Original Article

The Effect of Nature-Based Sound Therapy on Apgar Score after Cesarean Section Under Spinal Anesthesia

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Abstract

Background: Non-pharmacological methods, either independently or in combination with pharmacological methods, are increasingly used for pain prevention and management. The aim of this study was to investigate the effect of Nature-Based Sound Therapy (NBST) on Apgar score after Cesarean Section (CS) under Spinal Anesthesia (SA). **Materials and Methods:** This randomized clinical trial was conducted from April to December, 2020. Participants were 92 candidates for elective CS under SA conveniently selected from Motahhari hospital, Jahrom, Iran. They were randomly assigned to a control group (n = 46) and an NBST group (n = 46). Participants in the NBST group listened to nature-based sounds from twenty minutes before entering the operating room to the time of childbirth using an MP3 player and a headphone. Neonatal Apgar score was measured at minutes 1, 5, 10, 15, and 20 after birth. **Results:** There were no significant differences between the study groups respecting participants' demographic characteristics ($P > 0.05$). The mean of 1-minute Apgar score in the NBST group was significantly more than the control group ($P = 0.003$). **Conclusions:** NBST is effective in significantly improving Apgar score after CS under SA and can be used to improve neonatal outcomes.

Keywords: *Apgar score, cesarean section, music therapy, naturopathy, spinal anesthesia*

Introduction

The type of delivery is an influential factor on maternal and neonatal outcomes. There are two main types of delivery, namely Cesarean Section (CS) and normal vaginal delivery. According to the protocols of the World Health Organization, CS should be used when normal vaginal delivery is contraindicated or when it puts women or neonates at risk for serious health problems.[1,2] Statistics show that the rate of CS has increased from 7% in 1990 to 21% in 2020.[3] The prevalence of CS in Iran was 47.9% in 2019.[4] The type of anesthesia for CS significantly determines neonatal viability.[5] Spinal Anesthesia (SA) has more frequently been used in recent years in order to minimize maternal and neonatal problems.[6] Nonetheless, sympathetic block in SA may lead to problems such as hypotension and alter uterine and peritoneal perfusion.[7]

Apgar score, introduced by Virginia Apgar in 1952, is a method to score neonatal physical conditions and need for resuscitation[8] and determines neonatal and infantile care-related needs.[9] The acronym APGAR stands for Appearance (A), Pulse (P), Grimace (G), Activity (A), and Respiration (R). Each of these criteria is scored 0–2, and hence, the total Apgar score is 0–10. Scores 7–10 show good physical conditions, while scores less than 7 indicate considerable risk of neonatal disorders.[10] A low Apgar score at five minutes after birth can significantly predict neurological diseases and mortality rate among neonates. For example, 5-minute Apgar scores 0–3 show the high risk of central nervous system injuries (such as coma and convulsions), mortality, and low body temperature among both preterm and full-term neonates.[11] Compared with a low 1-minute Apgar score, a low 5-minute Apgar score is associated with more serious long-term complications.[10,12] Although Apgar score shows neonatal physical conditions, it cannot show the etiology of neonatal physical problems.

Factors such as maternal anxiety, agitation, and emotional status can influence

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neonatal conditions.[13,14] Maternal anxiety has significant direct relationship with negative neonatal outcomes. For example, the physiological stress response to anxiety may cause vasoconstriction in the uterine and thereby, cause fetal distress.[15] Similarly, anesthesia and sedation for CS can reduce neonatal physical tone and responsiveness and thereby, reduce Apgar score.[16,17] Anxiety and pain during pregnancy are also associated with maternal and neonatal complications, poor birth outcomes, and low Apgar score.[18,19]

There are many different pharmacological and non-pharmacological methods to reduce pain and anxiety during the perinatal period.[20] Pharmacological methods for anxiety management have different side effects such as over-sedation and respiratory depression, while non-pharmacological methods usually have fewer side effects.[21-23] Non-pharmacological methods can be used to manage a wide range of problems from somatic pain to psycho-emotional problems.[24] Examples of non-pharmacological methods for pain and anxiety management are psychological treatments, distractions, short films, mindfulness-based cognitive therapy, yoga, meditation, music therapy, and Nature-Based Sound Therapy (NBST).[25,26] NBST, as a type of wordless music therapy, is one of the easiest and safest interventions for patients in healthcare settings.[27] Wordless music therapy helps patients focus on the music instead of the words.[28] NBST has been used since 1984 to reduce pain and anxiety among different patient populations.[27,29] Music therapy helps women feel more relaxed and has positive effects on neonatal outcomes.[30,31] A study reported that cognitive-behavioral stress management significantly reduced maternal anxiety and improved neonatal Apgar score.[32] Another study on women with CS found that music therapy significantly improved the scores of women's health status, the maintenance of physical comfort, ego orientation, birth atmosphere, and health status.[33]

Despite the availability of research data respecting the positive effects of different non-pharmacological methods, there are no specific data about the effect of NBST on Apgar score. Therefore, the present study was conducted to investigate the effect of NBST on Apgar score after CS under SA.

