Effect of Implementing Nurse-led Eye Care Protocol on the control of of Eye Complications among Mechanically Ventilated Patients.

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Abstract

Background: *Critically ill patients admitted to intensive care units are at a great risk for the developing eye complications as a result of the impairment of normal eye protection mechanisms, such as tear production, blinking, and keeping the eye closed. This is attributed to many risk factors including connecting to a mechanical ventilator, sedation, and decreased level of consciousness. Implementing of protocolized eye care such as nurse-led eye care protocol can have an impact on incidences of eye complications and patient quality of life after discharge from the ICU.* ***Design:*** *A quasi experimental research design was used to conduct this study* ***.Settings:*** *The study was carried out in the General Medical Intensive Care Units at Damanhur Medical National Institute in Damanhur City, Egypt.* ***Subjects:*** *A convenience sampling of 100 newly adults admitted mechanically ventilated patients was included in the study. Subjects were divided into 2 equal groups: 50 patients for control group and 50 for intervention group.* ***Tools:*** *two tools were used. Tool one: "Patient's Admission Assessment Form ".Tool two: "Eye Complications' Evaluation Scales ".* ***Results:*** *The study showed that the incidence of overall ECs decreased significantly from 84% in the control group to 46% in the intervention group (p <0.001) after the implementation of the nurse-led eye care protocol. Furthermore, the intervention group exhibited a significantly lower incidence of eye dryness, conjunctival injection, periorbital edema, and eye discharge than the control group (p<0.001).* ***Conclusion:*** *The implementation of nurse-led eye care protocol significantly decreased the incidence and severity of eye dryness, conjunctival injection, periorbital edema, and eye discharge.* ***Recommendations:*** *Critical care nurses should implement the nurse-led eye care protocol for mechanically ventilated patients to prevent ECs after establishing educational programs to increase their knowledge and expertise about the protocol.*

Keywords: eye complications, mechanically ventilated patients ,nurse-led eye care protocol.

Introduction

Patients admitted to intensive care units (ICUs) usually have failures in one or more vital organ systems such as respiratory, neurologic, and cardiovascular systems accompanied by many other complications. The ICU team usually pays attention to saving the patient's life and eye care has little attention which contributes to eye complications(ECs). The incidence of ECs in ICUs ranges between 10 and 60%. Patients undergoing mechanical ventilation (MV), sedation, and/or paralytic medicines, as well as comatose patients, have a great risk of

developing ECs due to weakened natural defense systems of the eye. They lose the ability to produce tears, blink, and close the eye during rest or sleep which typically protects the eye (Elkasby et al., 2021 & Johnson et al.,2021).

Critically ill patients who are attached to MV are highly vulnerable to developing ECs. Among mechanically ventilated patients who receive sedation for more than 48 hours, the incidence of ECs was shown to be up to 60%. However, this high incidence rate can be reduced, and ECs can be avoided by getting regular eye care. Avoidable ECs include dry eye, chemosis, conjunctival injection, and eye discharge. ECs associated with prolonged ventilation also include exposure to keratopathy and keratitis, which occur due to persistent severe eye dryness. Finally, corneal abrasion, corneal ulcers, and vision loss may also develop (Hearne et al., 2018& Ceylan et al.2022).

Although ICU patients are indeed more vulnerable to ECs, eye care is a secondary nursing concern. Even when the patient's survival is not assured, eye care should be a high priority because ECs are easily avoided, resulting in compromised vision, which has a disastrous impact on the quality of life in those patients who recover and are discharged. Since there is a deficit of clear eye care protocols, eye care is still provided upon the assumption of various points of view (Elkasaby et al.,2021&Momeni Mehrjardi, Z. et al.,2021).

Furthermore, a deficiency of evidence-based practice and inadequate training has led to uncertainty and knowledge gaps in eye care. This highlighted the importance of enhancing Critical care nurses (CCNs) 'understanding and practice in mechanically ventilated patients' eye care. Educating and training nurses on protocolized eye care will improve their skills and knowledge, reducing the risk of ECs(Ahmadinejad,2020; Alagami,2018& Ebadi,2021).

