Corneal injuries: incidence and risk factors in the Intensive Care Unit[1]

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Patients hospitalized in the Intensive Care Unit (ICU) may present risk for corneal injury due to sedation or coma. This study aimed to estimate the incidence of corneal injuries; to identify the risk factors and to propose a risk prediction model for the development of corneal injury, in adult patients, in an intensive care unit of a public hospital. This is a one year, prospective cohort study with 254 patients. The data were analyzed using descriptive statistics, univariate and logistic regression. Of the 254 patients, 59.4% had corneal injuries and the mean time to onset was 8.9 days. The independent variables that predispose to risk for punctate type corneal injury were: duration of hospitalization, other ventilatory support device, presence of edema and blinking less than five times a minute. The Glasgow Coma Scale and exposure of the ocular globe were the variables related to corneal ulcer type corneal injury. The injury frequencies were punctate type (55.1%) and corneal ulcers (11.8%). Risk prediction models for the development of punctate and corneal ulcer type corneal injury were established.

Descriptors: Corneal Diseases; Corneal Ulcer; Risk Factors; Diagnosis of Nursing; Intensive Care Units; Nursing.

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Lesões na córnea: incidência e fatores de risco em Unidade de Terapia Intensiva

Pacientes internados em unidade de terapia intensiva (UTI) podem apresentar risco para lesão na córnea devido à sedação ou coma. Este estudo teve por objetivo estimar a incidência das lesões na córnea, identificar os fatores de risco e propor modelo de predição de risco para o desenvolvimento de lesão na córnea, em pacientes adultos, em unidade de terapia intensiva, de um hospital público. É estudo de coorte prospectiva de um ano, com 254 pacientes. Os dados foram analisados por estatística descritiva, univariada e de regressão logística. Dos 254 pacientes, 59,4% tiveram lesão na córnea e o tempo médio para o seu aparecimento foi de 8,9 dias. As variáveis independentes que predispõem ao risco para lesão na córnea, tipo puntacta, foram: tempo de internação, outro dispositivo de assistência ventilatoria, presença de edema e piscar de olhos menor que cinco vezes por minuto. Escala de coma de Glasgow e exposição de globo ocular foram as variáveis relacionadas à lesão na córnea do tipo úlcera de córnea. As lesões foram do tipo puntacta (55,1%) e úlceras de córnea (11,8%). Modelos de predição de risco para lesões na córnea do tipo puntacta e úlcera foram estabelecidos.

Descritores: Doenças da Córnea; Úlcera da Córnea; Fatores de Risco; Diagnóstico de Enfermagem; Unidades de Terapia Intensiva; Enfermagem.

Lesiones en la córnea: incidencia y factores de riesgo en Unidad de Terapia Intensiva

Pacientes internados en Unidad de Terapia Intensiva (UTI) pueden presentar riesgo de lesión en la córnea debido a la sedación o al coma. Este estudio tuvo por objetivo estimar la incidencia de las lesiones en la córnea; identificar los factores de riesgo y proponer un modelo de predicción de riesgo para el desarrollo de lesión en la córnea, en pacientes adultos, en Unidad de Terapia Intensiva, de un hospital público. Estudio de cohorte prospectivo de un año con 254 pacientes. Los datos fueron analizados por estadística descriptiva, univariada y de regresión logística. De los 254 pacientes, 59,4% tuvieron lesión en la córnea y el tiempo promedio para su aparición fue de 8,9 días. Las variables independientes que predisponen al riesgo de lesión en la córnea tipo punteada fueron: tiempo de internación, otro dispositivo de asistencia ventilatoria, presencia de edema y parpadeo de ojos menor que cinco veces por minuto. La escala de coma de Glasgow y la exposición del globo ocular fueron las variables relacionadas a la lesión en la córnea del tipo úlcera de córnea. Las lesiones fueron del tipo punteada (55,1%) y úlceras de córnea (11,8%). Modelos de predicción de riesgo para lesiones en la córnea del tipo punteada y úlcera fueron establecidos.

Descriptores: Enfermedades de la Córnea; Úlceras Corneales; Factores de Riesgo; Diagnóstico de Enfermería; Unidades de Cuidados Intensivos; Enfermería.

