Effect of Noise Control Methods on Physiological Stability and Comfort of Preterm Babies Admitted in NICU

***Anju. P. Shaju, **Shreeja Vijayan, ***Dr Gouri Rao Passi, ****Rakhi Chandel**

Abstract

More and more infants with birth weight less than 1000 grams are surviving in India in tertiary care centres, but they all have a long stay in the NICU. The treatment of high-risk neonates admitted to neonatal intensive care units (NICU) requires a quiet environment in addition to capable professionals and appropriate equipment. The main objective of the study was to compare the effectiveness of two noise control methods (sound sensing light alarm and ear muff) on physiological stability and comfort of preterm babies admitted in NICU.A quasi-experimental one group pre-test post test research design was adopted in the study. The assessment of physiological stability and comfort of preterm babies was carried out by monitoring 3 parameters (heart rate, respiratory rate and oxygen saturation) and using modified comfort alert scale by **Razmus and Clarke (2004)** respectively. The findings of the study concluded that both methods (sound sensing light alarm and ear muff) are effective but ear muff method is more effective while comparing both the methods.

Keywords: Noise control, Physiological stability, Comfort, Effectiveness, Preterm babies, Sound sensing light alarm, Ear muff

Background

Premature babies are very fragile and need to cope with their environment with immature organ systems. Their auditory, visual, and central nervous systems are the last systems to mature. These last stages of development occur, in part, during the time the premature baby is in the incubator or NICU. Many researches and surveys have documented that noise levels in NICUs, are reported to be above acceptable levels**.** The American Academy of Paediatrics, Committee on Environmental Health, recommends a maximum safe noise level of 45 dB in a NICU. (**American academy of paediatrics, 1997)**[1]

Need of the Study & Literature Review

India holds second place for higher incidence (28%) of preterm babies among SEAR countries**(UNICEF 2009)**[2]. They need special care ideally an in-utero environment has to provide for babies in NICU. **(Sudha Chaudhari, 2011)**[3] It has been recognized that high noise levels exist in the NICUs. It impacts negatively both in physiological and in behavioural aspects in the baby.

Tainara Milbradt Weich et al. (2011)[4] conducted an experimental study at Brazil to evaluate the effectiveness of a noise control program in the Neonatal Intensive Care Unit. The sample size was 40 healthcare professionals. Information leaflets were distributed and posters were installed to educate healthcare professionals about the harmful effects of noise on neonates. Investigator assessed the noise level of their NICU (43- 114dB). Result showed that 71.5% of the healthcare professionals admitted that their own behaviour generated noise. 97.67% of the healthcare professionals believed that reducing noise levels was possible. After the educational program, 78.5% of the respondents began speaking more quietly. The study concluded that noise control program was considered to be successful because healthcare professionals took greater care to prevent their professional behaviour from causing unnecessary noise.

** MNS officer, Army Hospital(R& R), Delhi. Mob. 09818294255 Email: anjupshaju@gmail.com*

Modification of the environment could minimize the iatrogenic effects. Developmental care is a broad category of interventions designed to minimize the stress of the NICU environment. These interventions may include elements such as control of external stimuli (vestibular, auditory, visual, tactile), clustering of nursery care activities, and positioning or swaddling of the preterm infant. Individual strategies have also been combined to form programs, such as the 'Newborn Individualized Developmental Care and Assessment Program' (NIDCAP) **(Symington A J 2009)[5].**

Investigator during her clinical posting in NICU noticed that the babies are getting continuous sleep disturbance due to the noise created by conversation between health care workers and alarms from equipments. Normally, anewborn baby sleeps around 20hrs/day. But due to continuous sleep disturbance in babies in NICU leads to irritability, excessive crying, excessive energy consumption, fatigue as compared to babies with their mothers. Also, it has been noticed that noise disturbance causes short term physiological changes like increased heart rate, respiratory rate and decreased oxygen saturation level in babies especially during cleaning time, rounds time, handing over and emergency situations in NICU.

While attending one national conference regarding innovations in NICU in tertiary care settings, the Investigator got the idea of introducing sound sensing light alarm to alert the health care workers to reducing the noise level. As the investigator went through more reviews she found out that applying ear muff is also effective direct method of reducing noise to babies and which is being used in most of hospitals in developed countries.