Materials and Methods

This prospective double-blind randomized clinical trial (IRCT20130718014049N9) was conducted from April to December, 2020. The target population included all candidates for elective CS under SA in Motahhari hospital, Jahrom, Iran. Ninety-two women were conveniently selected for this study. Inclusion criteria were elective CS under SA, full-term singleton pregnancy, good psychological and mental health, no addiction to sedatives, alcohol, or drugs, no hearing problem, and ability to establish verbal communication. Exclusion criteria were the need for non-routine treatments (such as painkillers) during CS, hemodynamic instability, and meconium-stained amniotic fluid. Sample size was calculated using the mean difference sample size calculation formula and with a type I error of 0.05, a type II error of 0.2, and a power of 0.80. For sampling, we attended the study setting, received the list of the candidates for elective CS under SA, assessed women in the list for inclusion criteria, selected eligible women to the study, and randomly assigned them to a control group (n = 46) and an NBST group (n = 46) through dice throwing. Participants with numbers 1, 3, and 5 were assigned to the control group and participants with numbers 2, 4, and 6 were assigned to the NBST group.

Participants in the NBST group listened to nature-based sounds from twenty minutes before entering the operating room up to the time of childbirth using an MP3 player (NWZ-B183F model, Sony) with a sound level of 25–50 decibels and a headphone (Major model, Marshal). The nature-based sounds included soothing bird songs as well as waterfall, rain, river, and jungle sounds. We calibrated the sounds according to the comments of an audiologist. The sound volume was low enough to allow participants to have verbal communication during the intervention. Participants in both groups were recommended to comfortably lie down on the bed, deeply breathe, close eyes, and focus on the sounds.[29] Participants in the control group received no sound therapy.

All participants in both groups underwent CS under SA with an identical surgical and anesthesia protocol and received identical intravenous fluid therapy before SA. An experienced anesthesiologist induced SA through injecting 5% Bupivacaine (Marcaine) 2–2.5 milliliters using a sterile 25-gauge spinal injection needle while the intended participant was in sitting position. All participants received routine care services before and after SA based on the opinion of the anesthesiologist. Participants in the control group were unaware of the study intervention in the NBST group, while they were in face-to-face contact with the third author throughout CS.

After childbirth, a trained nurse, who was blind to the study groups, assessed neonates and documented their Apgar scores in an Apgar score sheet at minutes 1, 5, 10, 15, and 20 after birth. A demographic questionnaire was also used to gather data on participants' age, weight, gestational age, educational level, and disease history.

The IBM SPSS software (v. 21.0) was used to analyze the data through the Chi-square, Mann–Whitney *U*, and independent-sample *t* tests. The measures of descriptive statistics (i.e., mean, standard deviation, and relative frequency) were used for data description.

Ethical considerations

The Ethics Committee of Jahrom University of Medical Sciences, Jahrom, Iran, granted ethical approval for this study (code: IR.JUMS.REC.1398.095). Informed consent was obtained from all participants.

Results

Ninety-two candidates for CS under SA participated in this study in two 46-person groups. None of the participants were excluded and the data obtained from 92 participants were analyzed [Figure 1]. There were no significant differences between groups respecting participants' demographic characteristics ($P > 0.01$) [Table 1].

Eighteen participants in the control group (39.13%) and twelve participants in the NBST group (26.08%) reported pain before CS. The between-group difference respecting preoperative pain was insignificant ($P = 0.182$).

Apgar score in both groups significantly changed from minute 1 to minute 10 after childbirth and reached to around 10 at minute 10. The results of the Mann–Whitney *U* test revealed that the mean of 1-minute Apgar score in the intervention group was significantly more than the control group (9.04 (0.815) vs. 8.46 (1.005); $P = 0.003$). However, there were no significant differences between the groups respecting the mean of 5-minute Apgar score (9.67 (0.598) vs. 9.46 (0.657); $P = 0.065$) and the mean of 10-minute Apgar score (9.85 (0.363) vs. 9.89 (0.315); $P = 0.538$). Moreover, there were significant between-group differences respecting the difference between the means of 1-minute and 5-minute Apgar scores ($P = 0.010$) and between the means of 5-minute and 10-minute Apgar scores ($P = 0.016$). The between-group difference respecting the difference between the means of 10-minute and 15-minute Apgar scores was not significant ($P = 0.538$) [Table 2].

Discussion

Pregnancy is one of the most important parts of women's life and studies noted that many pregnant women experience high levels of stress and anxiety,[32,34,35] particularly at the time of childbirth. Women's psychological problems during pregnancy can significantly affect fetal and neonatal health and reduce neonatal Apgar score. Apgar scores less than 7 at the first five minutes after childbirth is a significant predictor of neonatal death. Apgar score measurement is essential to assess neonates' care-related needs.[36] Non-pharmacological interventions, such as music therapy, can exert positive effects on maternal and neonatal health and hence, are increasingly used in maternal and pediatric clinical settings around the world.[37]

The aim of this study was to investigate the effect of NBST on Apgar score after CS under SA. Results showed that NBST significantly increased 1-minute and 5-minute Apgar scores after CS under SA. Maternal pain and anxiety are among the factors which can affect birth-related outcomes, such as Apgar score.[18] Physiological response to anxiety-induced stress can cause uterine vasoconstriction and thereby, can result in fetal distress.[15] NBST in the present study might have increased Apgar score through reducing maternal pain and anxiety before CS.

