The influence of incubator coating on the oxygen saturation percentage of arterial blood of premature neonates admitted to neonatal intensive care

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Keypoints

In this study, incubator cover improved O_2 saturation of premature neonates hospitalized in neonatal intensive care units and stable of oxygenation.

Abstract

Introduction

Nutrition problems in premature infants occur due to malformations and lack of coordination between sucking, swallowing, and breathing, and premature infants usually require neonatal intensive care unit care. This study was designed to evaluate the effect of incubator cover on the arterial O_2 saturation of premature infants admitted to neonatal intensive care unit.

Keywords

Material and Methods

This quasi-experimental study was performed on 70 neonates admitted to NICU of Ali Ibn Abi Talib Hospital in Zahedan who were randomly assigned into incubator cover (n=35) and control (n=35) groups. Intervention was performed in the intervention group by dark cloth with one side dark and the other side light. After intervention, infants' arterial O_2 saturation was assessed. Data were analyzed using SPSS software version 16 and t test and Chi-square test.

Results

The mean of O_2 saturation of neonates in the incubator group was 95.8 ± 0.6% and control 93.1± 1.1%. Results of t test showed mean of O_2 saturation of neonates in the incubator group was significantly higher than control group (P <0.001).

Conclusion

In this study, incubator cover improved O_2 saturation of premature neonates hospitalized in neonatal intensive care units and stable of oxygenation.

Keywords

Incubator cover, Arterial O_2 Saturation, Premature infant

Introduction

Although medical science has made many progress, but the birth rate of premature neonates is still increasing, and from 8% to 10% of childbirths are labor premature (1). Worldwide more than 15 million premature neonates are born each year. Almost half-million babies born in the US each year that are born at less than 37 weeks, many of whom are transferred to the neonatal intensive care unit (2). Although premature neonates birth is a global problem, but in low-income countries the rate of premature neonates' birth is higher. Iran is among the countries with high premature neonates' birth rates (3). Oxygenation status stability is one of the important issues in these neonates, the main purpose of admission the premature infants in ICU is to assist in achieving stability and complete physiological function(4). Most neonates in the intensive care unit are hospitalized in a favorable heat setting and are monitored for physiological parameters including temperature, heart rate, respiratory rate, blood pressure and oxygen saturation (5). The optimal oxygen saturation level for infants is from 85 to 95% and normal heart rate is from 120 to 160 bpm (6). Many premature neonates have not physiologically well-grew and have more physiological problems compared to healthy and mature neonates. body temperature fluctuations, the presence of a flexible chest, lung (7) and an underdeveloped respiratory center make premature neonates unable to breathe effectively (8). therefore, it makes periodic respiratory resonance, hypoventilation, and repeated and longer periods of apnea. Very poor cardiac sphincter tonus stimulates chemical and bradycardic receptors and increases the risk of aspiration(9). Thus, premature neonates are susceptible to many physiological disorders such as bradycardia, hypotension, cardiac disorders and apnea (7). On the other side, premature neonates undergo physiological changes such as increased heart rate, blood pressure and respiration caused by environmental stress. Also, the nervous system of premature neonates is vulnerable (10) because the brain and their central nervous system are undergoing the fastest developmental phase that occurs in the third trimester of the embryo instead of within the uterus in the ectopic environment (11). Evolutionary care or supportive care of evolution is One of the nursing interventions that first introduced by Ales (12). And it is the care that provides the right environment for the baby to grow in the out of the womb. The goal of evolutionary care is to improve the status of the development and to have favorable evolutionary consequences in the future. breastfeeding is recommended in this method, and helps to protect the neonate against the pain caused by painful stimulation (13). The US Institute of Health Care Quality Improvement, based on the TQM evolutionary care model, has introduced 5 key areas for the most comprehensive evolutionary care model in neonate intensive care units that includes: Sleep care (considering the sleep and wakefulness cycle and providing family education about neonate sleep care and recording it), management and evaluation of pain and stress (use of pain evaluation tools and non-pharmacological pain control techniques at the time of treatment method performing and family education), usual and daily care (nutrition, skin care and sleeping status of neonate), family-based care (unlimited parental appointment program, entrust neonate care, hug care and ongoing interactions between parents and neonate), and providing a healthy environment in the neonate intensive care unit (Light and sound control, group collaboration). The purpose of these evolutionary care is to preserve neonates' energy for growth, maintain physiological stability and facilitate its neonate recovery (14). The environment in which neonates are placed after birth should be similar to that of the uterus. There is a lot of noise and light in the ward and it is very different from the prenatal environment. While light in the womb is low. The US Academy of Medicine have suggested that the light level in neonate ward should be adjusted from 600 to 10 lux and light level changes more than 600-900 lux will damages brain and activity of heart rate and biological rhythm of premature neonate, causing disorder of sleep and nutrition, disruption in weight gain and inattention to the surroundings. Hence, all premature neonates' equipment should be covered so that light does not damage the neonate's eyes and brain. This study was done to compare the influence of breast milk odor and incubator coating on the percentage of arterial oxygen saturation in premature neonates of neonates' intensive care unit of this hospital in 2018.

