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Effectiveness of Ear Plugs in Enhancing Comfort and Sleep among Critically Ill Patients

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Abstract: ***Noise can be defined as any unwanted or undesirable sound which is subjectively annoying or disrupts performance and is physiologically and psychologically stressful. Sleep deprivation due to nursing interventions and ambient noise can be more disturbing for patients in intensive care units (ICUs), which can exacerbate confusion and ICU-related delirium. The study adopted quantitative research approach to assess the effectiveness of ear plugs in enhancing comfort and sleep among the critically ill patients. A Pre and Post test Experimental design was adopted for the study. The population chosen was critically ill patients admitted in Medical Intensive Care Unit of a tertiary care hospital. A total of 80 samples (40 experimental, 40 control) were selected using simple random sampling technique. The data was collected using a questionnaire to assess the sources of noise and Likert scale to assess the level of comfort and sleep using interview technique. Effectiveness of the ear plugs was assessed using paired t- test, and was found to be statistically significant at (p<0.001). Study findings support the use of ear plugs as a non- pharmacological measure that significantly enhances comfort and sleep among patients in the Intensive care units.***

Keywords: Noise, comfort, sleep, ear plug, critically ill patients

1. Introduction

Noise can be defined as any unwanted or undesirable sound which is subjectively annoying or disrupts performance and is physiologically and psychologically stressful. Noise can be continuous, fluctuating or intermittent (Al-Tarawneh et al., 2020). Sleep deprivation due to nursing interventions and ambient noise can be more disturbing for patients in intensive care units (ICUs), which can exacerbate confusion and ICU-related delirium. According to the World Health Organization (WHO) the average hospital sound levels should not exceed 35 dB with a maximum of 40 dB overnight (Darbyshire & Young, 2013). Studies have reported that noise in ICUs frequently exceed the average noise level of 60-70 dB (A) with peaks over 90dB (A) (Wenham & Pittard, 2009). Sleep deprivation is a major problem in the ICU and the effects of sleep deprivation on physiologic and immune function should also be taken into consideration, which has been associated with the ICU syndrome. Though multiple factors interfere with sleep in the ICU, noise has been implicated as the single most significant cause of sleep disruption in the ICU. Effective means of controlling noise and sensory overload in ICU patients must be developed. Non pharmacologic options to enhance sleep should be considered in all ICUs (Schwab, 1994). The use of non-pharmacological sleep-promoting interventions (earplugs) may have a beneficial effect on subjectively perceived sleep quality.

Equipment alarms, loud personnel conversations, screams of other patients, telephones and television, etc are identified as some of the major sources of noise in the critical care units. It is necessary to implement organizational measures to reduce noise, in order to achieve and maintain quality sleep. Sleep promotion strategies include non-pharmacological nursing interventions. Four major domains of the described strategy can be identified: reduction of noise, reduction of light, clustering nursing activities and increasing the patient's comfort (Locihová et al., 2018). Associations between various noise parameters and subjective sleep quality were found in this multicenter study, confirming the negative consequences of noise on the sleep quality in ICU patients and thereby strengthening the usefulness of noise-reducing strategies (Simons et al., 2018).

In nursing practice, there are a number of other alternative techniques available to achieve the highest possible sleep quality in an ICU. Alternative and complementary practices in patient care are becoming increasingly important in both the non-professional and professional community, where a particular role is beginning to be attributed to them according to the principles of evidence-based medicine (EBM). The most important non-pharmacological sleep-promoting strategies that can be used in an ICU include music therapy, aromatherapy, acupressure, massage, phototherapy, relaxation and the integration of hygiene protocol of sleep care (Hu et al., 2015).

Medical equipment like monitors, ventilator alarms cannot be set at low volume since it is meant to detect immediate or life threatening danger that requires prompt attention. Hence using ear plugs on the conscious critically ill patient may help to control the constant exposure to noise within the critical care unit. This study was intended to help identify the causes of noise pollution and the levels of comfort and sleep of patients in a critical care unit. Findings will contribute to a new initiative of using ear plugs to enhance rest, comfort and sleep among critically ill patients.