In agreement with our findings, a study in Singapore reported listening to music as a safe and effective intervention for alleviating women's anxiety before CS.[38] This emphasizes the importance of effective stress management before CS in order to improve maternal conditions and neonatal outcomes. Two other studies reported the significant positive effects of music and nature sounds on stress and physical and mental well-being.[31,38] However, we could not find any study into the effects NBST on neonatal Apgar score after CS under SA. The positive significant effect of NBST on Apgar score in the present study is attributable to its positive significant effect on maternal pain and anxiety. Another study reported that music therapy helps reduce oxygen dependency and improves neurodevelopment

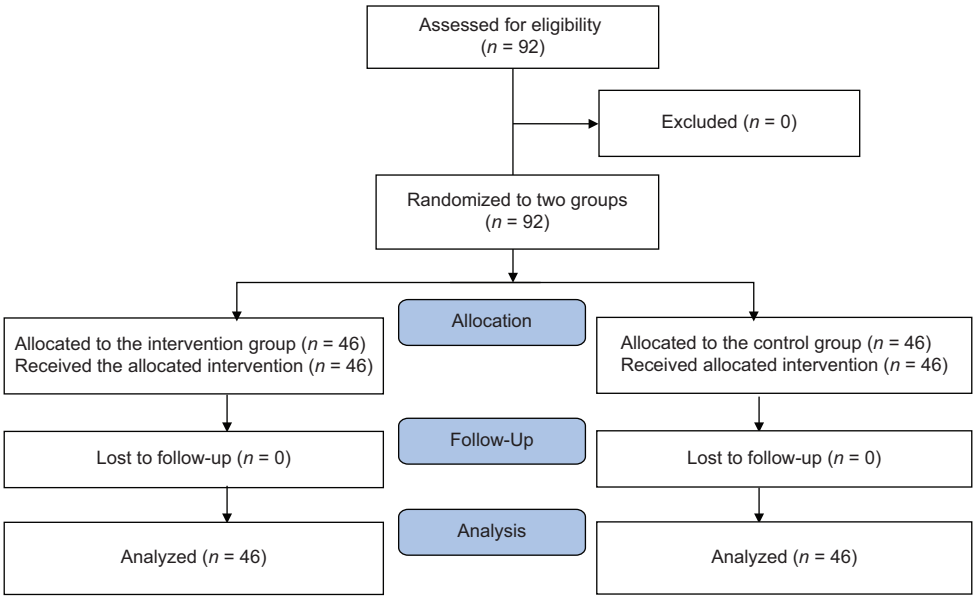

Figure 1: The flow diagram of the study

Table 1: Participants' demographic characteristics

Group Characteristics	Intervention (n=46)	Control (n=46)	p
Age (Years)	28.41 (3.763)*	27.74 (3.88)*	0.400**
Educational level			
Primary	11 (23.91)	7 (15.22)	0.159***
Secondary	15 (32.61)	24 (52.17)	
University	20 43.48)	15 (32.61)	
History of previous surgery			
Yes	14 (30.43)	19 (41.30)	0.277***
No	32 (69.57)	27 (58.70)	
Smoking			
Yes	0	0	****
No	46 (100)	46 (100)	

*Mean(SD), **The results of the independent-sample t test, ***The results of the Chi-Square test, ****No test was performed because smoking status in the groups was the same

Table 2: Between-group comparison respecting the mean (SD) differences of Apgar score

Group Mean difference	Intervention Mean (SD)	Control Mean(SD)	p*
Between minutes 1 and 5	0.63 (0.57)	1.00 (0.70)	0.010
Between minutes 5 and 10	0.17 (0.57)	0.43 (0.58)	0.016
Between minutes 10 and 15	0.15 (0.363)	0.11 (0.31)	0.538

*The results of the Mann–Whitney U test

among neonates.[39] Adequate oxygenation has significant effect on Apgar score.[12] Although many studies assessed the effect of prenatal maternal stress on neonates[13,15,40] and the effect of prenatal music therapy on neonates,[25,41] there are limited studies into the effect of maternal stress, fear, and anxiety before CS on neonatal outcomes such as Apgar score. Therefore, more studies in this area are necessary.

Conclusion

This study suggests that NBST is effective in significantly improving Apgar score after CS under SA probably through reducing maternal pain and anxiety. Therefore, physicians and nurses can use NBST as a safe and easily applicable intervention to improve maternal and neonatal outcomes.

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Conflicts of interest

Nothing to declare.

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