Journal of Pediatric Nursing xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Pediatric Nursing

Effects of Covering the Eyes versus Playing Intrauterine Sounds on Premature Infants' Pain and Physiological Parameters during Venipuncture

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ARTICLE INFO

Article history:
Received 20 January 2017
Revised 23 June 2017
Accepted 24 June 2017
Available online xxxx

Keywords:
Preterm infants
Intrauterine sounds
Covering eyes
Venipuncture
Pain
Physiological parameters

ABSTRACT

Background: There is a need to assess the impact of initiatives to reduce exposure to environmental light and sound in preterm infants undergoing painful interventions in neonatal intensive care units.
Objectives: In this study, we aimed to identify the effect of covering the eyes and playing the intrauterine ambient sounds on premature infants' pain and physiological parameters during venipuncture.
Methods: This was a randomized controlled trial. Ninety-four preterm infants were randomly divided into three groups: intrauterine sounds (n = 32), covered eyes (n = 32), and control (n = 30) groups. Data were collected on the Preterm Infant Information Form, Preterm Infant Follow-up Form, and Neonatal Infant Pain Scale (NIPS), used to assess pain.
Results: A significant difference was found between the intervention and control groups' NIPS score after venipuncture, which was primarily due to covered eyes' group. No significant difference was found between the intervention and control groups' NIPS score during venipuncture. In addition, no significant difference was found between the intervention and control groups of infants physiological parameters before, during, and after venipuncture. The practice of covering preterm infants' eyes during venipuncture positively affected their pain scores after venipuncture.
Clinical Implications: The effect of covering the eyes and playing the intrauterine ambient sounds in preterm infants may be recommended as simple, safe, and supportive stimuli that facilitate positive effects during painful procedures.

Introduction

The development of sensory organs in the fetus begins during the prenatal period in the following sequence: tactile, vestibular, chemical, auditory, and visual development (Kisilevsky et al., 2009; Lickliter, 2011). The early sensory experiences of the fetus in the intrauterine period are essential for normal brain development (Ramachandran & Dutta, 2013; Reid & Freer, 2010). Neonatal intensive care units (NICUs) aim to sustain the lives of infants who leave this environment prematurely. However, preterm infants are exposed to unfamiliar stimuli in the NICU and are deprived of intrauterine sensory experiences (Ramachandran & Dutta, 2013; Reid & Freer, 2010; Vandenberg, 2007). There have been tremendous developments in the medical field to sustain the life of preterm infants. Despite this, developmental disorders have been observed in preterm infants such as neurological disorders, permanent learning and behavioral disorders, decreased motor skills, as well as an increase in other developmental disorders has been observed (Özdemir & Tüfekci, 2014; Vandenberg, 2007). This has highlighted the necessity of developmental support approaches, which should focus on supporting the development of preterm infants during and after the intensive care process in the NICU. These arrangements include reducing the stressful stimuli and increasing the stimuli that supports development, based on observations of the infant's physiological responses and behaviors to various stimuli (Eras, Atay, Şakrucu, Bingöler, & Dilmen, 2013; Reid & Freer, 2010).

Hearing is the ability to distinguish sounds at various frequencies, intensities, and duration. Fetuses respond to auditory stimuli (e.g., maternal voice) with spontaneous movements as early as the 27th gestational week (Kisilevsky et al., 2009). In the uterus, fetuses are familiar with sounds of uterine blood flow, bowel movements, maternal heartbeat, mother's voice, and sounds synchronized with her body movement (Krueger, 2010). Exposure to high volume stimuli in the NICU is a major problem for preterm infants who are separated from the intrauterine environment, which is their ideal environment for the proper development of their auditory sense. Furthermore, excessive noises and higher volumes cause some sound-related physiological and behavioral changes, and may lead to hearing loss in preterm infants (Eras et al., 2013; Sizun & Westrup, 2004; Vandenberg, 2007). Because of unwanted noise in the NICU, physiological reactions such as changes in

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http://dx.doi.org/10.1016/j.pedn.2017.06.016
0882-5963/

heart rate, oxygen saturation levels, blood pressure, intracranial pressure, and corticosteroid hormones, as well as stress behaviors such as fatigue, excessive stimulation, and startling have been observed (Chen et al., 2009; Standley, 2001).

Therefore, the recommended sound level in the NICU is ≤50 dB (Eras et al., 2013; Reid & Freer, 2010). To achieve this, the following recommendations can be implemented: use only the flashing alarms instead of noisy alarms; silence the sound-based alarms immediately; and avoid conversation at the infant's bedside. In addition, the sound levels in the NICU should be checked regularly, noise prevention programs should be developed, and the staff should be trained on this issue regularly (Küçük, 2015; Ramachandran & Dutta, 2013).

The visual system is the last of the sensory organs to develop, and the visual function becomes mature in the 39–40th gestational week. Ambient light has a direct impact on the infant's visual ability, physiological stability, and organization of the central nervous system. It is reported that the visual environment in the NICU reduces infants' visual activity, causes problems with visual processing, and changes visual attention–perception, visual memory, and visual identification (Eras et al., 2013; Reid & Freer, 2010). Although the maximum light intensity recommended for the NICU is 646 lx, the light intensity inside the NICUs easily reach 600–900 lx (Küçük, 2015). Therefore, various initiatives can be undertaken to reduce the negative effects of light intensity. For example, intermittent lighting is reported to cause a reduction in an infant's heart rate; strengthens the biological rhythm; and increases restful sleep, nutrition, weight gain, and the infants' attention to its surroundings (Küçük, 2015; Ramachandran & Dutta, 2013; Reid & Freer, 2010). It is recommended that infants be shielded from direct light, other than for interventions and procedures, such as covering the equipment with light in the NICU, reducing the incubator light by veiling, and applying pads on closed eyes. In addition, the light levels at certain times of the day should be changed to provide a day–night cycle (light intensity of 300–580 lx during the day and 30 lx at night) and support the infants' REM sleep (Eras et al., 2013; Küçük, 2015; Sizun & Westrup, 2004; Vandenberg, 2007;).

