The effectiveness of maternal voice in critically Ill children undergoing suctioning with acute pain

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ABSTRAK

Latar Belakang: Nyeri akut selama prosedur *suction* (penyedotan sekresi) pada pasien anak di unit perawatan intensif tidak dapat dihindari. Hal tersebut perlu dilakukan intervensi non-farmakologis yang dapat dilakukan oleh perawat. Salah satu intervensi yang dapat diterapkan dalam situasi tersebut adalah dengan pemberian *maternal voice*. Intervensi tersebut dilakukan dengan memperdengarkan suara ibu yang telah direkam di *voice recorder* ke anaknya yang sedang dirawat di PICU.
Tujuan: Penelitian ini dilakukan untuk mengetahui pengaruh *maternal voice* terhadap nyeri akut yang dialami anak sakit kritis saat dilakukan prosedur *suction*.
Metode: Metode penelitian yang digunakan adalah *quasi experiment pretest posttest without control group design*. Penelitian dilakukan pada bulan Mei-Juni 2022 di ruang PICU salah satu rumah sakit di Jakarta. Sampel penelitian dipilih secara *purposive sampling*, sebanyak 21 responden yang dinilai pada saat *pretest* dan *posttest* (5 menit sebelum prosedur penyedotan, selama prosedur, dan 5 menit setelah prosedur). Rasa nyeri anak-anak yang sakit kritis diamati menggunakan instrumen FLACC (*Face, Leg, Activity, Cry, Consolability*).
Hasil: Uji normalitas data Saphiro Wilk digunakan untuk pengecekan kenormalan semua data, baik data pretest maupun post-test (skor nyeri, frekuensi nadi, dan frekuensi napas). Uji bivariat dianalisis menggunakan Wilcoxon Signed Rank Test (untuk data tidak normal) dan Paired T-Test (untuk data normal) dengan hasil skor nyeri sebelum dan sesudah diberikan suara ibu (saat memulai *suction*, nilai p = 0,001; setelah memulai *suction*, nilai p = 0,001; 5 menit setelah *suction*, nilai p = 0,002).
Kesimpulan: Perawat PICU dapat mempraktekkan pemberian *maternal voice* pada saat tindakan *suction* untuk mengurangi sensasi nyeri yang diterima anak. Intervensi maternal voice dapat dijadikan pilihan bagi tim keperawatan untuk mengontrol nyeri pada anak yang sakit kritis pada berbagai prosedur medis atau keperawatan yang menimbulkan rasa sakit.

KATA KUNCI: *maternal voice; nyeri akut; perawatan kritis; suction*

ABSTRACT

Background: *Acute pain during suction in pediatric patients in the intensive care unit is unavoidable. However, it is necessary to provide non-pharmacological interventions that nurses can guide. One of the interventions that can applied in that situation is*

maternal voice. That intervention giving the opportunity to the children in the PICU to hearing the voice of their mother via voice recorder.

Objectives: This study was conducted to determine the effect of maternal voice on acute pain experienced by critically ill children during suctioning procedure.

Methods: The research method used was quasi experiment pretest posttest without control group design. The study was conducted in May-June 2022 in the PICU in one of the hospitals in Jakarta. The research sample was selected by purposive sampling, 21 respondents assessed at the time of pretest and post-test (5 minutes before suctioning procedure, during procedure, and 5 minutes after procedure). The pain of the critically ill children was observed by FLACC (Face, Leg, Activity, Cry, Consolability) Scale.

Results: The Saphiro Wilk test of normality data was carried out for all the data, either pretest or post-test data (pain score, heart rate, and respiratory rate). Bivariate tests were analysed using Wilcoxon Signed Rank Test (for the abnormal data) and Paired T-Test (for the normal data) with the results of pain scores before and after being given maternal voice (when starting suction, p value = 0.001; after starting suction, p value = 0.001; 5 minutes after suction, p value = 0.002).

Conclusions: PICU nurses should practice maternal voice along with suction to reduce the pain sensation received by the children. The maternal voice could be an alternative intervention for the nursing team to control pain of the critically ill children in another painful procedure.