Critical care nurses play an important role in delivering comprehensive care for patients with a critical illness, so nurses must use accurate and evidence-based methods in ECs for mechanically ventilated patients. Despite the different methods of EC ,ICU nurses need to follow protocolized evidence–based eye care methods. Brennan et al., (2017) applied a nurse-led eye protocol to prevent ECs in the ICU at Manchester University. According to the study, using such protocol reduced ECs and increased nurses' capacity to provide eye care. The nurse-led eye care protocol covers the integrated clinical steps of eye care for mechanically ventilated patients. Moreover, the study recommended gathering additional data to re-evaluate the utility and long-term durability of the nurse-led eye care protocol for ECs prevention, So, we carried out this study to evaluate the effect of implementing the nurse-led eye care protocol on the prevention of ECs in mechanically ventilated patients. (Brennan,2017; Demirel et al.,2014; Khalil ,2019& Johnson, 2021).

Aim of the Study

This study aims to determine the effect of implementing a nurse-led eye care protocol on the control of ECs among mechanically ventilated patients.

Research hypotheses

- Mechanically ventilated patients subjected to a nurse-led eye care protocol exhibit fewer eye complications than those who are not subjected.
- Mechanically ventilated patients who will be subjected to a nurse - led eye care protocol exhibit higher eye complications than those who are not subjected.

Materials and Method

Materials

Design: This study was carried out using a quasi-experimental research design.

Settings: This study was carried out in the General Medical ICUs at Damanhur Medical National Institute in Damanhur City, El Behera Governate namely: General ICU "I" which consists of 15 beds, the General ICU "II" which includes13 beds.

Subjects: The study included a convenience sampling of 100 mechanically ventilated patients who had recently been admitted to the previously indicated settings. Patients were eligible if they were unconscious with a Glasgow Coma Score (GCS) of 3-8, sedated with a Richmond Agitation Sedation Scale (RASS) of -2 to -5, had grade 1 or 2 Lagophthalmos, and aged more than or equal 18 years of both sexes. The sample was divided into two groups, each with 50 patients: the control group and the intervention group. The power analysis (Epi-info application) was used to calculate the study sample size: expect frequency =50%, tolerable error =5%, confidence coefficient =95%, and minimum sample size =97

Tools: Two tools had been used for getting the essential data for the study:

Tool one: "Patient's Admission Assessment Form" The researcher developed this tool after researching the relevant literature (Dawson, 2005; de Franca et al., 2016; Nikseresht et al., 2021& Knaus et al., 1985). On admission, it was used to collect baseline data on patients, which reflected their medical conditions and hemodynamic status. **It was divided into three sections:**

Part I: Sociodemographic and Clinical Data of the Patients: The researcher developed this part after reviewing the relevant literature (Nikseresht et al.,2021; Dawson, 2005& Ahmadinejad,2020). It was used to collect patients' sociodemographic and clinical data. Socio-demographic data include age and gender. Furthermore, clinical data such as diagnosis, GCS, RASS, and if regular medication is provided, notably for glaucoma and eye, ventilator parameters such as PEEP, Medications, and CVP were collected. Additionally, it included risk factors such as lower level of consciousness, decreased blinking and/or inadequate eyelid closure, sedation and paralyzing medications, and PEEP ≥5cmH.

Part II: Lagophthalmos (Eye Closure) Scale: This part was used to assess the patient's ability to close the eyelids completely. It was adopted from Kam et al. (2011). It was used to classify the degree of lagophthalmos which ranges from 0 - 2 as the following; grade 0 means that Lids are completely closed, grade 1 reflects any conjunctival exposure (any white of the eye being visible) but no corneal exposure, and grade 2 that relate to any corneal exposure, even a very tiny amount. The Kappa score indicated significant reliability (0.88) for the lagophthalmos (Eye Closure) Scale .

Part III: Acute Physiology and Chronic Health Evaluation (APACHE II) Score:

This part was adopted from Knaus et al. (1985). It is used to estimate the degree of illness and the patient's risk of mortality during the first 24 hours upon ICU admission. The reliability of the three APACHE II sections is (0.90, 0.84, and 0.94).

Tool two: Eye Complications' Evaluation Scales. This tool was used to assess the incidence and severity of four different ECs developed in mechanically ventilated patients in the ICU. It consists of four adopted scales. Part I: The eye dryness scale that was adapted from (Ervin et al. 2010 & Aggarwal et al.,2020). Part II: periorbital edema scale that was adopted from (Kara et al. 2005). Part III: conjunctival injection scale which was adopted from (In Ki Park,2013). Part IV: conjunctival discharge scale that was adopted from (Dawson et al. 2005).