Preterm infants are frequently exposed to painful procedures during the first days of their life in NICU. Painful procedures such as venipuncture adversely affects the infants physiological parameters, comfort, sleep, development, and the length of hospital stay; hence, proposing methods that calm newborn infants is necessary (Anand, 2007; Grunau et al., 2005). Reducing pain and stress in preterm infants is an important issue in the NICU (Symington & Pinelli, 2006). Many pharmacological and non-pharmacological interventions are used to reduce pain in invasive methods. High-frequency sounds cause disturbance in neonates, whereas low-frequency rhythmic sounds have a calming effect. Music therapy intervention in the NICU has the potential to sedate, train, and support neurological development and to reduce stress, balance the heart rate and breathing, accelerate growth, and shorten the duration of hospital stay (Reid & Freer, 2010). Auditory stimulation effectively distracts a baby and provides a pain control and cognitive strategy to suppress the pain response (Gfeller, 2003; Hartling et al., 2009; Kemper & Danhauer, 2005; Kisilevsky et al., 2009; Reid & Freer, 2010; Standley, 2001). However, in the intrauterine period, infants mostly hear maternal heart sounds. Therefore, infants will remember their secure environment as soon as they hear these sounds, and this will help to create a sense of relief in these infants (Panagiotidis & Lahav, 2010). Previous studies have found that soothing music (Hartling et al., 2009; Standley, 2003) and maternal sounds (Cevasco, 2008; Krueger, Parker, Chiu, & Theriaque, 2010; Panagiotidis & Lahav, 2010) are beneficial in NICU incubators. This concept has generally been accepted as a sign of the infants antenatal sensitivity to the music (Cevasco, 2008; Eras et al., 2013; Standley, 2001). In addition, it is reported that reducing the lights at certain hours of the day causes a reduction in the infants heart rate and activities, strengthens the biological rhythm, increases restful sleep, improves nutrition, and leads to weight gain and increased attention of the infant to his/her surrounding (Eras et al., 2013; Vandenberg, 2007). Attempts to reduce light in the NICU setting are important to ensure developmental support and safe care for preterm infants. The provision of a day and night cycle contributes to the growth and development of the newborn, and helps to regulate vital signs and cycles of activity and rest (Küçük, 2015; Ramachandran & Dutta, 2013). There is a need for NICU individualized developmental care practices that assess the impact of initiatives to reduce exposure to environmental light and sound in preterm infants who undergo painful interventions. Therefore, in this intervention study, we aimed to identify the effects of covering the eyes and playing intrauterine sounds on pain and physiological parameters in preterm infants during venipuncture.

Methods

This was a randomized controlled trial. The study population comprised preterm infants who underwent treatment and care in the NICU of a state hospital between October 2014 and August 2015. On the other hand, the sample of the study consisted of 143 preterm infants meeting the case selection criteria and infants were randomly assigned to each group. However, due to the infants excluded from the study, total number of the infants in all the groups was 94 (32 infants in intrauterine sounds group, 32 infants in covered eyes group, 30 infants in control group) (Fig. 1). Randomization was performed by using a computer program. As a result of post hoc power analysis, the power was determined as 0.94 with the risk of $\beta = 0.20$ and $\alpha = 0.05$ at significance level of 0.05 for 94 preterm infants. Preterm infants born between 28th and 36th gestational week participated in this study. Exclusion criteria were congenital anomalies or genetic disorders requiring surgery and a 5-min Apgar score of less than six. At the time of data collection, participants were excluded if they underwent phototherapy, respiratory support, or any pharmacological or non-pharmacological pain reliever 4 h prior to the procedure.

Participants

We found no statistically significant differences between the preterm infants in the control and intervention groups in terms of gender; gestational age; birth weight, height, and head circumference; diet; 5-min Apgar score, and diagnosis ($p > 0.05$, Table 1) indicating that the intervention and control groups were identical with respect to aforementioned variables.

Ethical Considerations

Written permission from the hospital and ethical consent from the ethics committee were obtained prior to the conduct of this study. The infants' parents were informed of the aim and protocol of this study (why the babies were recorded, and for what purpose these recordings were being used), and both their written and oral consent were obtained. In the study, the related ethical principles of the Informed Consent Policy, Volunteer Policy, and Privacy Protection Policy were fulfilled.

Data Collection

Data were collected using the following two forms developed by our researchers to record natal and postnatal information and measurements of the participating preterm infants: the Preterm Infant Information Form and Preterm Infant Follow-up Form. In addition, Neonatal Infant Pain Scale (NIPS) was used to assess pain.

Preterm Infant Information Form

This form captures data regarding newborn's gender; gestational age; birth weight, length, and head circumference; Apgar score; and diagnostic details.

Please cite this article as: Alemdar, D.K., & Özdemir, F.K., Effects of Covering the Eyes versus Playing Intrauterine Sounds on Premature Infants' Pain and Physiological Parameters during Ven..., *Journal of Pediatric Nursing* (2017), http://dx.doi.org/10.1016/j.pedn.2017.06.016