Original Article

Knowledge and practice patterns of Intensive Care Unit nurses towards eye care in Chhattisgarh state

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Purpose: The aim of the study was to present the level of knowledge and practice patterns regarding exposure keratopathy in mechanically ventilated patients among Intensive Care Unit (ICU) nurses in Chhattisgarh state. **Methods:** A previously validated semi-structured questionnaire was administered in the ICU of six multispecialty hospitals in Chhattisgarh in 2014–2015. Demography included age, gender, level of education, and months of working in ICU. Most of the questions dealt with frequency of eyelid closure assessment, frequency of cleaning of eyes with saline gauze, using a protocol-based approach for eye care, and documentation of ophthalmic complications. Common barriers to delivery of eye care such as shortage of time and too much writing tasks were also inquired. **Results:** Our study included 120 nurses. They worked for mean 22.9 ± 17.8 months in ICU. Knowledge about high risk of exposure keratopathy in ventilated patient was present in 93% (78%; 95% confidence interval [CI]) nurses. Only six nurses (5%) followed a strict protocol for eye care, 52 nurses (43%) checked for eyelid closure in the ventilated patients, and 58 (48%) cleaned the eyes frequently. Those who were aware of exposure keratopathy checked eyelid closure (73% vs. 48%) and cleaned eyes with saline gauze more frequently (24% vs. 4%). Nurses in cardiac ICU were significantly lesser aware of exposure complications compared to medical ICU nurses (40% reduction in awareness, 95% CI = 0.37–0.98, $P = 0.04$). **Conclusion:** Although there is high awareness, practice patterns of ICU nurses were less than desired. Educational initiatives should focus on weaknesses in knowledge and practice noted to improve eye care of patients in ICU.

Key words: Chhattisgarh India, exposure keratopathy, eye care, Intensive Care Unit, knowledge, nurse, practice patterns

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Patients admitted to the Intensive Care Unit (ICU) in an unconscious or comatose condition and requiring mechanical ventilation are extremely susceptible to various comorbidities unrelated to their medical diagnosis such as bed sores, sepsis, aspiration pneumonia, and exposure keratopathy.[1-5] The incidence of exposure keratopathy varies from 3.6% to as high as 60% in these patients.[5] The exposure keratopathy is usually due to inadequate lid closure resulting in dryness of lower half of the cornea. In an ICU setting, exposure keratopathy is usually bilateral and if not tackled adequately, predisposes patients to infective keratitis. These infections are nosocomial and have widespread antibiotic resistance and they are difficult to treat. Various methods have been studied to prevent exposure keratopathy such as moisture chambers, lubricant eye drops, patching of the eyes, and polyethylene covers.[6-9]

The nurses and intensivists in the ICU cater to the specific needs to all those on mechanical ventilation. Hence, the knowledge of nurses regarding exposure-related ocular complications and the preventive strategies used are crucial to limit this condition. There have been some surveys to understand the knowledge, attitude, and pattern of nurses with respect to eye care in the past.[4,10-12] In addition, investigators have designed different types of educational programs to improve the awareness among nurses and reduce rates of exposure keratopathy.[12-14] In view of a large number of patients admitted to the ICU and limited number of ophthalmologists, it is impractical to expect routine eye examination for all such patients. However, nurses, when trained adequately, can screen for ocular complications and triage so that only those who need special ophthalmic care are referred to the ophthalmologists.[3,15]

The purpose of performing KAP surveys in specific domains such as ICU is to document the levels of knowledge and prevalent practices. This is the first study assessing the knowledge and practice patterns of ICU nurses regarding eye care from India which will help us to formulate the strategy to improve nurse's knowledge.

Methods

This was a cross-sectional study done to assess the knowledge and practice pattern of ICU nurses on eye care of unconscious mechanically ventilated patients. This study was conducted on a convenience sample of ICU nurses in six multispecialty hospitals of Chhattisgarh state, in and within 250 km of the capital city Raipur in 2014–2015. Only those nurses

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working in ICU for at least 6 months, having at least 1 year of nursing experience, and willing to participate in the study were included in the study. The study was approved by the Institutional Ethical Committee of the parent institution and informed consent was obtained from all the participating nurses. The study methodology and reporting is compliant with the COREQ guidelines.[16] The nurses were briefed about credentials of the principal investigator (PI) performing the study (SV) and were explained the nature and rationale of the study in a single session in each ICU by the PI. The printed questionnaires were handed out to the nurses by the ICU head nurse in each ICU and were collected back by the end of their shift. Before starting their response, nurses were informed that answering all questions was not mandatory.

