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Contents

Thrice Monthly Volume 9 Number 5 February 16, 2021

MINIREVIEWS

- 999 Remote nursing training model combined with proceduralization in the intensive care unit dealing with patients with COVID-19

Wang H, Kang K, Gao Y, Yang B, Li J, Wang L, Bi Y, Yu KJ, Dai QQ, Zhao MY

ORIGINAL ARTICLE

Case Control Study

- 1005 Metabolic syndrome, ApoE genotype, and cognitive dysfunction in an elderly population: A single-center, case-control study

Wang JY, Zhang L, Liu J, Yang W, Ma LN

- 1016 Serum neuron-specific enolase: A promising biomarker of silicosis

Huang HB, Huang JL, Xu XT, Huang KB, Lin YJ, Lin JB, Zhuang XB

Retrospective Study

- 1026 Biochemical recurrence of pathological T2+ localized prostate cancer after robotic-assisted radical prostatectomy: A 10-year surveillance

Yang CH, Lin YS, Ou YC, Weng WC, Huang LH, Lu CH, Hsu CY, Tung MC

Observational Study

- 1037 Clinical characteristics of perineal endometriosis: A case series

Liang Y, Zhang D, Jiang L, Liu Y, Zhang J

- 1048 Safety of gastrointestinal endoscopy in patients with acute coronary syndrome and concomitant gastrointestinal bleeding

Elkafrawy AA, Ahmed M, Alomari M, Elkaryoni A, Kennedy KF, Clarkston WK, Campbell DR

SYSTEMATIC REVIEWS

- 1058 Clinical features of SARS-CoV-2-associated encephalitis and meningitis amid COVID-19 pandemic

Huo L, Xu KL, Wang H

CASE REPORT

- 1079 Neuropathy and chloracne induced by 3,5,6-trichloropyridin-2-ol sodium: Report of three cases

Ma Y, Cao X, Zhang L, Zhang JY, Qiao ZS, Feng WL

- 1087 Effect of rifampicin on anticoagulation of warfarin: A case report

Hu YN, Zhou BT, Yang HR, Peng QL, Gu XR, Sun SS

- 1096 Severe lumbar spinal stenosis combined with Guillain-Barré syndrome: A case report

Xu DF, Wu B, Wang JX, Yu J, Xie JX

- 1103** Treatment of pediatric intracranial dissecting aneurysm with clipping and angioplasty, and next-generation sequencing analysis: A case report and literature review
Sun N, Yang XY, Zhao Y, Zhang QJ, Ma X, Wei ZN, Li MQ
- 1111** Imaging characteristics of a rare case of monostotic fibrous dysplasia of the sacrum: A case report
Liu XX, Xin X, Yan YH, Ma XW
- 1119** Primary aldosteronism due to bilateral micronodular hyperplasia and concomitant subclinical Cushing's syndrome: A case report
Teragawa H, Oshita C, Orita Y, Hashimoto K, Nakayama H, Yamazaki Y, Sasano H
- 1127** Management of corneal ulceration with a moisture chamber due to temporary lagophthalmos in a brain injury patient: A case report
Yu XY, Xue LY, Zhou Y, Shen J, Yin L
- 1132** Bronchoscopy for diagnosis of COVID-19 with respiratory failure: A case report
Chen QY, He YS, Liu K, Cao J, Chen YX
- 1139** Pembrolizumab as a novel therapeutic option for patients with refractory thymic epithelial tumor: A case report
Wong-Chong J, Bernadach M, Ginzac A, Veyssière H, Durando X
- 1148** Successful bailout stenting strategy against rare spontaneous retrograde dissection of partially absorbed magnesium-based resorbable scaffold: A case report
Liao ZY, Liou JY, Lin SC, Hung HF, Chang CM, Chen LC, Chua SK, Lo HM, Hung CF
- 1156** Chronic myelomonocytic leukemia-associated pulmonary alveolar proteinosis: A case report and review of literature
Chen C, Huang XL, Gao DQ, Li YW, Qian SX
- 1168** Obturator nerve impingement caused by an osteophyte in the sacroiliac joint: A case report
Cai MD, Zhang HF, Fan YG, Su XJ, Xia L
- 1175** Venetoclax in combination with chidamide and dexamethasone in relapsed/refractory primary plasma cell leukemia without t(11;14): A case report
Yang Y, Fu LJ, Chen CM, Hu MW
- 1184** Heterochronic triple primary malignancies with Epstein-Barr virus infection and tumor protein 53 gene mutation: A case report and review of literature
Peng WX, Liu X, Wang QF, Zhou XY, Luo ZG, Hu XC
- 1196** Negative conversion of autoantibody profile in chronic hepatitis B: A case report
Zhang X, Xie QX, Zhao DM
- 1204** Dumbbell-shaped solitary fibrous tumor in the parapharyngeal space: A case report
Li YN, Li CL, Liu ZH
- 1210** Spontaneous small bowel perforation secondary to *Vibrio parahaemolyticus* infection: A case report
Chien SC, Chang CC, Chien SC