2. Objective

- To identify sources of noise in the Medical Intensive Care Unit.
- To evaluate the effectiveness of ear plugs among the critically ill patients in experimental and control group.
- To find an association between level of comfort and sleep with selected demographic and clinical variables.

3. Methods

The study adopted qualitative research approach to assess the effectiveness of ear plugs in enhancing comfort and sleep among the critically ill patients. A Pre and Post test Experimental design was adopted for the study. The

population chosen was critically ill patients admitted in Medical Intensive Care Unit of a tertiary care hospital. A total of 80 samples (40 experimental, 40 control) were selected using simple random sampling technique. The data collection tool consists of two parts. The first part assessed the demographic details of the subjects such as age, gender, diagnosis and number of days in ICU. The second part was the tool had two sections which were collected by interview technique. Section (A) of the tool was the dichotomous questionnaire which has 12 items to assess the sources of noise. A score of 1 was given for 'yes' response and a score of 0 was given to 'No' response and was interpreted as follows:

Multiple sources of noise : > 75%
Moderate sources of noise : 50% - 74%
Minimal sources of noise : < 49%

Section (B) of the tool comprised of a rating scale to assess the comfort and sleep among ICU patients. It is an opinionaire with 5 point Likert scale consisting of 14 items with positive and negative statements that was administered pre and post intervention. Lower the scores better the adequacy of comfort and sleep. Final scoring was converted into percentages and categorized as follows:

Adequate --- < 49%
Moderately adequate --- 50% - 74%
Inadequate --- >75%

Content validity was obtained from Medical and Nursing experts in the field.

4. Data Collection

Formal permissions were obtained from the Nursing Superintendent and HOD's of Medical Nursing and MICU. Verbal informed consent was taken from patients since they had IV infusions on both hands. The investigator selected the subjects using simple random sampling technique. Lots were picked from those who fulfilled the inclusion criteria and randomized into experiment and control group. On the second day, Part II, section (A) questionnaire and Part II (B) rating scale was administered to the subjects to assess the source of noise and rating scale to assess the comfort and sleep. For the experimental group the investigator explained about the technique of applying the ear plugs and instructed to use it during the rest period between 9 pm to 5 am and whenever needed. Assigned staff nurses were also trained in the technique so they would ensure that patients used the ear plugs at night. On third day, the same questionnaire and rating scale was administered to both groups.

5. Results and Discussion

The collected data were organized, tabulated and analyzed based on the objectives of the study using descriptive statistics i.e., percentage and mean to calculate source of noise, while inferential statistics was used to determine the effectiveness of the intervention.

Table 1: Demographic variables of subjects (n= 80)

Demographic variables	N	%
Age (yrs) (mean± SD)		50.68±17.42
< 25	6	7.5
26 – 50	31	38.75
51 - 75	35	43.75
>75	8	10
Sex		
Male	47	58.8
Female	33	41.3
Diagnosis		
Poisoning	10	12.5
ARDS	7	8.8
Pneumonia	8	10
Pyelonephritis	8	10
CKD	7	8.8
DKA	5	6.3
Septic shock	7	8.8
Febrile Neutropenia	8	10
Others	20	25
No of days in ICU		
2	52	65
3	26	32.5
4	2	2.5

It is evident from Table 1 that majority (43.75%) of the subjects were between the age of 51to 75 years with mean and standard deviation of 50.68±17.42. Among the 80 subjects, 58.8 % of them were males. The clinical profile denoted that 12.5 % of them were diagnosed to have poisoning, followed by 10% each for Pneumonia, Pyelonephritis and Neutropenia while 65% of them spent two days stay in the ICU.

Table 2: Sources of noise in the ICU, (n=80)

Sources of noise in the ICU	Yes		No	
	N	%	N	%
Call bell	39	48.75	41	51.25
Telephone	40	50	40	50
Monitor	74	92.5	6	7.5
Ventilator	68	85	12	15
Health care personnel	36	45	44	55
Hand dryer	60	75	20	25
Trolley	14	17.5	66	82.5
Side rail	44	55	36	45
Screen	49	61.25	31	38.75
Printer (n=49)	25	51.02	24	48.98
Visitor	7	8.75	73	91.25
Infusion pumps	5	6.25	75	93.75
Total	461	49.62325	468	50.37675

Table 2 reveals that majority (92.5%) of the subjects expressed that they were most frequently disturbed due to noise from the monitor. A study conducted by Dabyshire et al., (2013) also reported that there was a clear indication that much loud sound originated from physiological monitors and ventilators sited near patients' ears.