KEYWORD: maternal voice; acute pain; critical care; suction

INTRODUCTION

Children admitted to the Pediatric Intensive Care Unit (PICU) receive various invasive procedures. It makes the children respond psychologically and physically by showing fear, anxiety, and pain (1,2). Repeated invasive procedures received by children in the PICU traumatize the children even when the procedure has just begun, such as rubbing alcohol swabs (1). Some of the common invasive procedures performed in hospitals that cause pain are lumbar puncture, finger or heel blood draw, blood vessel opening, nasogastric tube insertion, endotracheal intubation, and suction (2).

One of these invasive procedures that is commonly performed in the PICU is suction. The procedure is performed to safely maintain airway patency by removing pulmonary secretions or foreign objects from the patient's endotracheal tube or tracheostomy tube as a component of bronchial hygiene and mechanical ventilation (3). Suction has been shown to cause pain in children (2).

A study in 2015 stated that when the children received suction procedures there were changes in the status of physiological values, wherein 80% of children experienced an increase in heart rate and 53.8% of children were found to have an increase in arterial blood pressure (2). These changes in physiological value status are markers of pain experienced by the patients (4). Therefore, nurses should be able to minimize the patient's experience of pain when suction is performed.

The pain that is perceived by children is something that nurses need to pay attention to. In this case, nurses can provide self-administered nursing interventions and collaborative actions. One of the interventions independently or non-pharmacologically which is often given to the neonate age group in terms of reducing pain is the maternal voice (5,6). Similar study in 2022 found that neonates in the intervention group had a lower heart rate (p<0.001) and more pain scores (p<0.001) than the control group when a painful procedure was performed (7). Research on maternal voice in pediatric groups other than neonates remains very limited. Therefore, one of the studies conducted in Turkey stated that the children who were given maternal voice during invasive procedures had lower pain levels and heart rate compared to children who were not given the intervention (1). Inevitably, children who have been away from their families, especially their mothers, will feel uncomfortable. Therefore, listening to the mother's voice through the maternal voice may provide an appropriate intervention to reduce the children's pain of not being able to be around their mothers (5). Children admitted to the PICU were not directly attended to by their mothers. A study at Stanford Medical School states that there is a system in the children's brains that creates a sense of comfort when a child hears his own mother's voice (8).

Based on the previous explanations, it is necessary to conduct a study to examine the effectiveness of maternal voice in reducing the pain of pediatric patients. For initiation, maternal voice can be applied to one of the procedures that increase patient pain, specifically suction. Maternal voice will be given when suction is about to be performed, during suction, and up to 5 minutes after suction.

According to a study maternal voice can be provided effectively 5 minutes before the action, during the action, and 5 minutes after the action (1). This study was designed to determine the effect of maternal voice on acute pain in children who are being given suction in the PICU.

MATERIALS AND METHODS

Type of Method

This study used a quasi-experiment pretest-posttest without control group design. Pretest and posttest were applied to similar respondents.

Time and Place

This study was conducted in May 2022 in the PICU of one of the tertiary hospitals located in Jakarta.

Population and Sample

The population of this study were patients admitted to the PICU of the hospital. The sampling technique used in this study was purposive sampling where the sample was selected based on the criteria set. The inclusion criteria for this study as listed here were: (1) Children aged 1 month to 18 years who were admitted to the PICU, (2) Patients with indications for suction, (3) Patients without sedation, (4) Patients who received analgesics more than or equal to 3 hours when the action was performed, (5) The patient's mother agreed for her children to be the respondents in the study. The exclusion criteria for this study were children who did not respond when there was a voice. The total number of respondents obtained based on the paired numerical comparative analytic formula and added dropout anticipation was 21 patients.

Research variables

The independent variable in this study is maternal voice. The dependent variables were pain score, heart rate, and respiratory rate.

