Original Research Article

Effect of music therapy intervention in pain reduction during venepuncture in neonates

S. Ragasivamalni, N. S. Ragupathy*

Department of Pediatrics, Aarupadai Veedu Medical College and Hospital, Vinayaga Missions Research Foundation, Pondicherry, India

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***Correspondence:**

Dr. N. S. Ragupathy,

E-mail: yennessar@gmail.com

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ABSTRACT

Background: Neonates in a neonatal intensive care unit are exposed to a high number of painful procedures. Since repeated and sustained pain can have consequences for the neurological and behavior-oriented problem in the future. Non-pharmacological treatment methods are being increasingly discussed with regard to pain prevention and relief during mild or moderate procedures. The aim of this study was to identify effectiveness of music therapy interventions on pain reduction during venipuncture in neonates.

Methods: Total of 60 neonates undergoing venepuncture in the postnatal ward was included in this study. They were divided into the music group (n-30) and control group (n-30) by convenient sampling method. The neonates in music group were exposed to pre-recorded lullaby 5 minutes before starting the venepuncture and during the procedure of venepuncture. The NPASS was done 5 minutes before, during and 5 minutes after the procedure.

Results: Compared to the control group neonates, music group neonates showed significantly ($P < 0.05$) less pain perception during intravenous needle puncture. The results showed that music group neonates have significantly less score of NPASS than control group neonates ($P < 0.001$) all five domains.

Conclusions: Hence for routine painful procedures like venepuncture, music therapy could be helpful in neonates in reducing the pain perception. Further studies are needed to validate our findings in large sample with proper study design in future.

Keywords: Music therapy, Pain perception, Venepuncture

INTRODUCTION

Over the past two decades, the interest in pain in newborns, particularly preterm neonates, has increased dramatically. There are some issues in studying pain in neonates that appear to be unique to that population, yet, upon further inspection, there could be some avenues to indicate areas for research in older populations.¹ The American academy of pediatrics (AAP) and the Canadian pediatric society (CPS) updated their guidelines in 2006,

recommending that each health care facility treating newborns should establish a neonatal pain control program that includes, performing routine assessments to detect neonatal pain, reducing the number of painful procedures, preventing or treating acute pain from bedside invasive procedures, anticipating and treating postoperative pain after surgical procedures, avoiding prolonged or repetitive pain/stress during NICU care.² Numerous clinical studies have demonstrated that failure to treat pain leads to short term complications and long-

term physiologic, behavioral, and cognitive sequelae, including altered pain processing, attention-deficit disorder, impaired visual perceptual ability or visual-motor integration, and impaired executive functions.³⁻⁵ Conversely, other studies showed needless analgesic therapy prolongs the need for mechanical ventilation, delays feeding, or lead to other sequelae, including impaired brain growth, poor socialization skills, and impaired performance in short-term memory tasks.^{5,6} Repeated painful stimuli causes abnormalities in brain maturation which persists through childhood and adolescence leading to adverse neuro developmental outcomes.⁷ Hence minimizing pain helps in prevention of occurrence of long term neurological outcome. Nonpharmacologic approaches to pain relief are underappreciated, underutilized, and understudied.⁸ Non-nutritive sucking and sweeteners seem to work by increasing endogenous endorphins, as naloxone seems to blunt the response; however, the mechanism is not completely understood.⁹ Sweeteners seem to augment the antinociceptive response to pain compared with non-nutritive sucking.¹⁰ Both sucrose and glucose enhance its effectiveness; they both decrease crying time and improve pain scores after acute mild pain, such as from heel sticks. Studies using various non-pharmacological approaches were done before but music intervention and its impact on pain reduction among the neonates were insufficient. So, the present study was aimed to find the effect of music therapy intervention on pain reduction during venipuncture in neonates.

METHODS

The present non-randomized observational study was conducted at the unit of neonatology in Aarupadai Veedu Medical College and Hospital, Puducherry, India from October 2018 to December 2018. Institutional ethics committee clearance was obtained before the commencing of this project and informed consent was exercised from the parents of the neonates after explaining the complete details of the study in their local language. Total of 60 neonates undergoing venipuncture in the postnatal ward was included in this study. Neonates with an intravenous cannula, critically ill or immunized within 24 hours were excluded from the study. All the neonates were checked for hearing loss by startle reflex given by them to the auditory stimulus in the form of clapping hands by the investigator. The neonates without any hearing loss were included in the study. They were divided into the music group (n=30) and control group (n=30) by convenient sampling method. The neonates in music group were exposed to pre-recorded lullaby 5

minutes before starting the venipuncture and during the procedure of venipuncture. Keeping the music speaker 30cm away from the neonates the music was played through music player. Commercial (JBL flip 2 portable wireless) stereo speaker with maximum SPL of 86 dB and frequency response of 100 Hz-20 KHz was used in the present study. The sound decibel of the music played was checked using Benetech GM 1351 digital sound level meter before execution of the trial to the neonates. The volume of the speaker was adjusted such that the NICU environment sound level never exceeded beyond 65dB. The control group received no intervention but received only the standard nursing care during the venipuncture procedure. The pain levels were assessed using neonatal pain, agitation and sedation scale (NPASS) by the investigator.¹¹ The physiological parameters were assessed by an independent observer. The NPASS was done 5 minutes before, during and 5 minutes after the procedure. NPASS used in present study was commonly used to assess pain response in infants during painful procedures as the score evaluated 5 parameters-crying, behavioral state, facial expression, extremities tone and vital signs. The heart rate, oxygen saturation was monitored using pulse oximeter and the respiratory rate was counted manually. Minimum and maximum possible scores were-10 and 10 respectively.

