Ocular Surface Disorders In Intensive Care Unit Patients In A Sub-Saharan Teaching Hospital

I Desalu, F Akinsola, O Adekola, O Akinbami, O Kushimo, A Adefule-Ositelu

Citation

Abstract

Purpose: We investigated the incidence of ocular surface disorders and determined predisposing factors in order to establish guidelines for eye care in intensive care unit patients in a Nigerian teaching hospital.

Methods: All unconscious and critically ill patients were investigated. Data included duration of sedation, muscle relaxants and mechanical ventilation and presence of organ failure. The eyes were examined daily and the eyelid position noted.

Results: Fifty-six patients were studied. 31 patients (55.4%) developed OSD. The duration of sedation (4.06 vs 1.80 days) and ventilation (4.55 vs 1.62 days) as well as severity of illness significantly influenced the development of OSD, but the position of the eyelids did not. Patients who received saline irrigation were more likely to develop OSD (p=0.02).

Conclusion: ICU patients in our institution frequently develop OSD. There is a need to develop strict eye care guidelines especially in the setting of organ failure.

INTRODUCTION

Ocular surface disorders (OSD) characterized by disorders of the conjunctiva or cornea have been described in the anaesthetized patients. It also occurs in patients with compromised protective eye mechanism like the unconscious, sedated or paralysed patients. Though OSD are usually self-limiting, they may lead to visual impairment or blindness if extensive. Post-recovery visual loss would be devastating to any patient who has recovered from the physical and psychological impact of intensive care therapy.

In the critically ill and unconscious patients, predisposing factors include position of the lid, use of mechanical ventilation, presence of respiratory tract infection or organ failure and prophylactic eye care instituted. Temperature and humidity also play an important role in patients with incomplete eye closure. Nigeria is a tropical country with daily temperatures reaching 32 – 40°C and humidity of 65 – 87%.

In our institution, there is no definite protocol for eye care in the unconscious patient.

The object of this study therefore was to determine the incidence of ocular surface disorders in our critically ill patients and determine predisposing factors with the aim of establishing strict guidelines for the eye care in these patients.

PATIENT AND METHODS

A prospective study of all unconscious patients admitted into our intensive care unit (ICU) over a four month period, from June 2007 to September 2007 was done. Data included age and gender as well as indication for admission. ICU management strategies were documented. These included the use of sedation and muscle relaxants, duration of ventilation, sedation and muscle relaxation.

The eyelid position of the patients was noted and documented as either complete eye closure or incomplete eye closure when part of the conjunctiva or cornea was visible.

The eyes were examined daily with pen torch light and ophthalmoscope for presence of conjunctival or corneal
disorders. A binocular loupe of x 4 magnification was used where applicable as there was no hand-held slit-lamp. Conjunctiva disorder was defined as the presence of injection, oedema or exudates of the conjunctiva. Corneal disorder was diagnosed when haziness, dryness or ulceration was apparent with a positive fluorescein staining. Eye care treatment instituted if any was documented.

The room temperature and humidity of the ICU was recorded daily by reading of a room thermometer and a wet and dry hygrometer respectively.

Organ failure was determined using preset criteria; organic brain damage, hypotension (systolic blood pressure < 80mmHg) or the need for vasopressors, renal dysfunction and disseminated intravascular coagulopathy. The presence of respiratory infection was noted.

The patients were divided into two groups for analysis: OSD, those with ocular surface disorders and non-OSD, those with intact conjunctiva and cornea.

Data obtained was analysed by t-test, chi-square or Fisher’s exact test as indicated using SPSS® version 10.1. Numerical data was expressed as mean ± SD while categorical data was expressed as frequencies. A p value < 0.05 was considered statistically significant.

**RESULTS**

Fifty-six patients were recruited into the study. The mean age of the patients was 36.55 ± 16.68 years with a range of 5 to 78 years and a male: female ratio of 3 : 1.

Table I shows the indication for ICU admission.

**Figure 1** Table 1: Indications for ICU admission

<table>
<thead>
<tr>
<th>Indication for ICU admission</th>
<th>No. of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Head Injury</td>
<td>18 (32%)</td>
</tr>
<tr>
<td>Post-operative</td>
<td>12 (21.4%)</td>
</tr>
<tr>
<td>Cardiac Disorder</td>
<td>2 (3.6%)</td>
</tr>
<tr>
<td>Respiratory Insufficiency</td>
<td>3 (5.4%)</td>
</tr>
<tr>
<td>Aspiration pneumonitis</td>
<td>4 (7.1%)</td>
</tr>
<tr>
<td>Severe tetanus</td>
<td>3 (5.4%)</td>
</tr>
<tr>
<td>Severe sepsis + MODS</td>
<td>4 (7.2%)</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>3 (5.4%)</td>
</tr>
<tr>
<td>Severe PET/ Eclampsia</td>
<td>4 (7.1%)</td>
</tr>
<tr>
<td>Severe Burns</td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>56 (100%)</td>
</tr>
</tbody>
</table>