Introduction

In the Intensive Care Unit (ICU) severely ill patients are hospitalized that are usually dependent on technology and the use of medications for the maintenance of life. These patients are at risk for developing corneal injury due to multiple factors, among these the most prominent cause is ocular exposure[1]. The role of the intensive care nurse in prevention and monitoring to identify changes in the cornea is of fundamental importance[2-4]. Corneal

injury is an infectious or inflammatory lesion in the corneal tissue that can affect the surface or deep layers, being classified as traumatic, superficial, infectious, degenerative, keratoconus or miscellaneous[5-7]. In the adult ICU, the most frequent injuries are of the traumatic, superficial and infectious types[1,8-14]. The most common traumatic injury in hospitalized patients in the ICU is corneal abrasion. This is a superficial injury in the epithelium, subject to implementation of care for its regression[1-14]. Superficial injuries refer to superficial punctate keratitis and to exposure keratitis. They can be caused by ocular exposure, with ineffective palpebral closure and inadequate lacrimal fluid quality[1-4]. Among the most common infectious lesions is infectious ulcerative keratitis or bacterial corneal ulcers[1-14]. These injuries can be adequately prevented or treated. Conversely, they can lead to temporary or permanent visual impairment, depending on the degree of tissue involvement. In this respect, in ICU patients, the mechanisms responsible for the lubrication and protection of the eye may be compromised. The palpebra is preserved in sedated/comatose patients, as long as its integrity is maintained[5].

Normally, the eyes are kept closed during the period of sleep due to the contraction of the orbicularis oculi muscle. In the states of sedation or coma, orbicularis muscle relaxation occurs reducing its contraction, which makes passive complete eye closure difficult. Additionally, sedation and coma may compromise the random eye movements, cause loss of the blinking reflex and compromise the lacrimal film. Other factors involved in the formation of the lacrimal film include the administration of drugs such as atropine, antihistamines and tricyclic antidepressants. These factors seriously compromise the corneal and conjunctival defenses[13] and may result in superficial keratopathy and inflammatory diseases of the cornea, leading to ulceration and perforation and thus, to permanent damage. These exposures can occur in ICU patients, on average, from 48 hours to one week after hospitalization[9,13].

In randomized controlled studies[1,8,12], the rate of occurrence of corneal injury in ICU patients remained between 3.33% and 22%. Another study found that 60% of the ICU patients who receive sedation for more than 48 hours developed corneal abrasion, detected in 42% of the cases within the first week of hospitalization. In turn, abrasion leads to an increased risk of infections and ulcerations[13]. A study to estimate the incidence and risk factors for corneal injury in ICU patients is necessary since the problem is current and relevant. Therefore, this study aimed to estimate the incidence of corneal injury, to identify the risk factors and to propose a model for predicting risk of corneal injury. It is considered important that nursing diagnoses are identified in critically ill patients, initially in studies of incidence, such as in the case of the proposed study. It is believed that the identification of nursing diagnoses fosters better care planning and better communication between the nurses and the team, in addition to the recognition of phenomena considered important for investigation and description.

Methods

This is a prospective cohort study, conducted in an adult ICU of a public hospital in Belo Horizonte - MG. This is a large general hospital, with 30 ICU beds for the hospitalization of patients in the clinical and surgical specialties. It is a reference for trauma and non-trauma emergencies and part of the Brazilian National Health System (SUS). The sample size calculation was based on an overall incidence of the events of interest (corneal injury) of 57.1% in a pilot study previously conducted. Considering a margin of error of 10%, a significance level of 5% (type I error) and a power of 90% (1-type II error), a systematic random sample was estimated of approximately 254 subjects. The criteria for patient inclusion were: to be older than 18 years; to not present corneal injury on admission; to remain hospitalized in the ICU for a period exceeding 24 hours; and to consent to participate in the research or to have their participation authorized by the person responsible through the Terms of Free Prior Informed Consent. To collect data an instrument, constructed and tested in the pilot study, was used, containing the sociodemographic and clinical variables and the risk factors for developing corneal injury identified in the literature[1,8-9,11-14].