Material and Methods

This semi-experimental study was performed by two groups (incubator and control) and in neonate intensive care unit of Ali ibn Abi-Talib Hospital in Zahedan, in 2018. The sample consisted of 70 neonates admitted to the above mentioned medical center that had inclusion criteria including fetal age of 30-34 weeks, birth weight 1500 - 2200 g, Apgar score above 6 of fifth minutes, no congenital abnormalities, no head and face abnormalities, oral feeding and no asphyxia and exclusion criteria included neonate death, exacerbation of neonate problems, and other acute illnesses during the study and the neonate's parents' unwillingness to continue to participate in the study for any reason. After obtaining permission from the University Ethics Committee, sampling was done in coordination with the relevant authorities of Ali ibn Abi-Talib Hospital in Mashhad. Neonates were randomly assigned to one of two groups (35 person).

The characteristics used in this study included demographic and medical profile form (including 5 questions about fetal age, gender, height, weight, Apgar score) and arterial oxygen saturation percentage registration form. This form was designed by the researcher to record the status of neonate oxygenation; its unit is percentage and a higher percentage of arterial oxygen saturation means better oxygenation in infants.10 experts confirmed this specification through content validity and test-retest confirmed the reliability of the oxygenation record form. During the baseline study, this form was completed for 20 neonates in both study groups (10 each) and after 10 days the form was completed again for the same 20 patients. Then its reliability was assessed using Pearson correlation coefficient which was confirmed by r = 0.82.

intervention of the incubator coating was performed at one turn and two hours before neonate feeding. Neonate breastfeeding intervals were determined according to the physician's instructions, which differed based on the neonate admission status and varied from two to six hours. The volume of milk given to neonates is the same as that prescribed by a doctor.

In the intervention group, the coating of incubator was placed on the incubator two hours before the intervention that one side was dark and the other side was light and was open in the middle so that the neonate color can be seen and evaluated, the neonate was attached to a SAADAT monitor that the probe was connected to the right hand of the neonate, and the oxygen saturation percentage was recorded and then checked that the neonate be awakened. neonate was connected to the monitor in the control group and oxygen saturation was recorded before neonate feeding. In the post-intervention step, the oxygen saturation percentage of neonate was again recorded in both groups by use of a researcher-made form of arterial oxygen saturation of neonate. The data were entered into the computer after data collection and coding and after obtaining data entry accuracy, SPSS software version 16 and descriptive statistics and independent T-test, Mann-Whitney and chi-square tests were used to summarize and analyze the data.

Results

Based on the Mann-Whitney test, there is no significant difference between the mean neonate embryonic age of the incubator coating group (31.0 ± 1.3) and the control group (31.2 ± 1.3) (p = 0.308). Table 1 shows other demographic characteristics of participant neonate and their homogeneity in both groups. also, based on the results of Pearson correlation coefficient, there was no statistically significant relationship between the individual neonate variables and the percentage of arterial blood oxygen saturation (p>0.05).

Table 1. Comparison of demographic and medical characteristics of neonate studied in two study groups. *: Chi square, **: T independent

	Variable	Incubator coating	Control	Test result
gender	Female	14 (40/0)	15 (42/9)	*p=0/763
	Male	21 (60/0)	20 (57/1)	
height (cm)	Average± Standard deviation	43/0 ± 2/3	42/6 ± 2/2	**p=0/468
(g) weight	Average± Standard deviation	± 63/1 1446/9	± 60/2 144/6 4	**p=0/967
Apgar	Average± Standard deviation	8/9 ± 0/5	8/9 ± 0/2	**p=0/201

In the pre-intervention phase, the mean neonate arterial oxygen saturation percentage was not significantly different between neonate, incubator and control groups (p = 0.537). In the post-intervention phase, the mean neonate arterial oxygen saturation was higher in the incubation group than in the control group. According to the independent T-test after the intervention, there is a significant difference between the average arterial oxygen saturation percentage of neonate in the two groups of incubator and control (p <0.001) (Table 2).