Instruments

Pain scores were calculated with the FLACC instrument. The instrument is an observational pain rating scale on the behavior of children who cannot communicate the pain being experienced (9). The scale was originally designed to measure postoperative pain in infants and children aged two months to seven years, but recent studies have found that the FLACC scale could be used to assess procedural pain as well as pain experienced by infants under two months and children older than seven years (10). A study assessing pain from suction in the PICU also used FLACC for children aged 1 month - 18 years (2). The FLACC instrument contains 5 items that assess facial expression, position or movement of the legs, activity, crying/sound, and consolation with a scoring score of 0-2 on each component. The total score varies from 0 to 10, where a score of 0 indicates no pain while a score of 10 is severe pain or the maximum level of pain experienced by the patient (9,11). The advantage of the FLACC scale has better validity than other observation scales (12). The internal consistency of FLACC has a very good Cronbach's alpha = 0.88 (2). The results of the study obtained interrater reliability with excellent intraclass correlation coefficients (ICC, ranging from

0.76 to 0.90) and construct validity indicated by a decrease in FLACC scores (6.1 ± 2.6 vs. 1.9 ± 2.7; P < 0.001) (13).

Research Procedures

The flow of this study was started by selecting patients who fulfilled the inclusion criteria. After obtaining the appropriate number of patients, the research plan was informed to the mothers of prospective respondents. Respondents' mothers who agreed to be involved in this study will be asked for proof of research approval and asked to record the voices. The recorded mother's voice may consist of conversations, encouragements, motivations, songs, stories, and wishes that could be personalized between the mother and the child. The duration of the recorded mother's voice was a minimum of 10 minutes. The recording device used was a voice recorder device prepared by the researcher. The mother's voice was then listened back to the mother and only the voice that had been approved by the mother was given to the child. When the mother's voice was ready, the mother's recorded voice would be played during the procedure of the suction. The voice remained during suction until 5 minutes after the treatment.

The researcher recorded the FLACC pain score, heart rate, and respiratory rate at the beginning of the suction procedure, at the end of the suction procedure, and 5 minutes after the suction was completed. This applied to both the pretest and posttest. After the mother's voice was recorded, the researcher began to assess the pain score, heart rate, and breathing frequency when the patient was given suction (pretest). In the following suction session, the patient listened to the mother's voice before the procedure began. When the nurse started the suction action, the researcher or assistant recorded the pain score, heart rate, and respiratory rate when the nurse started and ended the suction procedure. Documentation of pain score, heart rate, and respiratory rate was written down again at the end of the suction action and again 5 minutes after the action was completed. Thus, the researcher or assistant ended the recording of the mother's voice that was played 5 minutes after the completion of the suction procedure.

Method of Analysis

The univariate analysis of this study included gender, age group, and the patient's main medical diagnosis. The data on these patient characteristics were categorical data resulting in a description of the analysis in the form of frequencies and percentages. Bivariate analysis was conducted to determine the relationship between the independent variable and the dependent variable. The analysis of bivariate was begun by looking at the

normality of the data. The data normality test used in this study used the Shapiro-Wilk test because the number of respondents was less than 30. Data were defined as normally distributed if the significance value was >0.05 and abnormally distributed if the significance value was <0.05. From the results of the data normality test, it was found that the data were normally and abnormally distributed. Furthermore, data that were abnormal were analyzed with the Wilcoxon Signed Rank Test. Normally distributed data were analyzed with the Paired T-test. According to the two bivariate analysis tests, the relationship between the independent variable and the independent variable has a relationship if the p-value <0.05. After the bivariate analysis was carried out, the researcher conducted an in-depth discussion of the statistical test results associated with the search for scientific literature.

Ethical Clearance

This research has been approved by the research ethics committee and obtained an Ethics Clearance Letter from the Faculty of Nursing Sciences, University of Indonesia with Ethics No.KET-188/UN2.F12.D1.2.1/PPM.00.02/2022.

The next steps were to provide an explanation of the research to prospective respondents. Moreover, when the prospective respondent agreed to participate, the prospective respondent was asked to sign the informed consent. The researcher asked about the mother's readiness to record the voice, if the mother was willing then the mother could immediately do the recording. However, there were also mothers who said they were waiting to be ready and compose words to be delivered to the children first.