(MODS- Multi-organ dysfunction syndrome, PET-Pre-eclamptic toxemia)

Thirty-one patients (55.4%) developed ocular surface disorders. Of these, 24 patients (77.4%) had conjunctival disorders (10 oedema, 5 injection and 9 exudates), 2 (6.5%) corneal disorders (1 haziness, 1 ulcer) and 5 patients (16.1%) a combination of both (3 exudate & dryness, 1 oedema & dryness and 1 oedema & haziness). In the majority of these patients (67.5%), ocular surface disorders developed during the first or second day of ICU admission.

Sixteen patients (51.6%) who developed OSD had incomplete closure of the eyelids compared to 10 (40%) who did not. This was not statistically significant. The mean duration of sedation (4.06 ± 2.90 vs 1.80 ± 0.94 days) and ventilation (4.55 ± 2.97 vs 1.62 ± 1.02 days) were significantly longer in patients that developed OSD (p<0.05), however the duration of ICU stay did not significantly influence the development of OSD. (Table II).

The severity of illness as indicated by the presence of one or more failed organ systems was statistically significant in the development of OSD (71% vs 44% p=0.43).

There was no significant difference in mean temperature and humidity between the two groups.

**Figure 2** Table 2: Comparison of Demographic and Clinical data of OSD and non-OSD groups.

<table>
<thead>
<tr>
<th></th>
<th>Ocular Surface Disorder (n = 31)</th>
<th>Non Ocular surface Disorder (n = 25)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>36.48 ± 16.44</td>
<td>36.65 ± 17.36</td>
<td>0.970</td>
</tr>
<tr>
<td>Male: Female ratio</td>
<td>26:5</td>
<td>16:9</td>
<td>0.008</td>
</tr>
<tr>
<td>Incomplete closure of Eye [%]</td>
<td>16 (51.6%)</td>
<td>10 (40.0%)</td>
<td>0.386</td>
</tr>
<tr>
<td>Mean Duration of ventilation (days)</td>
<td>4.55 ± 2.97</td>
<td>1.62 ± 1.02</td>
<td>0.001*</td>
</tr>
<tr>
<td>Mean Duration of Sedation (days)</td>
<td>4.06 ± 2.90</td>
<td>1.80 ± 0.94</td>
<td>0.008*</td>
</tr>
<tr>
<td>Mean Duration of muscle relaxation (days)</td>
<td>2.91 ± 0.58</td>
<td>1.80 ± 0.91</td>
<td>0.106</td>
</tr>
<tr>
<td>Mean Duration of ICU stay (days)</td>
<td>7.26 ± 6.88</td>
<td>5.40 ± 1.68</td>
<td>0.174</td>
</tr>
<tr>
<td>Failed Organ System [%]</td>
<td>22 (71.0%)</td>
<td>11 (44.0%)</td>
<td>0.043*</td>
</tr>
<tr>
<td>Mean ICU ambient temperature (°C)</td>
<td>36.08 ± 2.02</td>
<td>35.76 ± 0.46</td>
<td>0.221</td>
</tr>
<tr>
<td>Mean ICU Relative humidity</td>
<td>39.64 ± 1.97</td>
<td>90.13 ± 0.36</td>
<td>0.384</td>
</tr>
</tbody>
</table>

* Indicates significant difference (p<0.05)

Eye care was instituted in a total of 38 patients (67.8%). Twenty-seven patients who developed OSD (87.1%) had received some form of eye care compared to 11 patients (44%) in the non-OSD group. The variety of eye care administered is shown in Table III. The administration of saline irrigation was observed to significantly alter the incidence of development of OSD in the two groups (p = 0.02).
DISCUSSION

Our study confirms that ocular surface disorders is a relatively common complication in critically ill unconscious patients. With an incidence of 55.4%, it demonstrates that at least half of our unconscious patients will develop this complication. Similar results have been obtained in Japan of 60% and UK of 42% among sedated and immobilised ICU patients. The occurrence of ocular surface disorders was more likely with a longer duration of sedation and ventilation. Sedation and sometimes muscle relaxants are necessary to facilitate adequate ventilation of patients, prevent seizures and aid tolerance of airway toileting and other procedures. Lid closure is maintained during normal sleep by tonic contraction of the orbicularis oculi. Thus the use of muscle relaxants decreases muscle tone and therefore eye closure, reduces rapid eye movement and results in loss of blink reflex. This interferes with tear film production and therefore natural lubrication of the eyes that prevents dryness.