Problem Statement

A study to compare the effectiveness of two noise control methods on physiological stability and comfort of preterm babies admitted in NICU in selected hospital of Indore.

Objectives

To assess the baseline physiological status and comfort of preterm babies before noise control in group I (noise control using sound sensing light alarm)and group II (Noise control method using earmuff).

To determine the physiological stability and comfort of preterm babies after noise control using sound sensing light alarm in group I.

To assess the physiological stability and comfort of preterm babies after noise control using ear muff in group II.

To find out significant difference on the effect of noise control on physiological stability and comfort of preterm babies in group I and group II.

Hypotheses

H1: There is significant effect of noise control on physiological stability and comfort of preterm babies using sound sensing light alarm at $p \leq 0.05$.

H2: There is significant effect of noise control on physiological stability and comfort of preterm babies using ear muffs at $p \leq 0.05$.

H3: There is significant difference in the effect of noise control on physiological stability and comfort of preterm babies between group I, and group II at $p \leq 0.05$.

Methodology

Research Design: Quasi experimental research, two groups pre-test post test design.

Setting: The study was conducted at NICU of Choithram Hospital & Research Center, Manik Bagh Road Indore.

Population: The preterm babies between 30-37 weeks of gestation who are admitted in Neonatal intensive care unit

Sample and sample size: The sample consisted of 30 preterm babies, 15 each in Experimental group I and Experimental group II who were admitted in NICU for preterm care or phototherapy.

Sampling technique: Samples were selected through non probability purposive sampling technique.

Tool: The tools used in this study are:

Section A: Base line data

Section B: Physiological parameters observation data chart

Section C: Assessment of comfort using adapted comfort alert scale by Razmus and clarke (2004)

Validity & Reliability: The developed tools along with objectives were sent to 7 experts in the field of nursing and their valuable suggestions were incorporated.

The tool was tested for reliability by using rater-inter-rater method. The researcher and researcher's colleague checked the 4 parameters (heart rate, respiratory rate, oxygen saturation and comfort level) in each respondent simultaneously at same time. The correlation was found to be significant at r = 0.9

Certificate for reliability of sound sensing light alarm was given by the company Secure Electronics Reg. No: 1333839(Estd. 1991), Kerala.

Data Collection Procedure : Written permission was obtained from the administrative authority of the hospital prior to the data collection.

The study was conducted on 30 preterm babies (15 in each experimental group-I and experimental group-II) who were admitted for preterm care and phototherapy in NICU at selected hospital of Indore.

For Experimental Group-I a sound sensing light alarm [This device is a sound monitoring system designed to alerting the noise levels through light alarms if it exceeds the recommended level of 45db. The device functions as, sound below 45db display green light(which shows safe sound level), 45-55db display yellow light (giving a warning to reduce sound level), 55-65 db red light and if sound exceeds above 65db machine alarmed as 'keep quiet'] is placed centrally in the room. Healthcare workers made aware about this machine function and instruct them to talk in low voice and also reduced the alarm volume of all equipments in NICU during post test. Pre-test 5 observations for each parameter (Heart rate, respiratory rate, O_2 saturation and comfort level) were being taken before placing this machine on day 1. Then after placing this machine 5 observations were taken in the next two consecutive days, and mean value of these observations was taken as post test. The time interval between each observation was 4 hours from 6 am to 10 pm for both pre test and post test.

Sound Sensing **Ear Muff**

Light Alarm

In Experimental Group II, autoclaved ear muff [Ear covering pad made up of woollen material used to protect the preterm baby from excessive noise exposure] placed for the selected samples. Here no modifications was done in environment, all health workers were talking and functioning as routine. Before placing the ear muff 5 observations for each parameter taken as pre-test in day 1. Then after placing the ear muff 5 observations were taken in the next two consecutive days, and mean value of these observations was taken as post test. The time interval between each observation is 4 hours from 6 am to 10 pm for both pre test and post test.

Findings

Section I: Baseline data of the preterm babies

Findings of the study depicted that, majority 8 (53%) of babies in both group I and II belonged to 30-33wks of gestational age. Most of the babies in group I 9(60%) were female, in group II 8 (53%) were male babies. In both groups majority of babies in group I- 10 (66%) and in group II 11(73%) had the APGAR score 7-10. In group I majority of the babies 7 (46%) were with birth weight between 1501-2000, while in group II 7(46%) had birth weight 1000-1500. All the babies were fed by breast milk while the method used were different. In group I maximum babies 6 (40%) were equally fed by direct breast feed and katori spoon feed whereas in group II majority 8 (53%) by katori spoon feed method. Startle reflex waspresent for all babies in both group I and II.