The semi-structured questionnaire was based on the one published by Güler *et al*.[17] and was modified in-house for our current study. Questions regarding the barriers to eye care delivery were also incorporated into the questionnaire based on a study published by Mohammadi *et al*.[18] In the initial phase of questionnaire modification, based on the methodology of content analysis, nurses were asked open-ended questions for about 10–15 min about their eye care practices in the ICU by the PI. Field notes were taken, and the responses, along with input from key members of the ICU patient care team including physicians, senior nurses, and ophthalmologists from one of the participating hospitals, were compiled to create a modified questionnaire. This was administered to a pilot group of thirty nurses. Additional changes were made based on this pilot and were incorporated into the final questionnaire administered to the study participants. The questionnaire appeared to be easily understood and was finalized. The questionnaire was designed in English and translated into the local language (Hindi) by a language expert and then translated back into English to ensure that the meaning of the questions stayed the same. In the final questionnaire, questions were in both languages [Annexure 1].

The questionnaire was self-administered, and data were anonymously collected on the age, gender, level of education (diploma vs. degree in nursing), months of working in ICU, type of ICU they are working, and any special training taken for eye care in the past. Most of the questions were in yes/no format and the questions were about the frequency of eyelid closure assessment, frequency of cleaning of eyes with saline gauze, the nurses' beliefs about the goal of eye care, using a protocol-based approach for eye care, and documentation of ophthalmic complications. In addition, a list of ten essential nursing care activities (including tracheal suctioning, skin care, eye care, oral care, bowel care, writing reports, helping or doing personal hygiene for mechanically ventilated patients, care for catheters, nutrition, and preventing sensory overload) was inquired, and the nurses were required to rank these activities 1–10 based on priority of execution, with a higher rank indicating greater priority. Questionnaires were deemed to be incomplete if more than 5 questions were left unanswered by the nurses.

Statistical analysis

Continuous variables were expressed as mean with standard deviation or median with interquartile range (IQR) and group differences were analyzed using the Student's *t*-test or Wilcoxon rank-sum test. Categorical variables were expressed as proportions, and group differences were analyzed using Chi-square or Fischer's exact test. The sample was divided into two groups using the median of months of experience in the ICU and group differences analyzed. Similarly, group differences between diploma and degree holders and those aware of high risk for ocular surface disease versus not aware were analyzed. Based on the type of ICU nurses were divided into three groups: Medical ICU (MICU) is a unit providing acute care for critically ill medical patients, surgical ICU (SICU) is designated for care of critically ill surgical patients, and cardiac ICU (CICU) is a unit specialized in the care of patients with various cardiac conditions that require continuous monitoring and treatment. Factors influencing awareness of risk of exposure keratopathy were analyzed using logistic regression analysis and expressed as odds ratios with 95% confidence intervals (CIs).

All data were entered in excel and analyzed using STATA 12.0 (Stata Corp, Fort worth Texas, USA). $P < 0.05$ was considered statistically significant.

Results

We enrolled 120 nurses working in the ICU setting from six different hospitals during the study period. Responses were submitted by 128 nurses, of which 8 were found to be incomplete and were excluded from the analysis. The mean age of the participants was 25.1 ± 3.8 years (median = 24, IQR = 23–26 years) and 90 were female nurses (75%). Out of the 120, 85 (71%) were working at the MICU, 6 (5%) were at the SICU, and 29 (24%) were at the specialized cardiac care ICU. Sixty nurses (50%) had a diploma in nursing, 50 (42%) had a bachelor's degree, and 10 (8%) had a master's degree in nursing. Participants had an experience of 22.9 ± 17.8 months of working at the ICU (median = 18 months, IQR = 10–29.5 months).