Part I: Eye Dryness Schirmer Scale

Eye dryness The Schirmer scale is a scale for determining the degree of eye dryness based on the result of the Schirmer test, which is a strip that is put in the patient's eye and then becomes wet. The centimeters of wetting of the strip determines the severity of eye dryness. The scale includes three categories. The least one ranges from 0 to 5 which assumes severe dry eye. The second category

ranges from 5 – 10 of wetting of the strip which indicates moderate dryness of the eye. The highest one ranges from 10 to 15 mm which reflects mild dryness of the eye. The Kappa score indicated significant reliability (0.80) for the eye dryness Schirmer scale.

Part II: Periorbital Edema Assessment Scale

The periorbital edema assessment scale consists of four grades to assess the severity of periorbital edema. Grade 1 regards no coverage of the iris with eyelids, grade 2 means that there is a slight coverage of the iris with swollen eyelids. Grade 3 indicates full coverage of the iris with swollen eyelids and grade 4 reflects full closure of the eye. The Kappa score indicated significant reliability (0.80) for the periorbital edema scale.

Part III: Conjunctival Injection Assessment Scale

The conjunctival injection assessment scale consists of four grades ranging from 0 - 3 that classify the grade of the conjunctival injection. Grade 0 refers to that there is no redness of the eye and grade 1 indicates some redness. whether grade 2 means extensive redness of the eye and grade 3 reflects overall conjunctival redness. The Kappa score indicated significant reliability (0.89) for the Conjunctival Injection scale.

Part IV: Conjunctival Discharge Assessment Scale

The conjunctival discharge assessment scale includes four grades ranging from the lowest grade 0 to the highest one 3 to assess the amount of eye discharge. Grade 0 means that there is no eye discharge and grade 1 indicates small discharge on conjunctiva. While grade 2 refers to discharge on the conjunctiva and cornea. Finally, Grade 3 reflects discharge on the conjunctiva cornea and eyelid. The Kappa score indicated significant reliability (0.90) for the conjunctival discharge scale.

Method

The Research Ethics Committee of the Faculty of Nursing approved the study. After explaining the purpose of the study, official approval to conduct this study was acquired. The patients provided informed consent. Five experts in the subject of the study evaluated the study tools for content validity. The appropriate changes were made as a result. To test the clarity and usefulness of the tools, a pilot study has been carried out on 10% of the study sample. The data had been collected by the researcher between October 2022 and Mars 2023.

To avoid a double contamination impact between the control and study groups that might influence the study outcomes, data has been collected first from the control group and then from the intervention group.

The data has been collected as follows:

- **For both groups:**

-On admission, all patients in both groups were assessed for adequate eyelid closure using Tool One Part II. Tool one (part I & III) was used to collect the baseline socio-demographic and clinical data.

-Tool one part I was used daily through seven consecutive days of follow-up to collect clinical data including GCS and RASS. If the patient regained consciousness, became not sedated, or weaned from MV on any day of the follow-up days, they were excluded from the sample. Moreover, the incidence and severity of ECs for the two groups were assessed daily using tool II. The assessment findings were documented, and any abnormalities were communicated to the ICU physician for consideration of ophthalmology referral.

- **For the control group:**

-Patients were subjected to the routine eye care procedure that is performed by the CCNs without the researcher's interference. They cleansed the eye with tap water as a part of the patient’s bed bath and applied the

eye lubricant prescribed. Eye care is performed once per day.

•For the intervention group

-The researcher implemented the Nurse–led eye care protocol which included eye hygiene and ocular surface protection every four hours for seven consecutive days.

•The Nurse – led eye care protocol was performed as the following:

1-Eye Hygiene:

-Before performing eye hygiene, the researcher performed hand hygiene and maintained an aseptic non-touch technique (ANTT) to avoid the possibility of eye infection during the procedure.

A-Hand Hygiene:

-The researcher performed hand hygiene by using the seven-step procedure.

B- Maintaining Aseptic Non-Touch Technique (ANTT):

-The researcher kept an ANTT by doing the following; first, Cleaning the tray for eye care equipment with detergent was done. Then, the researcher prepared the equipment, the environment, and the patient. After that, the researcher performed hand hygiene again and wore gloves. During the procedure of eye care, all key parts or components of the eye care equipment tray have been kept away from being touched. After the procedure, the researcher removed the gloves, performed hand hygiene, and cleaned the tray.

C- Eye Hygiene:

-The researcher used artery forceps and sterile water-soaked gauze to cleanse the eye every 4 hours. Each gauze piece was single-used. The researcher wiped from the inner canthus to the external canthus in one direction and disposed of several times until the eyelid and eyelashes were free from any sticky discharge. For better cleanliness, the previous ointment was removed from the eyes by using warm sterile water that helps in dissolving them well. During the procedure, the researcher assessed the eye for any redness, swelling, or discharge and considered an ophthalmology referral.