The dependent variables for the determination of the incidence were corneal injury and type of corneal injury - punctate and corneal ulcer. The independent variables (risk factors for injury to the cornea), selected from the literature[1,8-9,11-14] were: ICU; degree of contamination from the surgery; ventilatory method; age; gender; origin; duration of hospitalization in the UTI; duration of hospitalization until the appearance of the corneal injury; Acute Physiology and Chronic Health Evaluation II - APACHE II severity-of-disease classification system; Therapeutic Interventions Scoring System (TISS 28); type of patient; American Society of Anesthesiologists (ASA); medical diagnosis; duration of postoperative period; estimate of weight; estimate

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of height; presence of edema; localization of edema; sedation; Glasgow Coma Scale (GCS); Ramsay Sedation Scale; intubation; tracheostomy (TQT); other ventilatory support device; mechanical ventilation (MV); duration of MV; non-invasive ventilation (NIV); duration of NIV; inspired oxygen fraction (FiO$_2$); positive end-expiratory pressure (PEEP); eyes blinks per minute; exposition of the ocular globe; degree of exposition of the ocular globe; conjunctival hemorrhage; ocular colonization/infection; secretion of the right and of the left eye; microorganism of the right and the left eye; pneumonia; medication in use; nutritional status; Cumulative Water Balance (CWB); degree of headboard elevation; Endotracheal Tube (ETT) or TQT Fixation; temperature of the unit; dosage of albumen; leukocyte count; total protein dosage; serum sodium dosage.

Before starting the data collection an intensive care nurse and physician were trained to evaluate the cornea by an ophthalmologist. This training consisted of theoretical and practical content regarding corneal injury. The ophthalmologist was considered the "gold standard" for the performance of the corneal evaluation. A Kappa coefficient of 0.77 (substantial agreement) was found between the intensive care physician and the ophthalmologist and of 0.88 (almost perfect agreement) between the intensive care nurse and the ophthalmologist. The Cronbach's alpha was calculated to evaluate the internal consistency and reliability of the evaluation. The value of 0.91 was found which shows excellent reliability in the test conducted.

The pilot study had a duration of 30 days and allowed the average time of data collection to be estimated, the instrument to be tested and the calculation of the sample size to be performed. After concordance was reached among the examiners and the testing of the instruments and calculation of the sample size, the study was conducted from May 2008 to May 2009. Data collection was performed by the intensive care nurse, five times a week. For the corneal evaluation a drop of fluorescein was placed in each eye of the patient and approximately three minutes allowed to pass. Then the ophthalmoscope with a cobalt filter for the evaluation of the cornea was positioned, under very low ambient light conditions for the best quality of examination. The collection of the cultures of the secretion of the conjunctiva with antibiogram was performed after 24 hours of hospitalization, and when the patients had signs and symptoms of ocular infection. For the collection of the material two plastic loops and two chocolate agar culture medias were used. The data obtained were transferred, treated and processed in the Statistical Package for the Social Sciences (SPSS) version 16.0 and in Minitab 15.1. The double entry procedure was used to avoid digitation errors. The descriptive analysis was conducted using simple frequency distributions, measures of central tendency (mean and median) and measures of variability (standard deviation). The incidence of corneal injury and the identification of the risk factors for the injury were determined. Univariate analysis was conducted and measures of association between the dependent and independent variables were calculated using the chi-square test (χ^2) or the Fisher exact test, in the case of qualitative variables. For the quantitative variables, the Student t test for comparing two groups (association with punctate injury and corneal ulcer) was performed.

In all tests, a significance level of 5% ($\alpha=0.05$) was used. To estimate the strength of association between the dependent and independent variables the odds ratio (OR) was used, with a confidence interval of 95% and a p-value=0.05. Multiple logistic regression was performed to estimate risk for corneal injury prediction models, punctate and corneal ulcer, through the Forward method. The Hosmer and Lemeshow test was used to evaluate the adequacy of the estimated models. The variables used to estimate the models were the independent variables that, in the univariate analysis, were statistically significant (p≤0.20). Some independent variables were excluded because they were correlated with other variables already included in the model. The study was approved by the Research Ethics Committee of the Federal University of Minas Gerais, COEP/UFMG, Protocol No. ETIC 008/08.

Results

Characteristics of the patients

Of the 254 subjects it was found that the majority (66.1%) were male. Only 21.7% were surgical patients and 63.4% came from the Emergency Unit beds for critical patients. The average age was approximately 55.9 years (18-100). The mean of the APACHE II was 19 and 37.2 for the TISS 28. The mean duration to the onset of corneal injury was 8.9 days. During the data collection period there was a loss of 60 patients (23.6%) due to death and 194 patients (76.4%) due to referral, with 187 of these (96.4%) to inpatient units. In relation to the ventilatory support devices, 199 (78.3%) were intubated, 200 (78.7%) on mechanical ventilation and 199 (78.3%) were using another ventilatory support

device. Macronebulization was used with 114 (57.3%) patients and non-invasive ventilation with only 16 (6.3%). Regarding conjunctival secretion, 48 patients (18.89%) were found to have ocular infections, 27 (10.6%) in the right eye and 21 (8.3%) in the left eye. 10 (3.94%) patients presented infection in both eyes. In relation to the medical diagnosis on admission to the ICU, pulmonary diseases were the most frequent, affecting 91 (35.8%) patients.