Ninety-three nurses (78%) were aware that ventilated patients were at a high risk of exposure keratopathy. Out of them, 58 (63%) were able to enumerate exact nature of eye diseases that could occur on their unconscious patients. Only six nurses (5%) reported following a strict protocol for eye care, 52 nurses (43%) reported checking for eyelid closure in the ventilated patients, and 58 (48%) said that they cleaned the eyes with normal saline gauge. In addition, only 23 nurses reported cleaning eyes every 6 h and 38 (32%) reported instilling lubricating eye drops in those with inadequate eyelid closure. Half the nurses (n = 60) reported using eye tape in patients whose eyes were not closed completely. Thirty-six nurses (30%) reported taking some precaution to protect eyes (such as covering the eyes with gauze) while performing tracheal suction and only ten out of these reported keeping the suction tube away from eye. Overall, only 57 responded (48%) correctly when asked, "why you take care of eyes of patients under mechanical ventilation?" Finally, 49 nurses (41%) said that they did not refer patients to ophthalmologists, 44 (37%) said that they referred patients when required or when prompted by the intensivist at the ICU, 24 (20%) said that they referred to ophthalmologists once every day, and 3 (2.5%) said that they referred once every 3 days. Out of 10 possible activities, 9 nurses (8%) reported performing eye care as the first task. None of the nurses maintained a register to document eye problems encountered in their ICU. On inquiring barriers faced in the ICU to provide adequate eye care [Fig. 1], 36% nurses (n = 43) reported lack of time as the most common barrier.

On dividing nurses as per their ICU experience using the median value (18 months), we found that there were significantly more male nurses in the experienced group. There were no differences in the attitude and pattern of

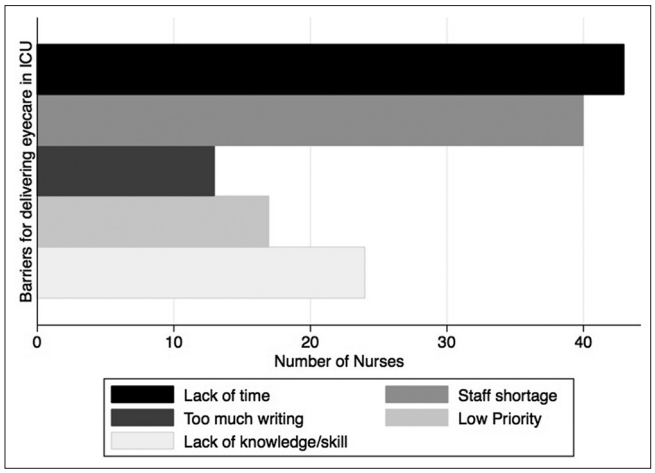

Figure 1: Number of nurses that said yes to barriers in eye care delivery in our study

delivering eye care in the two groups. However, those with lower experience cited a lack of adequate knowledge and skill about eye care in the ICU setting as a significant barrier for delivering eye care [Table 1]. On comparing those with a diploma versus degree in nursing [Table 2], we again found no significant differences in the attitude and pattern of delivering eye care in the two groups. However, a greater proportion of those with a nursing degree reported a lack of adequate knowledge and skill to deliver eye care.

On comparing those nurses aware ($n = 93$) of risk of exposure versus those unaware ($n = 27$), we found that [Table 3] those with greater awareness had significantly shorter experience of working in ICU and those working in the MICU had significantly greater awareness, whereas those in the CICU showed lesser awareness. In addition, we found that those who were aware of exposure-related complications check eyelid closure more frequently, greater proportion clean the eyes with saline-soaked gauze, and undertake this task more frequently compared to those who are unaware. Multivariable logistic regression analysis adjusting for experience and highest qualification, we found that [Table 4] CICU nurses were significantly lesser aware of exposure complications compared to MICU nurses (40% reduction in awareness in CICU nurses versus MICU nurses, 95% CI = 0.37–0.98, $P = 0.042$).

Discussion

Three-fourth of participating nurses were aware of exposure keratopathy and its associated sequelae in this cohort of nurses. However, almost none follow a protocol-based approach. Overall, only half the nurses checked eyelid closure and cleaned eyes with saline gauze and very few did it 6 hourly. However, those aware of the risk performed better in most parameters compared to those who were unaware. CICU nurses demonstrated least awareness. Finally, very few routinely referred their patients for ophthalmology consults and very few gave eye care the first priority while managing the comorbidities of their patients.