- 1215** Management protocol for Fournier's gangrene in sanitary regime caused by SARS-CoV-2 pandemic: A case report
Grabińska A, Michalczyk Ł, Banaczyk B, Syryło T, Ząbkowski T
- 1221** Infective bicuspid aortic valve endocarditis causing acute severe regurgitation and heart failure: A case report
Hou C, Wang WC, Chen H, Zhang YY, Wang WM
- 1228** Endoscopic repair of delayed stomach perforation caused by penetrating trauma: A case report
Yoon JH, Jun CH, Han JP, Yeom JW, Kang SK, Kook HY, Choi SK
- 1237** Bilateral musculocutaneous neuropathy: A case report
Jung JW, Park YC, Lee JY, Park JH, Jang SH

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Editorial Board Member of *World Journal of Clinical Cases*, Dr. Antonio Corvino is a PhD in the Motor Science and Wellness Department at University of Naples "Parthenope". In 2008, he obtained his MD degree from the School of Medicine, Second University of Naples. Then, he completed a residency in Radiology in 2014 at University Federico II of Naples. In 2015, he undertook post-graduate training at Catholic University of Rome, obtaining the 2nd level Master's degree in "Internal Ultrasound Diagnostic and Echo-Guided Therapies". In 2016-2018, he served on the directive board of Young Directive of Italian Society of Ultrasound in Medicine and Biology. His ongoing research interests involve ultrasound and ultrasound contrast media in abdominal and non-abdominal applications, etc. (L-Editor: Filipodia)

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WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

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Management of corneal ulceration with a moisture chamber due to temporary lagophthalmos in a brain injury patient: A case report

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Abstract

BACKGROUND

This study describes the use of a moisture chamber to treat corneal ulceration due to temporary lagophthalmos in a critically ill patient.

CASE SUMMARY

A 46-year-old woman was admitted to the intensive care unit after a car accident. She suffered multiple injuries that included brain injury and presented with moderately decreased consciousness and lagophthalmos in her right eye. Within 6 d, her consciousness improved considerably; at which time, exposure keratopathy occurred and worsened to corneal ulceration. Lubricating gel, antibiotic ointment, and bandage contact lens were all ineffective in preventing or treating the exposure keratopathy. Instead of tarsorrhaphy, a moisture chamber was applied which successfully controlled the corneal ulceration. The moisture chamber was discontinued when complete eyelid closure recovered a week later.

CONCLUSION

A moisture chamber may be an effective, noninvasive alternative to tarsorrhaphy for treating severe exposure keratopathy due to temporary lagophthalmos.

Key Words: Exposure keratopathy; Corneal ulceration; Moisture chamber; Lubrication; Bandage contact lens; Case report

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Core Tip: Moisture chambers, including moisture chamber spectacles, swimming goggles, and polyethylene covers that cover the area from the eyebrow to the cheek, act as barriers against tear evaporation and provide direct protection of the ocular surface. Here, we report a 46-year-old woman with lagophthalmos in her right eye treated with

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a moisture chamber, who suffered a brain injury after a car accident. Use of the moisture chamber successfully controlled the corneal ulceration.

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INTRODUCTION

Preventative protocols and treatment choices for exposure keratopathy in the intensive care unit (ICU) are not the same as those in the ophthalmic department. Except for those with pre-existing eye abnormalities or facial trauma, most critically ill patients who suffer from lagophthalmos are under heavy sedation or have impaired consciousness, and are therefore unable to report ophthalmologic complaints^[1]. ICU medical and nursing staff are naturally preoccupied with stabilizing vital signs and organ function. Therefore, it is essential for eye care measures to be effective, easy to apply, time saving, compatible with pupil examination, and acceptable to both staff and patients' family members. Compared with other interventions that solve life-threatening problems, there is much less evidence available to support the choice of an optimal eye-care modality to prevent or cure exposure keratopathy in critically ill patients.