Table 2. Comparison of average neonate arterial oxygen saturation percentage in both groups

Independent t-result	control Average± Standard deviation	Incubator coating Average± Standard deviation	arterial oxygen saturation percentage (%)
p=0/537	93/1±1/0	93/1±1/2	**Pre-intervention**
p<0/001	93/1±1/1	95/0±8/6	**Post-intervention**
p<0/001	-0/0±02/1	2/1±7/2	**Pre-intervention and post-intervention difference**
	p=0/875	p<0/001	**Paired T-test result**

Figure 1 also shows the improvement in the mean neonate arterial oxygen saturation percentage in the incubation group compared to the control group.

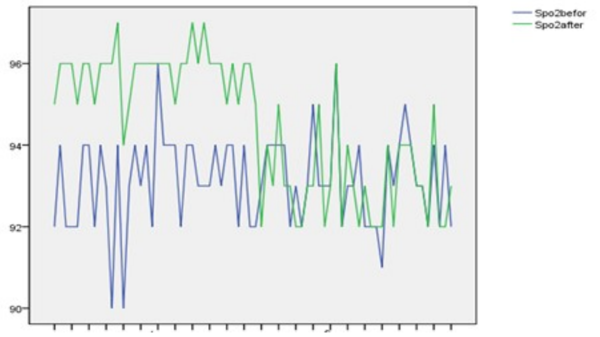

Figure 1. Comparison of neonate arterial oxygen saturation percentage in both under study groups

Discussion

Based on the results of the present study, in the post-intervention step, the mean saturation percentage of neonates' arterial oxygen was higher in the incubator group than in the control group. Although the present study is the first study in order to determine the influence of incubator coating on the mean saturation percentage of neonate arterial blood oxygen in Iran and other countries, but it is closest to studies. A study by Nourian et al. (2009) was done to "Compare the effect of two methods of kangaroo care and conventional care (incubator care) on physiological criteria of low weight neonate") and results showed that both caring methods (kangaroo and incubator) lead to the stabilization of arterial blood oxygen saturation (15). A study by Seyyed Rasouli et al. (2009) was conducted to show "comparison of physiological indices of premature neonate in two methods of kangaroo and conventional (incubator)" and according to the results of this study, the oxygen saturation percentage of arterial blood of the two methods is similar (16). The results of these studies are also in line with the results of the present study, because the incubator and its coverage can help to regulate neonates' biological rhythm and stabilize their hemodynamic status. Naderi and Goodarzi (2014) also conducted a study "to compare the mother and neonate hugging to conventional incubator care of premature neonates in speed up the achievement of discharge indices" and the result of this study showed that the mean percentage of neonate arterial oxygen saturation in the two groups was not significantly different, in other words, the effect of incubator care had the same effect on the oxygenation status of premature neonates (17). The result of study by Reyhani et al (2014) also showed that artificial night creation (using incubator coating) had a positive effect on stabilizing the physiological status of premature neonates and has a positive effect on creating the right environment to help the neonate grow better and prevent the complications of being premature the incubator coating (18). The results of above studies are consistent with the results of the present study. Possible causes of in lining can be the effects of incubator coating on the stability of neonates' hemodynamic status. Although incubation coverage has been used in the present study, but neonate mother is involved in both interventions and due to increased interaction between mother and neonate, close association, prevention of stress, coldness and providing adequate oxygenation can have positive effects on neonate oxygen saturation; hence, in all of the above studies and also in the present study, there was a stability and improvement of oxygenation status of premature neonates. Being single-centered (conducting research in one ward of one hospital) was one of the limitations of this study that should be more cautious and generalized in future studies and should be considered in future studies.

Conclusion

Since incubator coating had a positive influence on premature neonates' oxygenation in the present study, therefore, this non-pharmacological nursing intervention is effective, safe and cost effective and aims to reduce costs, reduce referral, control disease, and involve The neonate family is in the process of care. However, it is suggested to carry out further studies.

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Conflicts of Interest

The authors of the paper state that there are no conflicts of interest in the present study.

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