It was encouraging that, in a tier two city like Raipur, less than a quarter nurses responded by saying that they were unaware of the high potential for exposure keratopathy. However, the fact that only about 50% nurses checked eyelid closure and took steps to prevent exposure keratopathy as well as the lack of a protocol-based approach to eye care delivery suggests that the knowledge of risk has not influenced practice patterns of these nurses. Oh *et al*.[11] reported similar responses from a survey conducted in Korean nurses where only 42% reported providing eye care for their mechanically ventilated patients on a routine basis. Güler *et al*.[17] have reported higher proportions from Turkey and Palestine (70% overall). Hence, we find a lot of variability in the practice patterns of nurses across the globe, despite the heightened knowledge.

Table 1: A comparison between those with lower versus higher experience

Variable	Lower experience (*n*=49)	Higher experience (*n*=71)	*P*
Age	24.3±4.1	25.5±3.4	0.09
Gender (percentage males)	8 (16)	22 (31)	0.05
Experience (months)	9.2±2.3	32.3±17.7	-
ICU setting, *n* (%)			
Medical ICU	33 (67)	52 (73)	0.76
Surgical ICU	3 (6)	3 (4)	
Cardiac ICU	13 (27)	16 (23)	
Nursing qualification, *n* (%)			
Diploma	25 (47)	35 (38)	0.12
BSc nursing	23 (51)	27 (49)	
MSc nursing	1 (2)	9 (13)	
Questionnaire responses (*n*, % nurse's response as yes)			
Are ICU patients are higher risk of xerosis and exposure keratopathy?	41 (84)	52 (73)	0.18
Do you have eye care protocol	2 (4)	4 (6)	0.70
Is eyelid closure assessed in your ICU?	17 (35)	35 (49)	0.11
Do you clean eyes with normal saline gauze?	26 (53)	32 (45)	0.39
Do you use lubricating eye drops in patients?	18 (37)	20 (28)	0.32
Do you use eye tape in those with incomplete closure?	23 (47)	37 (52)	0.57
Do you take special precautions during tracheal suction	16 (33)	20 (28)	0.59
Routine referral to ophthalmologist	10 (20)	14 (19)	0.73
Eye care as first priority	2 (4)	7 (10)	0.10
Barriers for delivering eye care in ICU (*n*, % nurse's response as yes)			
Lack of time	19 (39)	24 (34)	0.57
Shortage of staff	12 (24)	28 (39)	0.09
Too much writing/ documentation	6 (12)	7 (10)	0.68
Low priority	7 (14)	10 (14)	0.97
Lack of knowledge and skill regarding eye care	14 (29)	10 (14)	0.05

ICU: Intensive Care Unit

Table 2: A comparison between those with diploma versus degree in nursing

Variable	Diploma (*n*=60)	Degree (*n*=60)	*P*
Age	24.6±4.1	25.4±3.4	0.23
Gender (percentage males)	6 (10)	24 (40)	<0.001
Experience (months)	21±13.7	24.8±21.1	0.50
ICU setting, *n* (%)			
Medical ICU	36 (60)	49 (82)	0.005
Surgical ICU	2 (3)	4 (7)	
Cardiac ICU	22 (37)	7 (12)	
Questionnaire responses (*n*, % nurse's response as yes)			
Are ICU patients are higher risk of xerosis and exposure keratopathy?	43 (71)	50 (83)	0.13
Do you have eye care protocol	3 (5)	3 (5)	0.99
Is eyelid closure assessed in your ICU?	29 (48)	23 (38)	0.27
Do you clean eyes with normal saline gauze?	32 (53)	26 (43)	0.27
Do you use lubricating eye drops in patients?	22 (37)	16 (27)	0.24
Do you use eye tape in those with incomplete closure?	30 (50)	30 (50)	0.99
Do you take special precautions during tracheal suction	20 (33)	16 (27)	0.43
Routine referral to ophthalmologist	13 (22)	11 (18)	0.25
Eye care as first priority	5 (8)	4 (7)	0.37
Barriers for delivering eye care in ICU (*n*, % nurse's response as yes)			
Lack of time	20 (33)	23 (38)	0.57
Shortage of staff	21 (35)	19 (32)	0.70
Too much writing/ documentation	5 (8)	8 (13)	0.38
Low priority	8 (13)	9 (15)	0.79
Lack of knowledge and skill regarding eye care	7 (12)	17 (28)	0.022

ICU: Intensive Care Unit

Table 3: A comparison between those aware of risk of exposure versus don't not aware