2-Ocular surface protection

-The same previously mentioned eye hygiene technique in addition to lubricating the eye and eye cover was used for ocular surface protection.

Eyes' Lubrication:

- Every 4 hours, the lubricant was applied to the lower eyelids by the researcher. the lower eyelid was Pulled down with a finger and 2cm of the ointment was into the cavity between the lid and the conjunctiva. Individual ointment-labeled tubes were used for each eye during eye lubrication to prevent cross-infection between the patient's eyes. The outside of the eye was clear of eye ointment, allowing the eye cover to be properly fastened.

Eye cover:

-The researcher covered the patients' eyes with transparent adhesive tape during the night shift and opened suction throughout the morning and evening shifts. A small transparent adhesive tape nearly 5-7 cm in length was applied horizontally from the epicanthus to the eyelid angle to prevent irritation to the skin and decrease the patient's and family's anxiety.

Ethical considerations:

After explaining the purpose of the study and the patient's right to decline participation and/or withdraw at any time, written informed permission was obtained from the patient. The patient's privacy was protected. During the study's performance, data confidentiality was ensured.

Statistical Analysis

Using the Statistical Package for Social Studies (SPSS) Version 20.0, the acquired data were processed, tabulated, and statistically evaluated. Numbers and percentages were used to describe qualitative data. The mean standard deviation was used to describe quantitative data. Finally, data analysis and interpretation were carried out. P-values of 0.05 or below were taken to be significant.

Results

Table 1 displays the sociodemographic, clinical data, and hemodynamic parameter

distributions of the two examined groups (Control & Study). In terms of all patients' sociodemographic, clinical data, and hemodynamic parameters, there were no statistically significant differences between the two groups.

Figure 1 displays the prevalence rates of ECs among the two studied groups throughout the study. It can be noted that the highest percentage of ECs was for eye discharge (80% of patients in the control group and 42% of patients in the study group). While the lowest percentage was for conjunctival injection (58%) of patients in the control group and 36% of patients in the study group). Additionally, the incidence of all eye complications was 84% of patients in the control group compared to 46% of the patients in the study group with a high significant difference ($p < 0.001$) between both studied groups.

Discussion

The eye is normally protected from dryness, infection, and injury by anatomical, physiological, and mechanical defensive mechanisms. Microorganisms, for example, are frequently flushed from the eyes, and tears are disseminated through the blink reflex to moisten the OS. These defensive systems become impaired in critically ill patients due to a variety of risk factors such as altered state of consciousness, sedation, and /or neuromuscular medications. Unfortunately, patients undergoing MV have a significantly increased risk of getting ECs. Furthermore, keeping the eyes open for an extended amount of time puts the patient in danger of corneal damage and infection. (Momen Mehrjardi, 2021; Algami,2018; Mobarez, 2022; Davoodabady,2018 & Kousha, 2018).

The current study's main findings revealed that implementing the nurse-led eye care protocol for mechanically ventilated patients resulted in a significant reduction in eye dryness, periorbital edema, conjunctival injection, and eye discharge among patients in the study group compared with the control group. Concerning eye dryness, this decrease may be linked to adequate moisturizing of the eye by regular eye lubrication and coverage of the exposed eye which decreases evaporation of tears and thus decrease dryness of the eye. The finding is congruent with the findings of the study that was conducted by **Mobarez et al. (2020).** They investigated the impact of an eye care protocol on the prevention of ocular surface disorders (OSDs) in ICU patients. They found that using an eye care protocol significantly reduced the incidence of eye dryness in the study group compared with the control group.

In relation to periorbital edema, the present study found that the occurrence of periorbital edema was significantly lower among the intervention group compared to the control group. These findings can be referred to improved drainage of excess fluid from the eye and reduced blood flow to the eye which is achieved by decreased inflammation and irritation of the eye (Mobarez,2021, Hearne et al. 2018 & Johnson,2021). The results of the current study are supported by **Pourghaffari Lahiji et al. (2021).** They found that periorbital edema decreased significantly among patients in the intervention group compared with the control group.

