·Clinical Research·

Corneal injury and its protection using hydro-gel patch during general anesthesia

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Received: 2014-02-26 Accepted: 2014-04-21

Abstract

• AIM: To evaluate corneal injury during general anesthesia and analyze the protective effect of medical hydro-gel eye patch in clinics.

• METHODS: Seventy-six patients with 152 eyes undergoing general anesthesia were included. None had positive corneal fluorescein staining before surgery. Both eyes of each patient were analyzed, with one randomly allocated to receive medical hydro-gel eye patch, and the other to receive common adhesive tape as a control. Corneal injuries were evaluated by scoring fluorescein staining under a hand-held slit lamp immediately after surgery in postanesthesia care unit and 24h thereafter. Patients´ discomforts were also evaluated.

• RESULTS: Twelve eyes (15.8%) in the hydro-gel patch group and 30 eyes (39.5%) in the adhesive tape group showed corneal injury immediately after surgery. The eyes protected with hydro-gel patch showed statistically less corneal fluorescein staining than the control group. Four eyes in hydro-gel patch group and 6 eyes in adhesive tape group suffered discomfort immediately after surgery without intergroup difference and all discomforts disappeared after 24h (P=0.257). No side effect was observed in hydro-gel patch group, while 5 eyes had brow avulsion and 2 got skin itching in adhesive tape group.

• CONCLUSION: Corneal injury complication was more frequent than we thought following general anesthesia. The medical hydro-gel eye patch can protect the occurrence of corneal injury following general anesthesia.

• KEYWORDS: general anesthesia; corneal injury; fluorescein staining; hand-held slit lamp; hydro-gel
DOI:10.3980/j.issn.2222-3959.2014.06.09

Wan T, Wang Y, Jin XM. Corneal injury and its protection using hydro-gel patch during general anesthesia. *Int J Ophthalmol* 2014;7(6):964-967

INTRODUCTION

Corneal abrasion is the most common ophthalmologic complication that occurs during general anesthesia for nonocular surgery [1-5]. Such abrasions can be caused by a variety of mechanisms and can lead to sight-threatening microbial keratitis and permanent scarring. There is no standard mode of protecting the cornea during general anesthesia for nonocular surgery. Methods described in the literature are not entirely effective and may be associated with unwanted side effects. It may occur as a result of loss of pain perception, decreased corneal reflexes, inadequate closure of the eyelids, or a decrease in basal tear production. It can range from irritating and temporary to permanent and life changing. Therefore, the value of corneal injury evaluation and prevention has been acknowledged repeatedly.

The incidence of perioperative corneal injury reported in the literature varies significantly depending on the design of the study, type of surgical population, method of assessment, and protection used[2, 4, 7]. Its prevalence ranges from as low as 0% with adequate protection up to 44% when no prophylactic measures were employed [3,4, 8-10]. With the development of hand-held slit lamp, much tinier injuries which were overlooked could be shown with fluorescein staining. However, its use for evaluating corneal injury during general anesthesia has not been analyzed. As direct trauma and tear film destruction are considered the main reasons for corneal injury, strategies currently used perioperatively involve taping the eyelids closed, with or without the instillation of

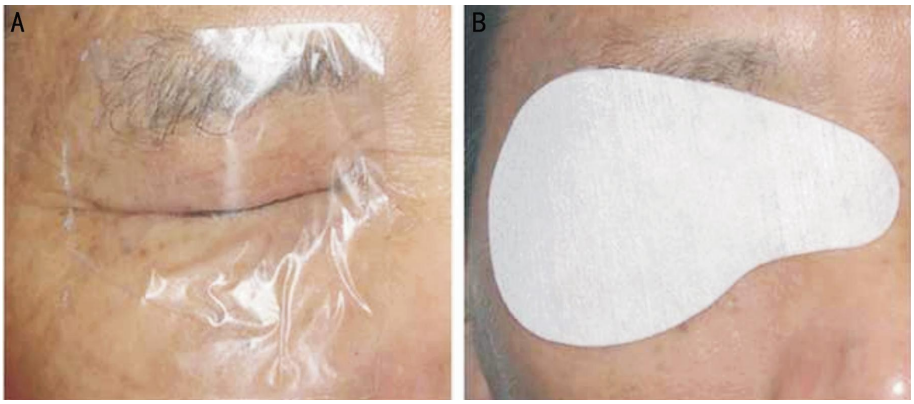

Figure 1 Placement of medical hydro-gel eye patch or adhesive tape over the closed lids following induction of anesthesia A: Placement of medical hydro-gel eye patch; B: Placement of adhesive tape.

protective ointment [9,11-13]. In fact, those strategies still show shortcomings, such as blurred vision and foreign body sensation. Ocular hydro-gel has been considered to improve patients comfort and decrease ocular inflammation as compared to conventional eye ointment, but its use should be combined with taping the eye close to prevent direct trauma[13]. Better strategies that are able to avoid both trauma and cornea drying are needed. Hydro-gel eye patch, which is rich in aqueous and construct an environment of high humidity, may prevent both cornea from trauma and drying when taped firmly onto the eyelids.

