

Comparison of three types of eye care for preventing exposure keratopathy in the Intensive Care Unit

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Abstract

• **AIM:** To compare the efficacy of three types of eye care (artificial tear, moist chamber and polyethylene covers) for preventing exposure keratopathy in intensive care patients.

• **METHODS:** Intensive Care Unit (ICU) patients were randomly divided to three treatment groups, including artificial tear group (29 cases), moist chamber group (27 cases) and polyethylene covers group (28 cases). Patients in artificial tear group received two drops of carboxymethylcellulose dropped to each eye every 2 hours. The moist chamber and polyethylene covers groups were changed every 12 hours or as needed if they became unclean or torn. Corneal fluorescein stain was performed daily.

• **RESULTS:** No one in the polyethylene covers group and one case (4%) in the moist chamber group had exposure keratopathy compared to 8 cases (28%) in the artificial tear group. There were statistical significance differences between both artificial tear group and moist chamber group ($P = 0.02$), artificial tear group and polyethylene covers group ($P = 0.003$). Everyday time of eye care in the artificial tear group, the moist chamber group and the polyethylene covers group was respectively 26.69 ± 2.39 , 35.33 ± 2.63 and 7.48 ± 0.87 minutes. Everyday time of eye care in the polyethylene covers group was statistically more time-saving than that in the artificial tear group ($P < 0.01$) and the moist chamber group ($P < 0.01$).

• **CONCLUSION:** Polyethylene covers are more effective and time-saving in reducing the incidence of corneal damage in intensive care patients.

• **KEYWORDS:** exposure keratopathy; critical care

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INTRODUCTION

Medical and nursing staff in the Intensive Care Unit (ICU) concentrate the majority of their efforts on problems seen as immediately life-threatening. This may lead to lack of attention to other serious issues^[1]. These patients in ICU, due to impairment of protective eye mechanisms, are susceptible to corneal dehydration, abrasions, corneal perforation and infection. The reported incidence for exposure keratopathy ranges from 20% to 42%^[2-4], within a relatively short time, ranging from 2 and 7 days in ICU^[3,4].

Since moist chamber and lubrication are two of the most common methods for preventing exposure keratopathy, polyethylene covers is a new method applied to preventing exposure keratopathy. In order to evaluate the effectiveness in preventing exposure keratopathy, we compared the three methods; artificial tears (carboxymethylcellulose drops), traditional moist chamber and polyethylene covers.

MATERIALS AND METHODS

Patients were recruited from the ICU if they were aged over 18 years, mechanically ventilated and unconscious, as assessed by the bedside nurse. The frequency of eye opening was limited to less than five blinks per hour. Exclusion criteria were patients with a pre-existing eye condition. Eighty-four subjects were recruited for the study. After randomization, 29 patients were assigned to artificial tear group, 27 patients to moist chamber group and 28 patients to polyethylene covers group. The average age and mean study hours showed no statistically significant difference among the three groups (Table 1).

The ICU patients meeting the inclusion criteria were simply randomised to the three treatment groups, artificial tear group, moist chamber group and polyethylene covers group. All patients received a standard eye cleansing regime of washes to the external eye using 90g/L saline and sterile gauze before every treatment. Patients randomised to artificial tear group received two drops of carboxymethylcellulose dropped to each eye every 2 hours. Patients of moist chamber group had moist chamber sealed by adhesive tape to cover the eye. The patients of polyethylene covers group had pieces of polyethylene (3M Healthcare) cut to cover the eye from the eyebrow to the cheekbone. The moist chamber and the polyethylene were changed every 12 hours or as needed if they became unclean or torn.

Patients completed the study if they regained spontaneous eye opening, were discharged from the facility during study enrolment, died or developed a corneal ulcer or eye infection.

Table 1 Comparison of mean age, study length and time on eye care every day in three groups $\bar{x} \pm s$

	Artificial tear group	Moist chamber group	Polyethylene covers group	F-value	P-value
n(cases)	28	27	29	-	-
Age (years)	54. 48 ± 18. 16	55. 96 ± 16. 20	55. 21 ± 18. 79	0. 048	0. 953
Study length (hours)	143. 62 ± 103. 04	157. 89 ± 103. 93	153. 61 ± 94. 33	0. 022	0. 978
Time on eye care per day (minutes)	26. 69 ± 2. 39	35. 33 ± 2. 63	7. 48 ± 0. 87	1264. 17	<0. 01

The cornea was assessed by instillation of fluorescein and viewing with cobalt blue light using an indirect ophthalmoscope and 20 dioptre lens. The corneal fluorescein stains were performed daily on all patients enrolled in the study. Any patient found to have a compromised cornea was removed from the study and treated with prophylactic antibiotic ointment.

Statistical Analysis *One-way analysis of variance, Tukey's multiple comparison tests and Chi-square tests* were used to evaluate the differences by SPSS 10. 0 software. A P-value less than or equal to 0. 05 was considered statistically significant.