Incidence and risk factors for corneal injury for the patients included in the study

Of the 254 subjects 151 corneal injuries were identified. The overall incidence of this type of injury was 59.4% for the period of study. The incidence of punctate type corneal injury was 55.1% and of the corneal ulcer type, 11.8%. The number of injuries of the corneal ulcer type was calculated based on the number of ulcers identified in the first evaluation plus the number of punctate type injuries that evolved into corneal ulcers in the period stipulated for the study. There was regression of the punctate type injuries in 14.3%.

Corneal injury risk prediction model

The qualitative variables that presented significant association (p≤0.05) with corneal injury were: origin of the patient; type of patient; presence of neurological disease; intubation; mechanical ventilation or TQT; use of another ventilatory support device; pneumonia; result of the conjunctival secretion culture of the right eye, result of the conjunctival secretion culture of the left eye; presence of edema; localization of the edema; patient sedated; eye blinks per minute; exposure of the ocular globe; area of ocular globe exposure; presence of conjunctival hemorrhage; use of vasoactive drugs; use of antihypertensives; use of antibiotics (ATB); use of diuretics; use of hypnotics/sedatives/anxiolytics; use of antifungal medication; use of other non-categorized drugs; use of vitamins; use of bronchodilators; use of neuromuscular blockers; and fixation of the ETT/TQT/macronebulization/nasal cannula.

The qualitative variables that presented significant association (p≤0.05) with corneal injury were: duration of hospitalization; duration of hospitalization until the appearance/regression of the corneal injury; age; APACHE II; TISS 28; PEEP; duration of MV in days; GCS, and CWB. The probability that a patient develops a corneal injury was estimated in the risk prediction model with the logistic regression equation using the Forward method. In the adjustment of the model, those independent variables considered statistically significant (p≤0.05) for corneal injury were used (Table 1).

Table 1 - Estimates of the Logistic Regression to define the final model in relation to the dependent variable corneal injury. Belo Horizonte, MG, Brazil, 2008-2009

Variables	Coefficient	OR	P-value	CI>95%
Constant	1.52	4.56	0.02	-
Duration of hospitalization until the appearance of the injury	-0.11	0.90	0.00	0.84-0.96
Intubation, mechanical ventilation or tracheostomy	4.76	117.11	0.00	11.16-1229.00
Eye blinks per minute	-3.81	0.02	0.00	0.00-0.15
Use of Neuromuscular blockers	-2.65	0.07	0.02	0.01-0.70

χ^2=12.583; p=0.127 R^2=62.5%.

Punctate type corneal injury risk prediction model

The qualitative variables with significant association (p≤0.05) for punctate type injury were: origin; type of patient; kidney disease; neurological disease; intubation/MV or TQT; other ventilatory support device; pneumonia; result of the conjunctival discharge culture of the right eye; presence of edema; patient sedated; eye blinks per minute; exposure of the ocular globe; area of ocular exposure; use of antihypertensives, use of vasoactive drugs, use of diuretics; use of hypnotics/sedatives/ anxiolytics; use of vitamins; use of bronchodilators; use of neuromuscular blockers; and fixation of ETT/TQT/macronebulization/nasal cannula. The quantitative variables with significant association (p≤0.05) for punctate type injury were: duration of hospitalization; age; APACHE II; TISS 28; PEEP; duration of MV in days; and GCS. The probability that a patient develops a punctate type corneal injury was estimated in the risk prediction model using the Forward method (Table 2).

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Table 2 - Independent variables considered in the final model in relation to the dependent variable punctate type corneal injury. Belo Horizonte, MG, Brazil, 2008-2009

Variables	Coefficient	OR	P-value	CI 95%
Constant of the equation / Duration of hospitalization	0.03	1.03	0.03	1.03-1.00
Other ventilatory support device	0.66	1.94	0.05	1.94-1.01
Presence of edema	0.62	1.86	0.01	1.86-1.14
Eye blinks per minute	-3.77	0.02	0.00	0.02- 0.01

$\chi^2=3.880$; p=0.868; $R^2=56.4\%$.