Table 3: Overall categorization of the sources of noise in the ICU, (n= 80)

Sources of noise	n	%
Multiple sources of noise	7	8.8
Many sources of noise	35	43.8
Minimal sources of noise	38	47.5

The above table shows that 47.5% of the subjects experienced minimal sources of noise in the ICU.

Table 4: Effectiveness of ear plugs in enhancing comfort and sleep among control and experimental group (n=80)

Variables		Mean ± SD	't' value	'p' value	CI
Comfort	Control	8.93±2.22	21.31	<0.001*	(7.68, 9.26)
	Experimental	0.45±1.17			
Sleep	Control	13.88±3.46	21.44	<0.001*	(11.68, 14.07)
	Experimental	1.00±1.55			

*p = <0.001

Table 4 reveals that the use of ear plug has been statistically significant (p<0.001) in enhancing comfort and sleep among patients in the Intensive care units. The study conducted by (Demoule et al., 2017) also had reported similar findings which revealed that earplugs and eye mask reduce long awakenings and increase N3 duration when they were well tolerated. A randomized controlled trial conducted by (Van Rompaey et al., 2012) also support the study findings which revealed that after the first night in the ICU, patients sleeping with earplugs reported a better sleep perception. An American experimental study (Wallace et al., 1999) confirmed that the use of earplugs reduced rapid eye movement (REM) latency significantly [(mean) without intervention, 147.8 min, confer (cf.) mean after intervention 106.7 min, P = 0.02] and increased the percentage of REM sleep statistically significantly (14.9% without intervention, cf. 19.9% with intervention, p = 0.04). The Chinese experimental study (Huang et al., 2015) confirmed a statistically significant reduction in sleep onset latency (71.4 min 25.6, cf. 46.6 min 21.6, P = 0.01) when applying the examined intervention (earplugs and mask), lower number of awakenings and a lower number of awake reactions per hour. Another experimental Chinese study (Hu et al., 2015) confirmed the use of earplugs and eye masks to increase the percentage of REM sleep statistically significantly (9.3% 4.3 without intervention, cf. 12.9 4.3% with intervention, p = 0.005).

Systematic reviews and meta analysis conducted by Locihova et al., (2018) revealed that the observed non-pharmacological interventions (earplugs and eye mask) may have a positive effect on the subjective sleep quality of patients in an ICU.

Table 5: Association of level of sleep with selected demographic and clinical variables (n=80)

Demographic variables	No	%	Level of comfort						Chi-Square Value	p-value
			Adequate comfort		Moderate comfort		Inadequate comfort			
			No	%	No	%	no	%		
Age in years										
<25	6	7.5	6	7.5	0	0	0	0	2.267	.519
26-50	31	38.75	26	32.5	5	6.25	0	0		
51-75	37	46.25	33	41.25	4	5	0	0		
>76	6	7.5	6	7.5	0	0	0	0		
Gender										
Male	47	58.75	44	55	3	3.75	0	0	2.745	.253
Female	33	41.25	27	33.75	6	7.5	0	0		
No of days in ICU										
2	52	65	9	11.25	41	51.25	2	2.5	2.571	. 276
3	26	32.5	7	8.75	18	22.5	1	1.25		
4	2	2.5	1	1.25	1	1.25	0	0		

Findings in Table 5 denote that there is no significant association between the level of comfort with selected demographic and clinical variables.

Table 6: Association of level of sleep with selected demographic and clinical variables, (n=80)

Demographic variables	*Total*		*Level of sleep*						*Chi-Square Value*	*p- value*
			Adequate sleep		Moderate sleep		Inadequate sleep			
	No	%	No	%	No	%	No	%		
Age in years										
<25	6	7.5	3	3.75	3	3.75	0	0	3.865	. 695
26-50	31	38.75	6	7.5	24	30	1	1.25		
51-75	37	46.25	7	8.75	28	35	2	2.5		
>76	6	7.5	1	1.25	5	6.25	0	0		
Gender										
Male	47	58.75	12	15	34	42.5	1	1.25	5.282	.260
Female	33	41.25	5	6.25	26	32.5	2	2.5		
No of days in ICU										
2	52	65	9	11.25	41	51.25	2	2	2.014	.733
3	26	32.5	7	8.75	18	22.5	1	3		
4	2	2.5	1	1.25	1	1.25	0	4		

The study findings reveal that there is no significant association between the level of sleep with selected demographic and clinical variables.