RESULTS AND DISCUSSION

RESULTS

The description of the implementation of maternal voice in children who experience acute pain during suction begins with a description of the characteristics of the respondents. These characteristics include age group, gender, and the main medical diagnosis underlying the children's admission to the PICU (14). The description of the respondents' characteristics is written in a frequency and percentage distribution which can be seen in **Table 1.**

Table 1. Characteristics of respondents who received suction procedure (n=21)

Characteristics	Frequency (N)	Precentage (%)
Gender		
Male	15	71.4
Female	6	28.6

Age Group (years old)		
Infant (0-1)	5	23.8
Toddler (1-3)	4	19
Pre-school (3-6)	4	19
School (6-12)	5	23.8
Adolescent (12-18)	3	14.3
Main Medical Diagnose		
Neurological organ dysfunction	11	52.4
Respiratory organ dysfunction	5	23.8
Chronical illness	2	9.5
Sepsis	2	9.5
Cancer	1	4.8

Respondents with the highest gender were male (71.4%). Two age groups dominated the innovation project respondents, which were infants and school-age children with a percentage of 23.8% respectively. Based on the main medical diagnosis underlying the child's admission to the PICU, it was found that patients who experienced neurological organ dysfunction had the greatest number of respondents (52.4%).

The results of the analysis of differences in pain levels before and after giving the maternal voice can be seen in **Table 2**. Statistical tests during and after suction were carried out with Paired t-test because the data were normally distributed. As applied 5 minutes after suction, the Wilcoxon Signed Rank Test was used because the data were distributed abnormally.

Based on statistical tests, the results showed that there was a significant difference in pain scores in the implementation of maternal voice when the beginning of suctioning (p-value = 0.001), after suctioning (p-value = 0.001), and 5 minutes after finishing suction procedure (p-value = 0.002).

Table 2. The differences of the pain scores after and before the implementation of the maternal voice (n=21)

Observation Time	Test	Mean/Mean Rank	P-value
Beginning of the suction	t = 7.67*	6.48 ± 4.62	0.001
After the suction	t = 6.5*	5.90 ± 4.52	0.001
5 menit after finishing suction	Z = -3.06**	8.69 ± 14	0.002

*Paired t-test

**Wilcoxon Signed Rank Test

The results of the statistical test analysis of the difference in heart rate before and after the intervention can be seen in **Table 3**. The table illustrates that the statistical test was conducted with Paired t-test. Based on statistical tests, it was found that there was a significant difference in heart rate in the provision of maternal voice when the beginning of the suctioning (p value = 0.001), after suctioning (p value = 0.001), and 5 minutes after finishing suction procedure (p value = 0.006).

Table 3. The differences of the heart rate after and before the implementation of the maternal voice (n=21)

Observation Time	Test	Mean	P-value
Beginning of the suction	t = 3.95*	125.81 ± 119.24	0.001
After the suction	t = 5.12*	141.05 ± 129.48	0.001
5 menit after finishing suction	t = 3.11*	124.24 ± 117.67	0.006

*Paired t-test

Table 4 below shows the results of statistical tests on differences in respiratory rate before and after giving maternal voice. Statistical tests were performed with the Wilcoxon Signed Rank Test. The result of the test is that there is a significant difference in the respiratory rate in the implementation of maternal voice for the beginning of the suctioning (p value = 0.006), after suctioning (p value = 0.012), and 5 minutes after finishing suction procedure (p value = 0.008).

Table 4. The differences of the respiratory rate after and before the implementation of the maternal voice (n=21)

Observation Time	Test	Mean Rank	P-value
Beginning of the suction	Z = -2.77**	13.25 ± 9.62	0.006
After the suction	Z = -2.52**	10.83 ± 9.84	0.012
5 menit after finishing suction	Z = -2.67**	11.73 ± 6.8	0.008

*Wilcoxon Signed Rank Test

DISCUSSION

Providing maternal voice can be used as a solution as an independent nursing intervention to reduce pain in the PICU. Reducing pain in children is important for nurses to take because children suffer stress when faced with pain sensations. One of the interventions proven to increase children's pain scores when admitted to the PICU is the implementation of suction (1,15,16). Maternal voice interventions have been

shown to reduce pain (7,15). Similarly, this study showed that after being given a maternal voice, there was a significant difference in the decrease in pain scores, heart rate, and respiratory rate. In line with research in the PICU of one of the Turkish hospitals which stated at the end of the study that the pain level and heart rate of children in the experimental group during and after the treatment were significantly lower than children in the control group (1).