Pertaining to conjunctival injection, the decrease in its incidence in the study group may be attributed to covering the exposed eye, especially during open suction which can protect the eye from injury, infection and decrease the risk of eye inflammation, redness, and subsequent conjunctival injection. Moreover, decreased eye dryness can lessen eye inflammation and thus decrease the incidence of conjunctival injection (Azfar et al.,2013; Kousha,2018& Mobarez et al., 2021). The findings of the current study are consistent with the findings of **Mobarez et al. (2021**). Moreover, our

findings were matching with **Azfar et al. (2013)** who reported that the conjunctival injection decreased significantly among patients in the intervention group after the implementation of eye care protocol compared with the control group. **Contrary to the current study's results, Pourghaffari Lahiji et al. (2021)** evaluated the effect of the implementation of evidence-based eye care protocol for patients in the ICU on superficial eye disorders. They found that there was no significant difference between the control and intervention groups regarding conjunctival injection after implementation of the protocol.

In terms of eye discharge, the current study's findings depicted that the occurrence of eye discharge decreased significantly among patients in the intervention group compared to the control group. These findings could be attributed to wiping of the eye and removal of excess eye discharge regularly in addition to cleansing the eye with distal water instead of normal saline which may cause eye irritation and increase the risk for eye infection. Also, this decrease may be referred to following the steps of the ANNT technique before and during performing the procedure of eye care. (Davoodabady et al.2018; Kalhori et al. 2015&Ehsani et al.2015). The current study agrees with the findings of **Pourghaffari Lahiji et al. (2021).** They revealed that there was a significant decrease in the incidence of eye discharge among patients in the intervention group compared to the control group.

The findings of the current study revealed that the overall incidence of all ECs among patients in the intervention group was significantly lower than its incidence in the control group. The point of view for these results could be that adequate implementation of the nurse-led eye care protocol can produce an effective strategy for better delivery of care among critically ill patients. Additionally, patients can benefit from the advantages of more than one eye care method rather than depending only on one eye care method (Mobarez et al. (2020) &Kousha, (2018). These results are in accordance with the findings of Lucyna **Płaszewska-Żywko (2021).** They applied a protocol that included several methods of eye care together. It was shown that the use of more than one eye care method was associated with a lower number of ECs .

Moreover, the results of our study were in line with the findings of **Ahmadinejad et al. (2020).** They performed a study to compare the efficacy of simple eye ointment, polyethylene cover, and eyelid taping in the prevention of OSD among critically ill patients. They reported that the use of these eye care methods as a part of a systematic, targeted eye care program in the ICU, along with increased knowledge and empowerment of nurses can prevent OSDs and overall ECs in the ICU settings. They reported also that keeping the eyelids closed without using an eye moisturizer like an ointment wasn't considered a complete and effective eye care method.

Conclusion

Based on the current study's findings, it can be concluded that implementing a nurse-led eye care protocol greatly reduced the occurrence and severity of ECs including eye dryness, periorbital edema, conjunctival injection, and eye discharge.

Recommendations

Responding to the study's findings, the following recommendations have been proposed:

- Critical care nurses should be educated about the nurse-led eye care protocol.
- Nurse-led eye care protocols should be implemented by Critical care nurses.
- Provide ICUs with a concise illustrated brochure outlining the nurse-led eye care protocol.

Table (1) Distribution of Sociodemographic, Clinical Data, and Hemodynamic Parameters of the Two Studied Groups (Control & Study):