CASE PRESENTATION

Chief complaints

A 46-year-old woman was admitted to the ICU after a car accident. She suffered multiple injuries, including right frontotemporal lobe and left temporal lobe contusion and laceration, right frontotemporal cranial bone fracture, bilateral orbital fractures, pulmonary contusion, and right tibiofibula fracture with displacement, which was treated with external fixation in the emergency department. The injuries caused rhabdomyolysis.

History of present illness

The patient was without significant medical history.

History of past illness

The patient was without significant medical history.

Personal and family history

The family history was unremarkable.

Physical examination

She was comatose with a Glasgow coma scale (GCS) score of 9, which measured eye response (1 point), verbal response (3 points), and motor response (5 points). Pupils were equally reactive. There was lagophthalmos (7 mm) in the right eye without Bell's phenomenon.

Laboratory examinations

The laboratory examinations were unremarkable.

Imaging examinations

The imaging examinations are described in the treatment section.

FINAL DIAGNOSIS

The patient was diagnosed with an exposed cornea in the right eye.

TREATMENT

Continuous infusion of intravenous sufentanil and dexmedetomidine were given to relieve agitation. Both eyes received daily cleansing with sterile water. A 2-cm strip of carbomer gel (Liposic; Dr. Gerhard Mann, Chem.-pharm. Fabrik GmbH, Berlin, Germany) was instilled in the right eye every 6 h.

On the 3rd ICU day, conjunctival congestion and mild chemosis occurred in the right eye. The carbomer gel was replaced with ofloxacin ointment. On day 5, the patient's level of consciousness improved to a GCS score of 12, which measured eye response (3 points), verbal response (3 points), and motor response (6 points). However, heavy chemosis with dellen formation and corneal opacity involving the inferior third of the cornea occurred in the right eye. It was then observed that in the ICU environment (temperature: 22.5-25.5°C, humidity: 50%-60%), a 2-cm strip of carbomer gel or ofloxacin ointment could maintain the patient's corneal wetting for approximately 1-1.5 h (Figure 1). A consulting ophthalmologist made a diagnosis of corneal ulceration and inserted a bandage contact lens (BCL; PureVision Extended Wear; Bausch and Lomb Inc., Rochester, NY, United States). Levofloxacin drops were placed in the right eye every 6 h. The patient regained consciousness the next day with a GCS score of 14, which measured eye response (4 points), verbal response (4 points), and motor response (6 points), but the contact lens dislodged. The conjunctiva prolapsed through the palpebral aperture, and corneal opacity involved the inferior 40% of the cornea. Visual acuity was hand motion. The consulting ophthalmologist suggested tarsorrhaphy, but we decided to apply a moisture chamber. The patient's family, who refused to cover her eye with plastic wrap (polyethylene cover), consented to apply swimming goggles. A drop of ofloxacin ointment was placed in the right eye every 6 h. The corneal ulcer was under control on day 7 (Figure 2).

OUTCOME AND FOLLOW-UP

Moisture chamber therapy was discontinued on day 13 when complete eyelid closure recovered. Visual acuity was counting fingers at 2 m. After discharge from the ICU, the patient continued using levofloxacin drops 4 times per day and ofloxacin ointment at night for 5 wk. When she was reevaluated 6 mo later, ocular findings were normal except for corneal nebula involving the inferior 40% of the right cornea. Uncorrected visual acuity was 20/25, and best corrected visual acuity was 20/20.

DISCUSSION

The results of a recent meta-analysis suggested that moisture chambers were more effective at corneal protection in critically ill patients than lubricating eye drops and similar in effectiveness to lubricating ointments^[2]. In the randomized controlled trials included in that meta-analysis, ointments were applied every 2-6 h. Accordingly, we chose lubricating gel to prevent and antibiotic ointment to treat exposure keratopathy, but neither was effective as applying these lubricants every 6 h could not prevent corneal dryness in this patient in our ICU environment. Aggressive hourly lubrication with gel or ointment may be able to prevent or cure exposure keratopathy. However, this significantly increases the workload of nursing staff, and may be omitted if there are other interventions with greater priority.