Variable	Not aware (*n*=27)	Aware (*n*=93)	*P*
Age	25.07±2.5	25.1±4.1	0.35
Gender (percentage males)	8 (30)	22 (24)	0.53
Experience (months)	27.7±16	21.5±18	0.02
ICU setting, *n* (%)			
Medical ICU	14 (52)	71 (76)	0.03
Surgical ICU	3 (11)	3 (3)	
Cardiac ICU	10 (37)	19 (20)	
Nursing qualification, *n* (%)			
Diploma	7 (26)	43 (46)	0.17
BSc nursing	14 (63)	43 (46)	
MSc nursing	3 (11)	7 (8)	
Questionnaire responses (*n*, % nurse's response as yes)			
Do you have eye care protocol	2 (7)	4 (4)	0.51
Is eyelid closure assessed 6 h in your ICU?	13 (48)	68 (73)	0.02
Do you clean eyes with normal saline gauze?	13 (48)	45 (48)	0.98
If yes, do you clean 6 h?	1 (4)	22 (24)	0.02
Do you use lubricating eye drops in patients?	7 (26)	31 (33)	0.46
Do you use eye tape in those with incomplete closure?	13 (48)	47 (50)	0.83
Do you suction away from eyes during tracheal suction?	0	10 (11)	0.07
Routine referral to ophthalmologist	5 (18)	19 (20)	0.64
Eye care as first priority	3 (11)	6 (7)	0.71
Barriers for delivering eye care in ICU (*n*, % nurse's response as yes)			
Lack of time	7 (26)	36 (39)	0.22
Shortage of staff	8 (30)	32 (34)	0.64
Too much writing/ documentation	0	13 (14)	0.04
Low priority	1 (3)	16 (17)	0.08
Lack of knowledge and skill regarding eye care	2 (7)	22 (24)	0.07

ICU: Intensive Care Unit

Those with awareness about exposure keratopathy checked eyelid closure more frequently, instilled lubricant drops, and cleaned eyes with saline-soaked gauze more frequently than those without awareness. This signifies that improving awareness in nurses may lead to improved eye care delivery in comatose patients on mechanical ventilation. Demirel *et al*.[13] described a simple and easy eye care protocol, including eye cleaning with saline, application of topical antibiotic or lubricant, and closing the eyes with vertical thin adhesive tape in detected cases of lagophthalmos. For proper follow-up in lagophthalmos, the authors emphasized that the eye should not be covered with a sponge and the blink reflex should be followed routinely. They trained 260 ICU nurses on this protocol and found a significant reduction in the rates of exposure keratopathy in the subsequent period posttraining. Similarly, Fashafsheh *et al*.[14] also described a checklist-based approach in 35 nurses and found a statistically significant difference in the total knowledge scores regarding eye care of unconscious mechanically ventilated patients. Hence, creating protocols and checklists can improve the nurse's knowledge and influence their practices to improve eye care delivery.

We found some important barriers in delivering eye care in our ICU settings. Whereas lack of time was the most common barrier cited, shortage of trained workforce and lack of adequate knowledge and skill were also cited commonly by the participating nurses. Cunningham and Gould[7] concluded that patients would benefit from the implementation and audit of guidelines for eye care, but before these innovations are undertaken, barriers to good

Table 4: Univariate and Multivariable logistic regression to identify factors indicative of a greater awareness of exposure related complications

Variable	Interval	Univariate regression		Multivariable regression	
		OR	95% CI	OR	95% CI
Age	1-year increment	1.00	0.9-1.1	-	-
Gender	Female versus male	1.35	0.5-3.5	-	-
Experience in ICU	1-month increment	0.98	0.9-1.0	0.98	0.9-1.1
Department	Cardiac ICU versus MICU	0.59**	0.4-0.9	0.61**	0.4-0.9
Qualification	Diploma versus degree	0.41*	0.2-1.1	0.64	0.3-1.4

*P<0.1, **P<0.05. CI: Confidence interval, ICU: Intensive Care Unit, MICU: Medical ICU, OR: Odds ratio

practice should be explored in ICUs. With knowledge of these operational barriers, we can design strategies to better utilize the time of nurses so that more time is made available for patient care in general and eye care in particular. As highlighted before, providing a structured training program may also help nurses perform better with respect to eye care.