Important predisposing factors to the development of OSD include lid position, respiratory infection and organ failure. We were unable to demonstrate any significant correlation between lid position and the development of OSD. Though more of our patients with incomplete closure of the eyes developed OSD, this was not significant. As eye care in our study was not dictated by any protocol, it could be that ICU nursing staff independently taped the eyes of those patients who had obvious exposure thereby inadvertently influencing the effect of eyelid position on OSD. In addition, environmental factors like the higher humidity and temperature in our sub-region may have offered some protection against extreme dryness of exposed eyes. Incomplete eye closure leads to constant exposure of the eyes and increased tear film evaporation with subsequent dryness and erosion formation. Exposed eyes are more likely to develop superficial keratopathy leading to ulceration, perforation and scar formation. Failure of the eyelids to close fully accounts for a majority of corneal injuries under general anaesthesia. It has been shown that the distribution of corneal erosion coincides with the exposed area of the cornea despite eye care instituted.

Critically ill patients frequently have some form of organ failure that may require supportive therapy like mechanical ventilation, use of inotropes or vasopressors, continuous renal replacement therapy or neuro-protective strategies. Severity of illness is a function of the number and degree of organ failure. The presence of organ failure was significant in the development of OSD among our patients. This has also been observed by other authors. Seventy-one percent of our study population who developed OSD had organ failure. This is likely due to a multitude of reasons. Patients with organ failure especially cardiac, circulatory and renal failure are likely to fluctuate between volume depletion and overload as intensivists aim for optimal perfusing pressure necessary for tissue oxygen delivery. Excessive volume depletion results in decreased perfusion to all organs including the eye leading to dryness and impaired restoration of eye cells. On the other hand, volume overload whether absolute or relative and increased capillary permeability states result in generalised oedema including conjunctival oedema. Conjunctival oedema prevents adequate tissue perfusion and oxygenation, worsens the inability to fully close the eyelids with possible prolapse of the conjunctiva and an increased risk of development of OSD.

Introduction of positive pressure mechanical ventilation with the addition of positive end expiratory pressure (PEEP) may have deleterious effects on the eye by increasing intra-ocular pressure which in turn compromises eye perfusion. In addition, high intra-thoracic pressures and PEEP in excess of 5cmH₂O encourages sodium and water retention thereby aggravating oedema.

Though we were unable to establish any correlation between the occurrence of OSD and the presence of respiratory infection, some authors have reported increased incidence of pseudomonas and nosocomial eye pathogens when patients had coincidental active respiratory diseases. They have proposed a link between respiratory pathogens, airway suctioning and eye infection. We did not undertake microscopy and culture of conjunctival exudates to compare with that of tracheal aspirate in this study and therefore were not able to establish such a link.

Eye care in our patients varied widely as we do not have a standard protocol for Care of the Eyes in our ICU. Therapy included two-hourly instillation of saline, two-hourly...
instillation of chloramphenicol eye drops with or without ointment and various combinations of both antibiotic and saline irrigation. Whether to institute eye care or not and the choice of eye care was not influenced by any of the authors but left to the discretion of the attending ICU nurses.

It is worthy to note that eye care was given to more patients in the OSD group than to those in the non-OSD group (87.1% vs 44%) and that saline irrigation was administered to significantly more patients in the OSD group. A reason for this unexpected observation is that, it is likely that the development of obvious dryness and haziness prompted the commencement of eye care in these patients, more so as most OSD’s occurred within the first day or two of admission. The use of contaminated eye care materials may also have contributed to this.

From our study we can conclude that OSD are a common complication of critically ill unconscious patients in this sub-region. The incidence is higher with a longer duration of sedation and mechanical ventilation as well as severity of illness. We were unable to observe any association between lid position and ocular surface disorders despite the fact that it is a known causative factor. Individual nursing therapy may have influenced this.

Though the admission of patients into the ICU is accompanied by various interventions that are deemed more important e.g securing the airway, commencing mechanical ventilation, securing intravenous access, administration of vasopressors etc, it is believed that the institution of proper eye care from the start of admission will go a long way in reducing this common but easily preventable complication. Studies have shown significant reduction in the prevalence of OSD when established guidelines existed.

Recommendations for eye care in critically ill patients include Eye hygiene regimes, Prevention of dry eyes, Eyelid closure and Programme for Eye care.

One limitation of this study was the fact that we did not follow-up our patients for further visual complication resulting from the OSD. We were also unable to perform slit-lamp examination of our patient as hand held Slit-Lamp was not available in our institution at the time of study. The availability of this examination may have influenced the results of this study as it is able to reveal early changes on the cornea.

From our study, we recommend the following guidelines for eye care of Intensive care unit patients in our institution.

1. All ICU patients should have prophylactic chloramphenicol eye drops 4hrly during the day and copious ointment at night.

2. All patients with poor Bell’s phenomenon should have their eyelids taped after application of chloramphenicol eye ointment.

3. Ocular examination should be carried out weekly for all patients in the ICU.

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