Section II: Mean difference values of 4 parameters in group I (sound sensing light alarm)

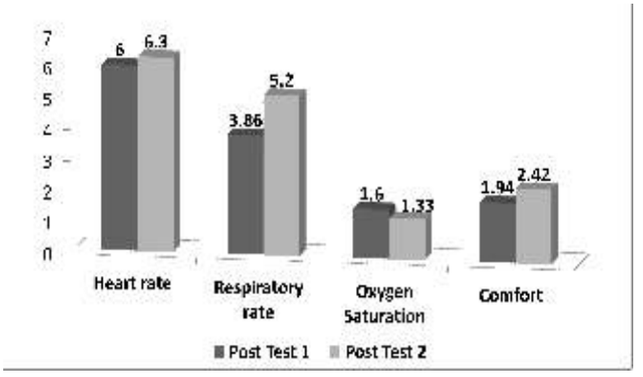

Figure 1: column diagram shows Mean difference values of 4 parameters in group I

The findings revealed that there was a significant difference in the physiological status and comfort between pre-test and posttest1 & post test 2, but there was no significant difference shown between post test 1 and post-test 2 for all parameters. This indicate that the noise control method using sound sensing light alarm is effective and which helps babies to become stable..

Section II: Mean difference values of 4 parameters in group II (ear-muff).

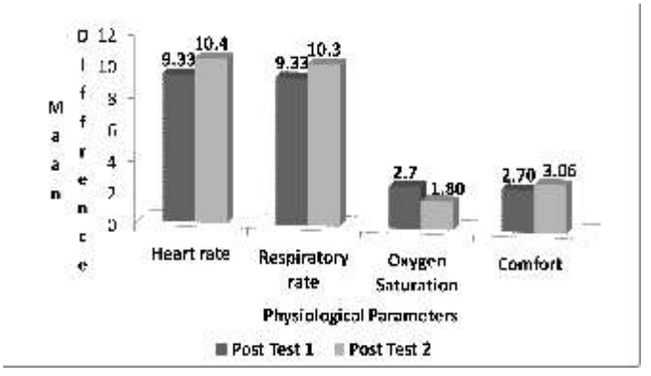

Figure 2: Cylindrical diagram shows Mean difference values of 4 parameters in group II

The findings reveal that there was a significant difference in the physiological status and comfort between pre-test and posttest1 and post test 2 , but there is no significant difference shown between post test 1 and post-test 2 for all the parameters except comfort level. This indicates that the noise control method using ear muff is effective and which helps babies to become stable.

Section-III :Comparison of mean comfort level of pre-test, post-test 1 and post test 2 between group I and group II.

Table 01: Comparison of mean comfort level of pre-test, post-test 1 and post-test 2 between group I and group II n1=15, n2= 15

Comfort	Mean	Mean diff.	SD	SE	df	t value
Pre test						
GROUP I	4.92	0.04	0.77	0.28	28	0.143 NS
GROUP II	4.88		0.76			
Post test 1						
GROUP I	2.98	0.81	0.87	0.25	28	3.170**
GROUP II	2.18		0.44			
Post test 2						
GROUP I	2.506	0.68	0.65	0.208	28	3.296**
GROUP II	1.82		0.479			

P≤0.05* p≤0.01 p≤0.001*** NS- Not Significant**

Data presented in this table shows that the mean pre-test comfort level in group I was 4.92 while in group II mean pre-test was 4.88, mean difference was 0.04 and the computed t_{28} value was 0.143, which shows that there was no significant difference in mean pre test comfort level between group I &II at the level of p≤0.05 and it also reveals the homogeneity in both the groups. Whereas in post test 1 the mean respiratory rate in 69 group I was 2.98 and in group II was 2.18, mean difference was 0.81 and computed t_{28} value was 3.170 which shows a significant difference at the level of p≤0.01 . Similarly in post test 2 the mean comfort level in group I was 2.506 and in group II was 1.82, mean difference was 0.68 and the computed t_{28} value was 3.296 which shows a significant difference at the level of p≤0.01. The computed t_{28} value of post test 1 and post test 2 for group I and II shows statistically significant at the level p≤0.01.