RESULTS

None of the 28 patients in the polyethylene covers group and one of the 27 patients (4%) in the moist chamber group had exposure keretopathy, compared to 8 of the 29 patients (28%) in the artificial tear group. There was statistical significance between both the artificial tear group and the moist chamber group ($\chi^2 = 5. 91, P = 0. 02$), and the artificial tear group and the polyethylene covers group ($\chi^2 = 8. 99, P = 0. 003$). However, there was no statistical significance between the moist chamber group and the polyethylene covers group ($\chi^2 = 1. 06, P = 0. 30$).

The time on eye care every day of the artificial tear group, the moist chamber group and the polyethylene covers group was 26. 69 ± 2. 39, 35. 33 ± 2. 63 and 7. 48 ± 0. 87 minutes, respectively. There was statistical significance among three groups ($F = 1264. 17, P < 0. 01$, Table 1). The eye care of the polyethylene covers group were statistically more time-saving than that of the artificial tear group ($P < 0. 01$) and the moist chamber group ($P < 0. 01$).

DISCUSSION

The cornea is an avascular layer of stratified, non-keratinised, non-secretory epithelium. It relies on a tear film to maintain adequate corneal wetting. Tears lubricate the ocular surface, providing oxygen to the cornea and washing away noxious stimuli and potential pathogens. The epithelia of ocular surface produces mucins that hold tears onto the eyes. In addition, tears have bactericidal properties; proteins contained in tears, including lysozyme, lactoferrin, tear lipocalin, and secretory IgA help prevent infection^[5,6]. Eyelid closure and blinking contribute to replenishing and spreading the tear film across the cornea and preventing tear film evaporation and keratopathy^[7].

ICU patients are often paralysed and sedated leading to incomplete eyelid closure and unable blinking. Critical illness is frequently associated with capillary leak and fluid retention

that causes peripheral oedema and conjunctival oedema and then may lead to inadequate eyelid closure. Additionally, sedation may result in a loss of the blink reflex and a lack of random eye movements. In addition, medications, such as antihistamines, atropine, phenothiazines and tricyclic antidepressants, can decrease secretions of tear. These factors seriously impair corneal and conjunctival surface defenses. As a result, these patients are susceptible to exposure keratopathy^[4].

In ICU, a variety of approaches have been used to maintain the tear film and prevent exposure keratopathy, including: artificial tears or ointment, lubricating prophylactic antibiotics, moist chambers, adhesive tape, eye patches, temporary sutures, and so on. Artificial tear and moist chamber were most regularly used. However, artificial tear wasn't so effective to prevent exposure keratopathy. In our study, there were 8 of 28 patients had exposure keratopathy in the artificial tear group, compared that no patient had exposure keratopathy in the polyethylene covers group and only one patient had exposure keretopathy in the moist chamber group. We found that moist chamber and polyethylene covers could provide greater protection than artificial tear. Moreover, the eye care of the polyethylene covers group were statistically more time-saving than that of the artificial tear group ($P < 0. 01$) and the moist chamber group ($P < 0. 01$). The polyethylene covers was easier and more efficient to apply.

The polyethylene covering creates a moist chamber providing a barrier against tear-film evaporation and exposure to air currents. It may also keep the eye clean and closed by providing a physical barrier to organisms and preventing possible translocation of infections from sources such as the respiratory tract^[8]. Cortese *et al*^[9] reported a trend for more patients to have a closed resting eye position when treated with polyethylene. Moreover, its transparency may facilitate assessment by allowing more frequent observation and monitoring of the cornea.

Additional considerations for clinical practice include the ease of application and expense associated with the three techniques. In a busy ICU environment, two-hourly eye drop or time-consuming traditional moist chamber is not always achieved due to factors such as additional procedures or operations being performed. During these times, failure to perform eye care may increase the risk of ulceration. However, time-saving polyethylene is easier to be performed and more advantageous.

In conclusion, polyethylene covers is more effective, more time-saving and easier in reducing the incidence of corneal

damage in intensive care patients, and it is deserved to be popularized in ICU.

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重症监护室患者暴露性角膜炎防治方法的比较

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摘要

目的:比较分析三种眼部治疗方法(人工泪液、湿房和敷贴)对于重症监护患者发生暴露性角膜炎的有效性。

方法:将重症监护室(ICU)患者随机分为3组:人工泪液组、湿房组和敷贴组。人工泪液组患者每2h行2滴羧甲基纤维素钠眼药水点眼。湿房组和敷贴组患者每12h更换湿房和敷贴一次或污染及损坏时更换。每天进行角膜荧光素染色观察角膜状态。

结果:在敷贴组28例患者中,无暴露性角膜炎发生;湿房组27例患者中,1例(4%)患者发生暴露性角膜炎;而人工泪液组29例患者中,8例(28%)发生了暴露性角膜炎。暴露性角膜炎的发生率,人工泪液组与湿房组($P=0.02$)和敷贴组($P=0.003$)比较有显著性差异。每日眼部护理所需时间在人工泪液组、湿房组和敷贴组分别是 26.69 ± 2.39 , 35.33 ± 2.63 和 7.48 ± 0.87 min;与人工泪液组和湿房组相比较,敷贴组更省时。

结论:在重症监护患者暴露性角膜炎的防治上,敷贴方法更有效、更省时。

关键词:暴露性角膜炎;重症监护