Corneal ulcer type corneal injury risk prediction model

The variables in the prediction model for corneal ulcer type corneal injury with statistical significance were: duration of hospitalization; other ventilatory assistance device; presence of edema; and less than five eye blinks per minute. The quantitative variables that presented significant association ($p \leq 0.05$) with the corneal ulcer were: APACHE II, TISS 28, weight, duration of MV in days, and GCS. The probability that a patient develops a corneal ulcer type corneal injury was estimated in the risk prediction model using the Forward method (Table 3).

Table 3 - Independent variables considered in the final model in relation to the dependent variable corneal ulcer type corneal injury. Belo Horizonte, MG, Brazil, 2008-2009

Variables	Coefficient	OR	P-value	CI 95%
Exposure of the ocular globe	0.99	2.70	0.00	1.39-5.27
Glasgow Coma Scale >7	-0.253	0.77	0.00	0.73-0.83

$\chi^2=7.077$; p=0.314. $R^2=74.2\%$.

Although it contains only two variables (exposure of the ocular globe and the Glasgow coma scale with values between 11 and 15), the value of R^2 indicates that this model is able to explain 74.2% of the variability of the probability of corneal ulcer development. In addition, it is possible to conclude, through the Hosmer and Lemeshow test, that the model is adequate to estimate the probability of corneal ulcers development (p=0.31). The total percentage of accuracy in the prediction of the response, according to the estimated equation, was 89.1% (95.5% accuracy in the negatives and 37% in the positives). It is important to observe that the OR value of -0.253 of the Glasgow coma scale indicated that for each one-unit increase in the scale, the likelihood of developing a corneal ulcer decreases by 0.253 times.

Discussion

Among the 254 ICU patients it was found that 151 presented punctate and corneal ulcer type corneal injuries. The incidence of punctate type corneal injury was 55.1% and of the corneal ulcer type, 11.8%. By combining the two, this number is greater than 59.4%, since 19 punctate type injuries evolved into corneal ulcers during the study period. Studies[15-16] have estimated an incidence of corneal injury from 20 to 40%, though they do not describe the characteristics of the patients studied. In turn, other studies[1,8-9,12] have estimated an incidence between 3.33% and 42%. It is noteworthy that the studies cited above were developed in countries with different social contexts to Brazil. Nursing care to prevent injury to the cornea should be established at admission of the patient to the ICU and for those at risk for injury, coming from other inpatient units, given the high incidence found (59.4%) in this study. Considering that the corneal ulcer is a type of injury that can often leave leukoma as sequel[5], their prevention is imperative, even when found at the punctate type injury stage. There was regression of the punctate in 14.3% of the cases. This number was estimated only for this type of injury, because it is the type of injury that resolves without medical treatment. At this stage the nurse can provide skilled care, through early detection and nursing interventions, with a view to its regression without medical treatment. The mean time to onset of injury to the cornea was 8.9 days. This is the critical period of hospitalization for the patient to developed a corneal injury. During this phase, the nurse and medical team are obliged to carry out the corneal evaluation so

that preventive actions can be implemented. Another study[12] presents the mean time of onset of injury as between 48 hours and 7 days. There are few studies that estimate the mean time to the onset of injury and the implementation of corneal care for ICU patients in Brazil, making it difficult to compare and analyze the data.

The variables that presented significant association (p≤0.05) with corneal injury were: origin of the patient; type of patient; presence of neurological disease; intubation; mechanical ventilation or TQT; use of another ventilatory support device; pneumonia; result of the conjunctival secretion culture of the right eye; result of the culture conjunctival secretion of the left eye; presence of edema; location do edema; patient sedated; eye blinks per minute; exposure of the ocular globe; area of ocular globe exposure; presence of conjunctival hemorrhage; use of vasoactive drugs; use of antihypertensives; use of antibiotics (ATB); use of diuretics; use of hypnotics/sedatives/anxiolytics; use of antifungal medication; use of other non-categorized drugs; use of vitamins; use of bronchodilators; use of muscular blocking; fixation of the ETT/TQT/macronebulization/nasal cannula; duration of hospitalization; duration of hospitalization until the onset of corneal injury; age; APACHE II; TISS 28; PEEP; MV duration in days; GCS; and CWB. The variables in the corneal injury predictive model were as follows: duration of hospitalization until onset/regression of the injury; presence of ETT/MV/TQT; eye blinks per minute; and use of neuromuscular blockers. The literature[1,8-14] indicates as possible risk factors for corneal injury: intubation; mechanical ventilation or TQT; result of the conjunctival secretion cultures; edema; sedation; eye blinks per minute; exposure of the ocular globe; area of ocular globe exposure; use of hypnotics/sedatives/anxiolytics; APACHE II; TISS 28; PEEP; MV duration in days; GCS Some of these variables were confirmed as risk factors in the prediction models constructed in the present study, such as intubation; mechanical ventilation or TQT; result of the conjunctival secretions culture; eye blinks per minute, presence of edema, among others.

