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## Original research article

# Effect of maternal heart sounds on physiological parameters in preterm infants during aspiration

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## ABSTRACT

**Aim:** The aim of this study was to evaluate the effect of maternal heart sound given to preterm infants during aspiration on pain and comfort.

**Methods:** This was a randomized controlled trial. Preterm infants ( $n = 62$ ) receiving care or treatment at a neonatal intensive care unit (NICU) were eligible for participation in this study. Infants in the intervention group were provided with prerecorded maternal heart sounds before, during, and after aspiration, whereas infants in the control group received routine care.

**Results:** In both groups, the infants' physiologic parameters were evaluated during aspiration. In the study, it was determined that while there was an insignificant difference between the experimental group and the control group in terms of respiratory rate and heart rate averages before, during, and after the aspiration, there was a significant difference between them in terms of  $SO_2$  averages before, during, and after the aspiration, and this significance arose from the experimental group.

**Conclusion:** Considering the positive effect of maternal heart sound given to preterm infants during aspiration, we recommend that this method can be used in NICU.

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## Introduction

Invasive procedures are common sources of pain in newborns [1,2]. Suctioning is an invasive procedure often applied by nurses in the care of patients treated with mechanical ventilation [3]. During the stressful process of suctioning, infants are observed to exhibit the same physiologic responses

encountered in other painful procedures. Using pacifiers or sucrose solutions or swaddling the baby may be used during the suctioning to help to relieve the pain. In addition, opioids may be administered through continuous intravenous infusion or slow injection [1].

In the NICU, the endotracheal aspiration, which is among the painful interventional procedures applied by nurses, is defined as the mechanical cleaning process of the pulmonary

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secretions of patients with an artificial airway [4,5]. A painful procedure such as aspiration adversely affects newborns' physiological parameters, comfort, sleep, development and the length of hospital stay [6]. There have been many studies on aspiration in recent years [3,7–14].

All sense organs in the fetus begin to develop during the prenatal period and generally develop in the following sequence: tactile, vestibular, chemical, auditory, and visual sense organs. Hearing typically starts in the 18th week of pregnancy and matures by approximately the 28th week. Fetal response to sound begins in the 26th–28th week [15]. During the 30th–35th gestational weeks, the fetus can hear the mother's voice, responds to her sounds, and differentiates her sound from the others [16].

Auditory stimuli such as structured, rhythmical, cardiovascular, and patterned bowel sounds occur in the intrauterine environment and consist of sounds such as the patterning of placental musical sounds [16]. Sounds arising from the mother's body include sounds from respiration, cardiovascular system, intestinal activities, and body movements. An average noise level of 50 decibels (dB) arises within the uterus. Furthermore, low-frequency sounds from the environment are more audible to the fetus, and the fetus learns about its mother's voice or the external music played. Both the fetus and the neonate may become accustomed to a sound that they have heard several times [17]. Voice control positively affects communication of infants with their families' as much as physiological stability, age-appropriate sensory development, and growth [17,18]. The American Academy of Pediatrics recommends that sound levels in the NICU should not exceed 45 dB [19–21].

It is a great problem for preterm neonates who are separated from the mother's voice, which is an important source for the development of sound sensation of the fetus, to be exposed to intense sound stimuli in NICU. The fetus is normally familiar with blood flow sound, bowel movements, the mother's heartbeat sound, the mother's voice and movements, and synchronized sounds in the uterus [22]. The environment of NICU has very high environmental and human-made sounds. As a result of unwanted noise in NICU; numerous stress behaviors such as fatigue, stress, hyperalertness, fear etc., as well as physiological changes; changes in heart rate, oxygen saturation level, respiratory rhythm, and blood pressure, increase in intracranial pressure, and changes in corticosteroid hormone are observed. However, an effective auditory stimulus occupies the infant, and provides a cognitive effect for pain control, physiological stability and suppressing the pain response [20,23–26].

The purpose of this experimental study was to determine the effect maternal heart sounds played on preterm infants' physiologic parameters during the aspiration procedure.

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## Materials and methods

This was a randomized, single-blind experimental study. The study population consisted of preterms, fulfilling the selection criteria, who received treatment and care in the Hospital's NICU in Turkey, between July 2012 and February 2013. The study was conducted with 62 preterm infants, randomly

divided into the experimental ( $n = 32$ ) and the control ( $n = 30$ ) groups. In the power analysis performed to determine the sample size, the calculated sample size was found to be 62 preterms in order to achieve a 0.90 power in the test, at a significance level of 0.05 with a medium level of effect.

### Selection criteria for the study group

The criteria of the study group were: Infants with gestational age  $\geq 28$  weeks and  $\leq 36$  weeks; who had no congenital anomalies; required tracheal aspiration; underwent at most three tracheal aspirations after the intubation process; had spontaneous breathing and needed mechanical ventilation support; and had not been given any pharmacological or non-pharmacological pain reliever before the procedure, were included in the study.

### Measuring instruments

Preterm Infant Introductory Information Form – includes items on the newborn's age, gender, gestational age, birth weight, length, head circumference, Apgar score, nutritional status (breastfeeding and/or formula feeding) and its diagnostics. Additionally, it is a form developed for the purpose of recording these measurements to evaluate the effect of interventions made before, during and after the aspiration on oxygen saturation, heart rate, and respiratory levels of premature infants.

### Intervention

Preterms admitted to the NICU were evaluated in accordance with the selection criteria for the study group. The preterm infants supported for mechanical ventilation are not sedated in the studied unit. The aspiration process was performed with aspiration-catheter no. 6 in preterm infants born between 28 and 34 weeks of gestation, and catheter no. 7 was used in 34–38 week-old preterm infants at 100 mmHg pressure. Oxygen at 100% concentration was applied before and after the procedure. The aspiration procedure was carried out in 10 seconds. All of the aspiration procedure was performed by the same nurse working in the day shift. Families of the infants were informed about the research, and the infants were included in the study after obtaining the consent of the families who agreed to participate. It was stated to the families that the data will be confidential and will only be used for this research.

In the study, preterm infants who had spontaneous breathing, but needed respiratory support through application of mechanical ventilation were included in the study during one of the three aspiration needed. In order to record the heart sounds of the mothers, whose babies were included in the experimental group, the maternal heart sounds were recorded using a hand doppler and an MP3 player. Then, these records were played for infants through a speaker set to 45 dB. Maternal heart sounds were played for the babies for 15 min prior to aspiration, during the aspiration and again for 15 min after the aspiration. Heart rate and  $SO_2$  were recorded from the monitor and the respiratory rate was counted by the researcher for 1 min.

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