We found that nurses in the CICU had much lower levels of knowledge and awareness regarding increased risk of exposure keratopathy compared to nurses in the MICU. The experience in the ICU and the type of degree did not influence awareness levels significantly. It is possible that CICU nurses are extremely focused on the cardiac status of their mechanically ventilated patients and thus are not concentrating on the eye health of their patients. It may be prudent to focus attention and increase awareness among this subgroup of nurses. Indeed, nurses in specialty ICU settings may be less aware about eye care than those in general MICU settings. It would be interesting to explore this hypothesis further and compare the KAP results among general and specialty ICU nurses.

The limitations of the study are the use of a semi-structured questionnaire. Recently, a structured questionnaire with psychometric analysis has been published for this purpose and future authors would do well to use this.[19] Lack of data on the incidence of exposure keratopathy in the participating ICUs is another limitation. The strength of the study was the participation of a relatively large number of nurses. To the best of our knowledge, this is the first such study assessing the knowledge and practice patterns of ICU nurses regarding eye care from India.

Conclusion

The awareness about the risk of exposure keratopathy is quite high in ICU nurses in our settings. Greater awareness translates into marginally better practices, but we find that knowledge of risk has not influenced practice patterns to make significant clinical impacts. Simple educational initiatives and awareness programs coupled with a protocol-based approach are required to improve the knowledge of nurses in our settings. CICU nurses and probably specialty ICU nurses should be targeted the most as they lack sufficient knowledge and have poor practice patterns toward eye care.

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Conflicts of interest

There are no conflicts of interest.

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Annexure

Annexure 1: Questionnaire used in the study.

This questionnaire is designed to assess your opinions in eye care for patients under mechanical ventilation. Please answer the questions or select the items best in accordance with your practice.

Gender: Female ☐ Male ☐

Age ☐ Years ☐

Years of working in ICU ☐ years Department…….

What is your highest qualification?

Nursing diploma ☐ B.sc., nursing ☐

Msc nursing ☐ others ☐ (Please specify)……

Are you trained specially in eye care?

No (I am not specially trained in eye care) ☐

Yes (I am specially trained in eye care) ☐

If yes, please specify where you trained in eye care for patients under mechanical ventilation.

At university as a nursing student ☐

In hospital while continuing education programs ☐

1. Patients in ICU are at high risk of developing eye complications? ☐ YES ☐ NO
2. If yes what are the common eye problems in ICU patients? .....
3. Do you have an eye care protocol or policy for unconscious patients? ☐ YES ☐ NO
4. Is eyelid closure assessed in your ventilated, sedated patients? ☐ YES ☐ NO
5. If YES how often in a day?. .... times.
6. Do you clean the eyes of ICU patients with normal saline gauge? ☐ YES ☐ NO
7. If yes how often in a day?.....times.
8. Do you use lubricating eye drops in patients who cannot close their eyes? ☐ YES ☐ NO
9. Do you use eye tape in patients whose eyes are not closed completely? ☐ YES ☐ NO
10. Do you take any special precaution for eye care during tracheal suction? ☐ YES ☐ NO
11. If yes what precaution you take?.....
12. Please tick why you take care of eyes of patients under mechanical ventilation?

    To provide comfort to the patients ☐

    To prevent dryness of eye ☐
13. On average, how often would you refer to an ophthalmologist?.....
14. If you had to give an estimate, how many ocular complications have you had in the last year?.....
15. What is the last eye complication you or your colleagues have encountered?.....
16. Do you keep a register/audit of eye problems? ☐ YES ☐ NO
17. Please tick what is the most common barrier for providing eye care in patients of ICU?

Number	Barriers	
1.	Lack of time	☐
2.	Staff shortage	☐
3.	Too much writing tasks	☐
4.	Having a low importance	☐
5.	Lack of knowledge and skill	☐

18. What is the sequence for nursing care in ICU? (Like which procedure you will do first and which one in last)

Number	Nursing care	Rank
1	Tracheal suctioning	☐
2	Eye care	☐
3	Oral care	☐
4	Bowel care	☐
5	Writing reports	☐
6	Helping or doing personal hygiene	☐
7	Care for catheters	☐
8	Nutrition	☐
9	Preventing sensory overload	☐
10	Skin care	☐

Thank you for your participation