A randomized pilot trial suggested that BCLs and punctal plugs were more effective than ocular lubrication (lubricating drops 4 times daily plus ointment 3 times daily) in limiting exposure keratopathy in critically ill patients^[3]. The BCLs and the punctal plugs in this study were all inserted by an ophthalmologist. It can be difficult for ICU staff without specific training to insert or remove a BCL. If the lens dislodges, a thorough eye examination performed by an ophthalmologist may be needed to reliably rule out folded lens retention in the eye. These also increase staff workload. Extended-wear soft contact lenses carry a risk of infectious keratitis^[4,5]. It was noted that working in hospital environments increased microbiological contamination of

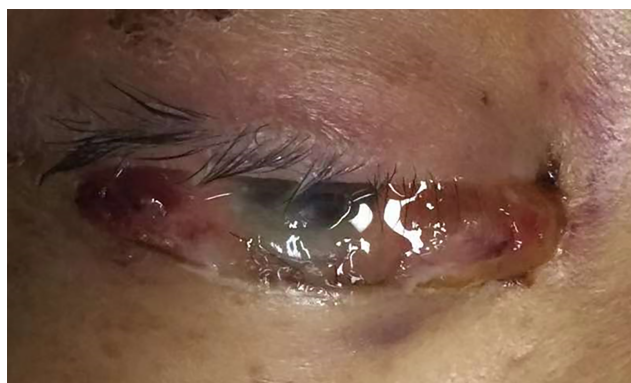


Figure 1 Appearance of the right eye after 5 days in the intensive care unit. There was heavy chemosis with dellen formation and corneal opacity involving the inferior third of the cornea. The center of the cornea became dry 2 h after instilling a 2-cm strip of ofloxacin ointment.

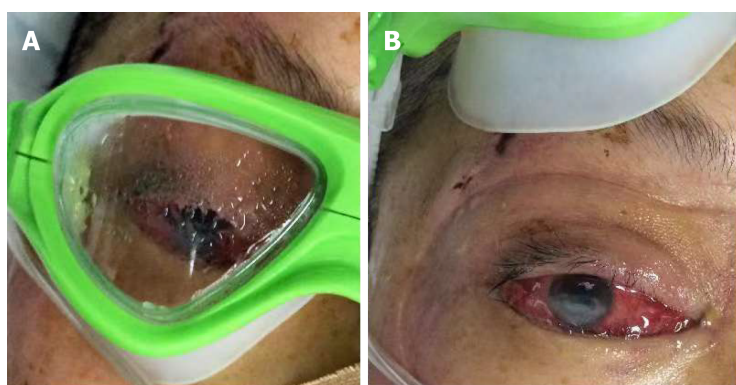


Figure 2 The patient wore swimming goggles to treat corneal ulceration. A: The moisture chamber increased periocular humidity; B: Chemosis and corneal opacity decreased after 7 days in the intensive care unit.

BCLs^[6]. Therefore, ICU patients wearing BCLs may have a higher risk of corneal infection. Punctal plug insertion helps to preserve aqueous and artificial tears on the ocular surface but does not prevent evaporation of tears or provide direct protection of the cornea. Spontaneous plug loss is a frequent complication, occurring in 40% of patients on average^[7], and it is difficult for ICU staff to detect whether the plug is *in situ*. For this patient, the active ocular infection contraindicated punctal plug placement.

Tarsorrhaphy, an invasive procedure, is suggested in extreme cases. It interferes with pupil examination and makes delivering eye treatment difficult. In addition, there is a risk of silent infections^[8]. Severe exposure keratopathy in this patient was an indication for tarsorrhaphy, but a noninvasive treatment was preferred. Choosing an appropriate treatment for exposure keratopathy depends not only on the severity of lagophthalmos but also on the potential for recovery. GCS score is one of the predictive factors for exposure keratopathy^[9]. As the patient's GCS score increased rapidly within a week, this indicated that eyelid closure would probably recover soon.

Moisture chambers (including moisture chamber spectacles, swimming goggles, and polyethylene covers that cover the area from the eyebrow to the cheek) act as barriers against tear evaporation and provide direct protection of the ocular surface. It was reported that moisture chambers increase the periocular humidity and tear-film lipid-layer thickness^[10,11], which may reduce lubricant use and thus be a time-saving measure.

CONCLUSION

This report describes the use of a moisture chamber to manage corneal ulceration due to temporary lagophthalmos in the ICU. Moisture chambers are inexpensive, require minimal training, and place a low demand on nursing care. As an alternative to tarsorrhaphy, this noninvasive procedure may effectively treat severe exposure

keratopathy in critically ill patients.

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