From the risk prediction model it was observed that for every one-unit increase in the duration of the hospitalization, the probability of injury development decreased by 0.11. This data could be explained by improvements in the clinical status of the patient with the increase in the duration of the hospitalization. The patient would no longer be intubated, on mechanical ventilation or tracheostomy and would present an adequate blink reflex. These variables were estimated by the model as risk factors for corneal injury. Intubation,

MV or TQT increases the chance of a patient developing a corneal injury by 117.11 times when compared to those who are not using these devices, while keeping the other variables constant. This finding is corroborated by several studies[1,8-17].

The eye blink rate of less than five times per minute increased the chance of a patient developing a corneal injury by 45.46 times compared to a blink rate of more than five times per minute, while keeping the other variables constant. This risk factor is confirmed in another study[10] which proposes a protocol for ocular care in accordance with the number of times the ICU patient blinks the eyes per minute. This is an important variable in relation to risk for corneal injury. In turn, it can be concluded that patients who use neuromuscular blockers are 14.085 times more likely to develop a corneal injury, when compared to those in which it was not administered. In these cases, the patient may often present exposure of the ocular globe when being given neuromuscular blockers[2].

No study was identified in the literature that estimates the risk factors for punctate type and corneal ulcer type injuries, therefore it was not possible to establish a comparison with the results found in the present study. In the available studies[1,8,13] the risk factors are established from the pathophysiology of the injury. For punctate type injury, with each one-unit increase in the duration of the hospitalization, the probability of developing the injury increases by 0.03 times. This could be explained by the severe profile of the patient. The more severe the clinical status of the patient, the greater the duration of hospitalization and, consequently, the greater the risk for developing a corneal injury.

Another important finding in the present study is that a risk factor for punctate type injury, presented by the patients, was the use of another ventilatory support device, such as macronebulization, Venturi mask and the nasal cannula. Patients using any of these devices have a 1.96 times higher chance of developing punctate type injury when compared with those who are not using any of them, keeping the other variables constant. This could be explained by the corneal exposure to oxygen at concentrations greater than 21%[17]. It can be concluded that patients who present edema have a 1.86 times higher chance of developing punctate type injury when compared with those who do not present this, if the other variables are kept constant. This variable is identified as a risk factor for corneal injury by several authors[1,8-13]. The exposure of the ocular globe increases the chance of a

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patient developing a corneal ulcer by 2.7 times when compared to those who have no exposure, keeping the other variables constant. This data is also consistent with the literature[1,8-14], because with the exposure of the iris the cornea also remains exposed. Without lubrication mechanisms, injuries in the epithelium can be presented. When the state of dehydration is maintained, there may be endothelial injury and consequently a corneal ulcer may develop.

Conclusions

The incidence of the punctate type injury encountered in this study was higher than those of other corneal injuries. The prevention of punctate type injury in adult ICU patients is essential and must be implemented by the intensive care nurse. In the final model, the variables that predispose to risk for developing corneal injuries were: duration of hospitalization until onset/regression of the injury; intubation; MV or TQT; eye blinks per minute; and use of neuromuscular blockers. The variables that predispose to risk for punctate type corneal injuries were: duration of hospitalization; other ventilatory assistance device; presence of edema; and eye blinks per minute. The variables that predispose to risk for corneal ulcer type corneal injury are exposure of the ocular globe and Glasgow coma scale values between 11 and 15. According to the study performed, a nursing diagnosis that contemplates the risk for corneal injury can be said to be of fundamental importance due to the high incidence of this type of injury subject to prevention by the nursing staff. The timely nature of the study conducted with a group of patients in public teaching hospitals, can be identified as a limiting factor requiring a multicentric study to legitimize the external validity of the study.

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