Statistical analysis

Data were expressed as mean and SD. The comparison between the mean was assessed by Mann Whitney U test and one-way ANOVA using R statistical software version 3.2.0. $p < 0.05$ set a statistical significance.

RESULTS

This study includes 30 neonates in each group with the average gestational age of 34 weeks (control-32.4 (4.3) and music 34.9 (3.2)) and weight of 2680grams (2452 (789) and music (2378 (982))). Control group consists of 16 male and 14 female and music group includes 18 male and 12 females. Compared to the control group neonates, music group neonates showed significantly ($P < 0.05$) less pain perception during intravenous needle puncture. Results of neonatal pain, agitation and sedation scale (NPASS) for each of five domains (crying, behavior state, facial expression, extremities tone and vital signs), for music and control groups during intervention are shown in (Table 3).

Table 1: Comparison of baseline characteristic of the neonates.

Variables	Control group	Music group
Gestation age (weeks)	32.4 (4.3)	34.9 (3.2)
Birth weight (grams)	2452 (789)	2378 (982)
Male / female	16/14	18/12

Table 2: Comparison of neonatal pain, agitation and sedation scale between control and music group.

Variables	Before intervention	During intervention	After intervention	P value
Control group	0.019±0.011	7.202±0.298	0.741±0.046	0.002*
Music group	0.02±0.009	4.858±0.618	0.527±0.068	0.01*
P value	0.726	0.002*	0.001*	

Table 3: Comparison of neonatal pain, agitation and sedation scale between control and music group during the music intervention between control and music group.

Variables	Control group	Music group	P value
Vitals signs	1.656±0.556	1.167±0.658	0.036*
Irritability	0.999±0.123	0.767±0.394	0.038*
Facial expression	1.558±0.725	1.068±0.541	0.045*
Behavioural state	1.511±0.781	0.731±0.61	0.005*
Tone	1.46±0.794	0.651±0.387	0.001*
NPASS total score	7.202±0.298	4.858±0.618	0.000*

The results showed that music group neonates have significantly less score of NPASS than control group neonates ($P < 0.001$) all five domains.

DISCUSSION

The present study showed significant improvement in all five parameters of neonatal pain, agitation and sedation scale (NPASS), i.e., facial expression, irritability, behavioral state, and tone in the music group neonates than control group. The duration of crying spell also significantly decreased during music intervention than the control group. Previous study done by Haarika et al, found that music intervention and mother voice have a significant impact in pain reduction during venipuncture among the neonates.¹² The insisted that pre-recorded music is better than mother voice for the management of pain in neonates. In another study, sucrose solutions have been shown to reduce the stress response and behavioral responses to pain in neonates, falling uneasily between being defined as pharmacological and non-pharmacological therapy. A recent Cochrane review confirmed its efficacy and safety for procedural pain in neonates for individual painful events.¹³ When auditory stimuli of music passes through the sound pathway to the cerebral cortex, there is reduction in the signaling in the amygdale.¹⁴ The reduced signaling of amygdale causes reduced level of stimulation of the hypothalamus, pituitary and endocrine glands. Hence there is decreased secretion of the cortisol and glucocorticoids thereby having effect on the autonomic system.¹⁵ This explains the lower heart rate and better oxygen saturation in the music therapy group when compared with the control group. Music intervention produces reduction of stress and inducing comfort and relaxation in neonates by its effects on the limbic and the autonomic system. Another mechanism for pain relief at higher levels of the brain is

the release of endorphins.^{16,17} Endorphins are released both by stress (including pain) as well as positive stimuli such as touch and music. For example, regarding the effect of music intervention, there is a hypothesis, that music sound triggers the release of endorphins in the brain which has the analgesic effect. Many non-pharmacological interventions have been put forward for reducing procedural pain in neonates. Non-pharmacological interventions that have been tested in neonates that have shown varying degrees of efficacy can be categorized into sensory stimulation (positioning or swaddling, vestibular action or rocking, non-nutritive sucking, music), nutritive (oral sweet solutions) and maternal interventions (maternal odor and voice, breastfeeding, and skin-to-skin contact).¹⁸

In above nonpharmacological interventions, music would be more ideal and easy way to apply among the neonates during any form of procedural pain. The use of these therapies is often recommended as the first step in neonatal pain management, particularly because of their favorable side-effect profile. This music intervention ability to diminish acute pain from invasive or noninvasive procedures and their beneficial long-term effects are needed to be validated with the systemic analgesics for the better care.

CONCLUSION

The music intervention reduces the pain perception in neonates during venepuncture and they have beneficial effects on the physical and behavioural parameters. Hence for routine painful procedures like venepuncture, music therapy could be helpful in neonates in reducing the pain perception. Further studies are needed to validate our findings in large sample with proper study design in future.

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