It was the objective of the present double-blind, prospective study to evaluate corneal injury by observing fluorescein staining under a hand-held slit lamp during general anesthesia, and to analyze the clinical effect of medical hydro-gel eye patch (Jujiu, Science & Biotechnology Co., Ltd, Hangzhou, China) on ensuring corneal safety and comfort in our anesthesia practice.

SUBJECTS AND METHODS

Subjects This study was performed according to the Declaration of Helsinki standards and was approved by the Research Ethics Committee. Written informed consent was obtained from all patients. Consecutive patients, 18 to 70 years old, of the American Society of Anesthesiologists (ASA) physical status 1-3 and who were scheduled for non-ophthalmic surgeries under general anesthesia with endotracheal tube intubation, were enrolled in this double blinded study. The anticipated duration of anesthesia was between 60 and 300min. Preoperatively, patients with severe systemic disease, positive corneal fluorescein staining, allergy to fluorescein or oxybuprocaine, as well as those unable to communicate properly with the investigators, were excluded. Both eyes of each patient were analyzed, with one randomly assigned by a computer generated list to receive medical hydro-gel eye patch, and the other to receive commonly used adhesive tape as control.

Methods A standard anesthesia protocol was followed and routine monitoring applied. Anesthesia and operation were administered with the patient in the supine position. Anesthesia was induced using intravenous etomidate (0.3 mg/kg) and midazolam (0.1 mg/kg), mixed with esmeron (0.6 mg/kg). Total intravenous anesthesia with remifentanil (10 μg/kg/h) and propofol (5 mg/kg/h) was used for maintenance of anesthesia. The anesthesia providers were instructed to tape the eyes shut as soon as the eyelid reflex disappeared. The hydro-gel patch or adhesive tape was applied from the bridge of the nose, across the upper lid, to the lateral canthus. Emphasis was placed on ensuring full closure of the eyelids (Figure 1). After surgery, those hydro-gel patches and adhesive tape were get rid of before examination by ophthalmologists. The temperature and humidity of the operating room were kept constant at 24℃ and 55%, respectively.

As is our practice, the following was recorded: demographic data, diagnosis, comorbidities, type of surgery and duration of anesthesia. The eyes were examined for corneal injury with fluorescein staining under hand-held slit lamp biomicroscopy before anesthesia, immediately after surgery and 24h thereafter. All of the examinations were finished by two ophthalmologists who were blinded to the group allocation. The tip of the strip impregnated with fluorescein was touched to the inner surface of the lower lid for 2s and, as the patient closed the eyes, dye spread well into the tear film. The denuded area of corneal epithelium was stained brilliant green, whereas the normal surface was left unaltered. When scoring, the whole cornea was divided into three parts and each part was scored (Figure 2) as: 0 (none), 1 (less than half), 2 (more than half), 3 (whole). All patients finished the questionnaire about eye discomfort, including pain, foreign body sensation, photophobia, tearing and eye dry. Those were

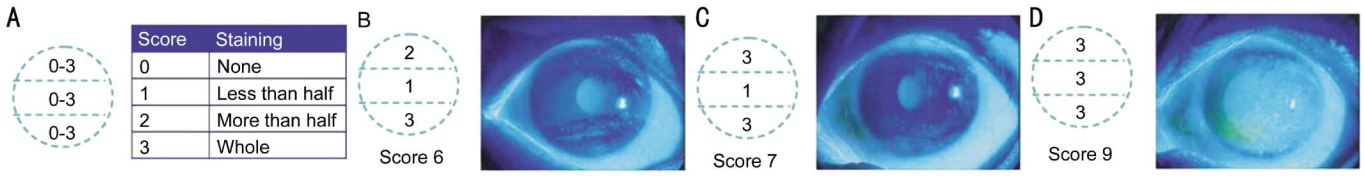

Figure 2 Corneal fluorescein staining scoring standard and examples A: Scoring method. Cornea was divided into three parts and staining score was defined as: 0 (none), 1 (less than half), 2 (more than half), 3 (whole); B: Example of score 6; C: Example of score 7; D: Example of score 9.

scored from 0 (absent) to 3 (severe); a global score, obtained adding the score of each symptom, was considered for the evaluation of ocular discomfort. Side effect of hydro-gel patch and adhesive tape, such as skin itching, allergy and edema were also evaluated.

Statistical Analysis Data were analysed using SPSS software (version 16; Chicago, IL, USA), and were presented as percentage (%) as appropriate. Corneal staining and ocular discomfort between groups were analysed using nonparametric two-related-samples tests. A value of $P< 0.05$ was considered statistically significant.

RESULTS

Seventy-six patients were enrolled in the study. Twelve eyes (15.8%) in the hydro-gel patch group and 30 eyes (39.5%) in the adhesive tape group showed ocular injury immediately after surgery (Figure 3). Statistical analysis showed that there was less ocular injury in the hydro-gel patch group than the adhesive tape group ($P<0.01$). All of the eyes with positive staining recovered spontaneously within 24h.

