthesia.

outcomes. Studies have reported reduced postoperative ocular discomfort and fewer eye related complications when compared with traditional protective methods (Grover et al, 1998; Kemei, 2012; Kunlin and Lamei, 2013; Wan et al, 2014; Wu, 2016). The properties of hydrogels contribute to a good eye protection during exposure to anaesthesia. In particular, the high water content of Hydrosorb provides a balanced moist environment (Zoellner et al, 2007). This may contribute to reduce eye dryness and discomfort after surgery, as reported by the patients in this case. The transparency of the dressing allowed continuous visual confirmation of complete eyelid closure throughout the procedure. Its adhesive border ensured secure fixation without the need for additional taping, and removal was reported to be painless for patients and uncomplicated for healthcare staff. Low levels of discomfort during hydrogel dressing removal have also been previously documented (Bazire et at, 2015).

The important aspects of this work are summarised below:

- Eye protection during general anaesthesia should be considered in order to avoid post-surgical side-effects, such as corneal abrasion.
- Application of gel pads to the superior and temporal orbit should be considered to relieve direct pressure on the eye on patients laying on prone position (McKevitt et al, 2022).
- Hydrogel dressings are a well-suited alternative to traditional methods, providing moisture, enabling monitoring due to transparency, being easily removable, and avoiding eye injuries and postsurgical discomfort (Kemei, 2012).
- The high water content of the hydrogel promotes a balanced moist environment, important in avoiding eye dryness (Zoellner et al, 2007).
- Hydrogels ensure patient comfort and are simple to handle, apply and remove (Bazire et al, 2015).
- Hydrogels are adaptable due to flexible and soft materials.

Conclusion

These cases suggest that the use of hydrogel sheets, specifically Hydrosorb Comfort for eyelid protection during prolonged surgical procedures under general anaesthesia can prevent common postoperative ocular injuries. Hydrosorb has been available for many years and is, therefore, a well-established technology. Notably, no adverse effects or patient discomfort have been reported to date regarding the use of hydrogel dressings for intraoperative eye protection. ●

Ethics approval and consent to participate

Jing'an District Central Hospital of Shanghai does not require ethical approval for reporting individual cases or case series. Written informed consent was obtained from the patients for anonymised information to be published in this article.

Trial registration number/date

Jing'an District Central Hospital of Shanghai does not require case reports or series to be registered.

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to privacy or ethical restrictions.

Competing interests

Dr Ana Maria Jorge is an employee of PAUL HARTMANN AG, Germany. All other authors declare no conflict of interest.

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