Section IV: Comparison of physiological status and comfort of pretest, post test1 and post test 2 between group-I &II.

Table 02: Comparison of mean heart rate of pre-test, post-test 1 and post-test 2 between group I and group II n1=15, n2= 15

Comfort	Mean	Mean diff.	SD	SE	df	t value
Pre-test						
GROUP I	148.27	0.133	4.83	1.55	28	0.932 NS
GROUP II	148.13		3.58			
Post-test 1						
GROUP I	142.27	3.47	3.53	1.12	28	3.108**
GROUP II	138.80		2.48			
Post-test 2						
GROUP I	141.93	4.20	1.42	1.27	28	3.283**
GROUP II	137.73		1.37			

p≤0.05* p≤0.01 p≤0.001*** NS- Not Significant**

Data presented in table no.02 shows that the mean pre-test heart rate in group I was 148.27 while in group II was 148.13, mean difference was 0.133 and the computed t_{28} value was 0.932, which shows that there was no significant difference in mean pre test heart rate between group I &II at the level of p≤0.05 and it also reveals the homogeneity in both the groups. Whereas in post test 1 the mean heart rate in group I was 142.27 and in group II was 138.80, mean difference was 3.47 and computed t_{28} value was 3.108 which shows a significant difference at the level of p≤0.01 . Similarly in post test 2 the mean heart rate in group I was 141.93 and in group II was 137.73, mean difference was 4.20 and the computed t_{28} value was 3.282 which shows a significant difference at the level of p≤0.01. The computed t_{28} value of post test 1 and post test 2 for group I and II shows statistically significant in mean at the level p≤0.01.

Discussion

Results revealed that in group-I the comparison of pre-test with post-test-1 of heart rate, respiratory rate, oxygen saturation & comfort level, the computed t values were 5.196, 4.276, 6.287 & 6.737 and similarly in comparison of pre-test with posttest-2 of heart rate, respiratory rate, oxygen saturation & comfort level, the computed t values were 6.254, 4.121, 5.73 & 10.56 respectively. These findings show a significant difference in comparison of both pre-test with post-test-1 and post test-2 at the level p=0.05 which can interpret that the noise control method using sound sensing light alarm is effective and helps babies to become stable if the staff deliberately take action to decrease noise production. These findings were supported by the study findings of **Chang Y J et al. (2006)**[6] which showed the mean reduction of sound level and episodes of sudden peak noise frequencies in the NICUafter using a noise-sensor light alarm at the level t = 8.619; p≤0.001

With regard to group-II the comparison of pre-test with post-test-1 of heart rate, respiratory rate, oxygen saturation & comfort level, the computed t values were 8.122, 6.528, 7.549 & 13.43 and similarly in comparison of pre-test with post-test 2 of heart rate, respiratory rate, oxygen saturation & comfort level, the computed t values were 11.309, 7.684, 5.077 & 3.384 respectively. Thus findings show a significant difference in comparison of both pre-test with post-test-1 and post test-2 at the level p≤0.05 can interprets that the noise control method using ear muff was found effective and which helps babies to become stable.

These findings were consistent with the study done by **Zahr LK and Traversay J (1995)**[7] which showed that when infants wore the earmuffs, they had significantly higher mean oxygen saturation levels and less fluctuation in oxygen saturation at p≤0.001.

In comparison between group-I and group-II of post test-1 there was a significant difference in heart rate, respiratory rate, oxygen saturation and comfort level with computed 't_{28}' values 3.108, 3.420, 3.350 & 3.170; again in post test 2 also there was a significant difference in heart rate, respiratory rate, oxygen saturation and comfort level with computed 't_{28}' values 3.282, 4.47, 4.480 & 3.296 respectively at the level p≤0.05. Thus the findings reveal that ear muff method of noise control is more effective than sound sensing light alarm.

Conclusion

As unfavourable environment in the NICU can affect infants negatively, it is needed to minimize the stress of the NICU environment by controlling the external stimuli in the form of noise so as to ensure a more comfortable and healthy environment to babies. The present study concluded that both noise control methods (sound sensing light alarm and ear muff) are effective but ear muff method is more effective while comparing both the methods. Thus present study recommends application of these methods in clinical setting.

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