No patient complained of eye discomfort before anesthesia. Immediately after surgery, four eyes in hydro-gel patch group and 6 eyes in adhesive tape group had discomfort with score equal to 1 or 2. Statistical analyses showed no significant difference between two groups ($P=0.257$, Figure 4). All discomfort disappeared after 24h in both groups.

In addition, no side effect was observed in hydro-gel patch group, while 5 eyes got brow avulsion and 2 got skin itching in adhesive tape group.

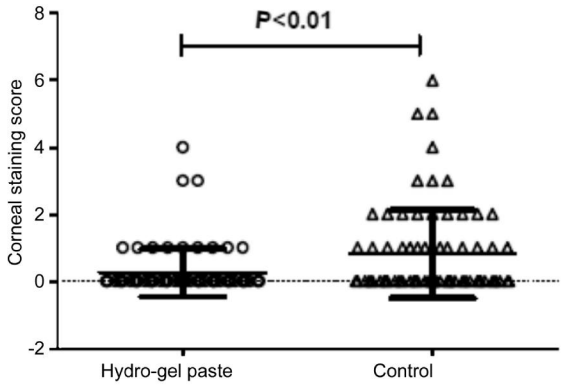

Figure 3 Corneal fluorescein staining scoring analysis Hydro-gel patch group showed much lower score as compared to adhesive tape group ($P<0.01$).

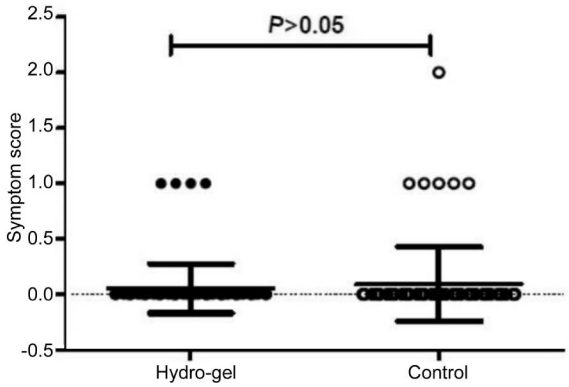

Figure 4 Eye discomfort analysis Four eyes in hydro-gel patch group and 6 eyes in adhesive tape group complained of discomfort after resuscitation with score equal to 1 or 2. No statistical difference was found between two groups ($P>0.05$).

DISCUSSION

Corneal injury has been mentioned as the most frequent ophthalmic complication following general anesthesia; therefore, a precise method for corneal injury detection is important. In a report in 1970s, no positive staining was detected in eyes which were naturally closed or covered with adhesive tape under direct light. With the development and employment of the slit lamp, eye examination has become much more convenient and delicate. As a result, tiny corneal injuries, which may be overlooked in direct light observation, should not be missed under a slit lamp. Actually, corneal injuries were detected in a few eyes in our present study under either hydro-gel patch or adhesive tape protection, with the incidence much higher than others [1, 3, 4, 12]. It is mainly because the different method for corneal injury assessment and design of study. On the other hand, hand-held slit lamp is more convenient and could be used immediately after surgery, which would provide instructions for the use of protective eyedrops or ointment after surgery to avoid eye discomfort and even permanent ocular sequelae. Therefore, the hand-held slit lamp is more delicate and represents a better way of evaluating corneal injury during general anesthesia.

Corneal injury during general aneasthesia happened due to several mechanisms, including mechanical injury [15,16], exposure keratopathy and tear film destruction [2, 18-20]. Thus, prophylactic strategies which could both prevent cornea exposure and maintain tear film should be emphasized. In the present study, we analysed the clinical effect of medical hydro-gel eye patch on preventing corneal injury. The hydro-gel eye patch is a pliant dressing consists of high polymer materials, including hydro-gel. Once in position, these polymer films maintain complete uniform lid closure and acts as a mechanical barrier to trauma, chemical injury, and infection. The high aqueous content of the hydro-gel patch constructed an environment of high humidity, which may prevent cornea from drying when taped firmly onto the eyelids. As a result, the eyes protected with hydro-gel patch had much less corneal injury as compared to adhesive tape. In addition, side effect such as skin itching, brow avulsion, blurred vision and foreign object sensation, which sometimes happen with adhesive tape or ointment, was not found in hydro-gel patch group[4,5].

In the present study, eye discomfort was questioned immediately after surgery. The incidents of discomfort may be missed because patients were not totally conscious, or they may overlook the eye discomfort because of the pain of wound.

In conclusion, more detailed perianesthesia corneal injury following general anesthesia can be detected with fluorescein staining under hand-held slit lamp. The medical hydro-gel eye patch can protect the eye better from the occurrence of corneal injury, and its use would be suggested.

ACKNOWLEDGMENTS

The authors thank Jujiu, Science & Biotechnology Co., Ltd, Hangzhou, China for providing hydro-gel patch.

Foundations: Supported by National Natural Science Foundation of China (No.81070705; 81270974); Zhejiang Provincial Natural Science Foundation of China (LQ13H120003); Zhejiang Key Laboratory Fund of China (No.2011233).

Conflicts of Interest: Wan T, None; **Wang Y,** None; **Jin XM,** None.

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