In the present study, the maternal voice was shown to significantly reduce pain scores in children in the PICU who underwent suction. This is aligned with research in Taiwan that maternal voice intervention has been found to be effective in reducing the pain level of children who have blood drawn from the heels (7). The results of another study showed that during and after procedures that cause pain there was a significant difference in reducing pain levels between the experimental group and the control group (1). The study also mentioned that children in the experimental group showed a higher level of participation in the intervention due to listening to the mother's voice.

The results of statistical tests related to pulse frequency in this research were evidently decreased in children who had received maternal voice. Heart rate is an indicator frequently used by clinicians and researchers to measure pain experienced by patients (4,15). A previous study stated that during and after the procedure there was a significant difference in pulse frequency between the experimental group and the control group (p-value = .000) where the experimental group had a significantly lower pulse frequency level than the control group (1). The results of a similar study showed that maternal voice intervention was effective in slowing down heart rate (17,18).

According to the data from the current study, the frequency of respiratory rate significantly decreased after the intervention. Respiratory rate is a physiological indicator that should be seen as an alarming signal that some sort of thing happened and further investigations should be continued such as pain assessment (15). During invasive procedures, if critically ill children are unable to maintain stable vital signs, it might be difficult to return to a stable state (15,19–21). Hence, monitoring of respiratory rate as one of the vital signs is required during suction. Research found that when infants were injected in the heel and then listened to the mother's voice reading a book (voice recorded), there was a significant decrease in respiratory rate and an increase in oxygen saturation level (18). Similar research results were reported that by providing a recording of the mother's voice, the respiratory rate of

the experimental group was more stable than that of the control group (16).

Maternal voice has been recognized to have an effect on pain reduction in children. It can be scientifically explained that the strength of the connection between brain regions activated by the mother's voice is predicted to awaken emotions that give the child strength (8). Furthermore, the child has been listening to the mother's voice since the intrauterine period, thus the child's brain will remember the environment where the voice is safe, which creates a safe and comfortable sensation in the child (22). Recorded mother's voice increases prefrontal cortex activation or gives a stronger effect emotionally compared to the voice of a stranger (8,23). Maternal presence through the voice can comfort and encourage faster recovery, reduce distress in children, and provide children with a sense of security (7,15). Providing an optimal maternal role will enhance the attachment between mother and child, providing a sense of safety and comfort thus children feel accepted and loved by the mothers (24). With the senses of safety, comfort, and love, children will feel more optimistic about overcoming pain. Providing this role can be done by providing maternal voice, especially since the PICU is not a room that can provide the mother's presence at any time in the room. The pleasure experienced by the children leads to an increase in endorphins and encephalins, thereby decreasing catecholamines, which results in a more relaxing sensation, as seen in the normality of heart rate and respiratory rate (25). Therefore, it is natural that a mother's voice has been shown to have a strong impact on reducing children's pain and stabilizing children's physiology. Accordingly, maternal voice could be recommended as an intervention that might reduce pain in children admitted to the PICU, especially during suction. In addition to proven effectiveness, maternal voice intervention is an easy and cost-effective intervention (26).

CONCLUSION AND RECOMMENDATION

The implementation of maternal voice is proven to reduce pain in children receiving suction. Pain scores, heart rate, and respiratory rate were shown to decrease when the child was administered maternal voice compared to before maternal voice was applied. This intervention has been applied to a wide range of pediatric age groups, genders, and medical diagnoses. Maternal voice can be an alternative independent nursing intervention to reduce pain, especially during suction in children. This intervention offers an easy-to-implement intervention for nurses. The nursing team

can develop this intervention in various other procedures when pain is encountered in children. This intervention may also be utilized in various settings where children cannot be accompanied directly by the mother, particularly in the PICU.

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