6. Conclusion

Lack of sleep and comfort of adequate quality and duration in an ICU, is a significant negative factor affecting the quality of provided care. However, at present, literary works agree on the importance of non-pharmacological strategies used for inducing sleep in ICUs. This study has revealed that the use of ear plugs was effective in enhancing comfort and sleep among the patients. Interventions improving the quality of sleep could affect the global critical care and outcome of ICU survivors and should be a part of good-quality clinical practice in the future.

References

[1] Darbyshire, J. L., & Young, J. D. (2013). An investigation of sound levels on intensive care units with reference to the WHO guidelines. *Critical Care*, *17*(5), R187. https://doi.org/10.1186/cc12870

[2] Demoule, A., Carreira, S., Lavault, S., Pallanca, O., Morawiec, E., Mayaux, J., Arnulf, I., & Similowski, T. (2017). Impact of earplugs and eye mask on sleep in critically ill patients: A prospective randomized study. *Critical Care (London, England)*, *21*(1), 284. https://doi.org/10.1186/s13054-017-1865-0

[3] Hu, R.-F., Jiang, X.-Y., Hegadoren, K. M., & Zhang, Y.-H. (2015). Effects of earplugs and eye masks combined with relaxing music on sleep, melatonin and cortisol levels in ICU patients: A randomized controlled trial. *Critical Care (London, England)*, *19*, 115. https://doi.org/10.1186/s13054-015-0855-3

[4] Huang, H.-W., Zheng, B.-L., Jiang, L., Lin, Z.-T., Zhang, G.-B., Shen, L., & Xi, X.-M. (2015). Effect of oral melatonin and wearing earplugs and eye masks on nocturnal sleep in healthy subjects in a simulated intensive care unit environment: Which might be a more promising strategy for ICU sleep deprivation? *Critical Care (London, England)*, *19*, 124. https://doi.org/10.1186/s13054-015-0842-8

[5] Locihová, H., Axmann, K., Padyšáková, H., & Fejfar, J. (2018). Effect of the use of earplugs and eye mask on the quality of sleep in intensive care patients: A systematic review. *Journal of Sleep Research*, *27*(3), e12607. https://doi.org/10.1111/jsr.12607

[6] Schwab, R. J. (1994). Disturbances of sleep in the intensive care unit. *Critical Care Clinics*, *10*(4), 681–694.

[7] Simons, K. S., Verweij, E., Lemmens, P. M. C., Jelfs, S., Park, M., Spronk, P. E., Sonneveld, J. P. C., Feijen, H.-M., van der Steen, M. S., Kohlrausch, A. G., van den Boogaard, M., & de Jager, C. P. C. (2018). Noise in the intensive care unit and its influence on sleep quality: A multicenter observational study in Dutch intensive care units. *Critical Care*, *22*(1), 250. https://doi.org/10.1186/s13054-018-2182-y

[8] Van Rompaey, B., Elseviers, M. M., Van Drom, W., Fromont, V., & Jorens, P. G. (2012). The effect of earplugs during the night on the onset of delirium and sleep perception: A randomized controlled trial in intensive care patients. *Critical Care (London, England)*, *16*(3), R73. https://doi.org/10.1186/cc11330

[9] Wallace, C. J., Robins, J., Alvord, L. S., & Walker, J. M. (1999). The effect of earplugs on sleep measures during exposure to simulated intensive care unit noise. *American Journal of Critical Care: An Official Publication, American Association of Critical-Care Nurses*, *8*(4), 210–219.

[10] Wenham, T., & Pittard, A. (2009). Intensive care unit environment. *Continuing Education in Anaesthesia Critical Care & Pain*, *9*(6), 178–183. https://doi.org/10.1093/bjaceaccp/mkp036