Variables	Control (n = 50)		Study (n = 50)		Test of sig.	P
	No.	%	No.	%		
Age in years						
18 – 39	7	14.0%	9	18.0%		
40-59	15	30.0%	6	12.0%	χ^2= 4.885	0.087
60+	28	56.0%	35	70.0%		
Mean ± SD	57.82±16.57		61.12±17.65		t = 0.964	0.337
Sex	**No.**	**%**	**No.**	**%**		
Male	29	58.0%	26	52.0%	χ^2= 0.364	0.546
Female	21	42.0%	24	48.0%		
GCS						
Mean ± SD	4.61± 1.35		4.35± 1.22		t =1.026	0.307
RASS						
Mean ± SD	-4.53 ± 0.40		-4.63 ± 0.38		t =1.313	0.192
Sedation	**No.**	**%**	**No.**	**%**		
Patients with sedation only	31	62.0%	24	48.0%	χ^2= 1.980	0.159
Patient with sedation and neuromuscular blockers	19	38.0%	26	52.0%		
APACHE score						
Mean ± SD	27.22± 4.85		28.54±4.95		t =1.346	0.181
CVP						
Mean ± SD	13.13±4.86		14.77±6.59		t =1.419	0.159
Reason for ICU admission	**No.**	**%**	**No.**	**%**		
Postoperative	15	30.0%	14	28.0%	χ^2= 0.049	0.826
Sepsis	15	30.0%	13	26.0%	χ^2= 0.198	0.656
Renal disorders	8	16.0%	10	20.0%	χ^2= 0.271	0.603
CNS disorders	9	18.0%	8	16.0%	χ^2= 0.071	0.790
Pulmonary disorders	8	16.0%	8	16.0%	χ^2= 0.0	1.000
Cardiac disorders	9	18.0%	9	18.0%	χ^2= 0.0	1.000
GIT disorders	6	12.0%	4	8.0%	χ^2= 0.444	0.505
RTA	8	16.0%	8	16.0%	χ^2=0.0	1.000
MV Mode						
SIMV	40	80.0%	39	78.0%		
AC	2	4.0%	0	0.0%	χ^2= 3.898	^{MC}p = 0.273
CMV	1	2.0%	3	6.0%		
PCAC	7	14.0%	8	16.0%		
PEEP						
Mean ± SD	5.19±0.38		5.36± 0.76		t = 1.475	0.145
Peak pressure						
Mean ± SD	24.89±3.80		25.74±1.73		t = 1.449	0.152
FIO_2						
Mean ± SD	66.14±11.08		67.63±6.86		t = 0.807	0.422
Hemodynamics						
Heart rate						
Mean ± SD	96.1±15.7		99.2±20.4		t = 0.856	0.394
Respiratory rate						
Mean ± SD	21.2±3.8		22.3±4.6		t = 1.399	0.165
Systolic Blood pressure						
Mean ± SD	119.2±20.7		118.4±19.8		t = 0.203	0.839
Diastolic Blood pressure						
Mean ± SD	74.4±11.5		73.7±11.6		t = 0.281	0.780
Temperature						
Mean ± SD	37.2±0.3		37.2±0.3		t = 1.332	0.186
SPO_2						
Mean ± SD	96.8±2.0		96.8±1.2		t = 0.090	0.928

Table (2): Comparison of the incidence rates of eye complications among the control and study groups throughout the study

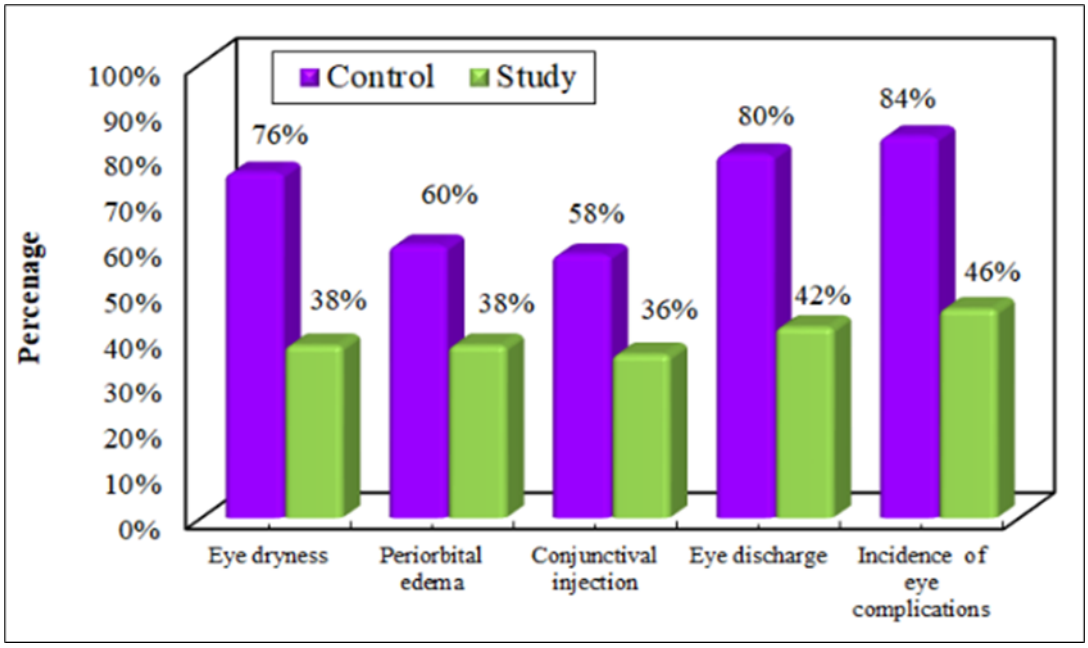

Figure (1): comparison of the incidence rates of eye complications among both groups throughout the study

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