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The Effects of Music Therapy on Pediatric Patients with Congenital Heart Defects in the Pre and Postoperative Setting

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**The Effects of Music Therapy on Pediatric Patients with Congenital Heart Defects in the
Pre and Postoperative Setting**

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For Marco. I promise I will continue on your legacy in the lives I will care for as I move forward in my career and live life the way you always did. Sing a song for me in heaven. I love and miss you always.

Abstract

Congenital heart defects is a prominent medical occurrence especially in pediatrics. These defects often require surgeries and extensive treatment plans. These treatment plans often include invasive surgeries and extensive treatment plans which can require long recovery times along with potential surgical complications. This study aims to evaluate the effectiveness of music therapy on pediatric patients with congenital heart defects in the pre and postoperative setting and how music therapy can be implemented in treatment plans to yield effective recovery results for these patients. This research is significant as elevated vital signs and preoperative anxiety are associated with an increased need for anesthesia and analgesia requirements which can correlate to a risk for surgical complications. Elevated postoperative pain can result in an increased need for analgesic medications which can contribute to medication toxicity in a pediatric patient which can cause further complications. This study would consist of 80 pediatric patients on a cardiac unit aged 1 day to 10 years old diagnosed with a congenital heart defect who is undergoing cardiac surgery. A quasi-experimental randomized control trial will be conducted to compare the results of these cardiac patients in both preoperative and postoperative procedures. In these settings nurses would be responsible for gathering pre and postoperative vital signs, assessing preoperative anxiety, and assessing postoperative pain levels. With this study it is expected that patients who received music therapy during both pre and post operative procedures experienced a stabilization of vital signs, reduced preoperative anxiety, and lower postoperative pain levels.

Introduction

Music has been around for thousands of years and is found to be part of many traditions, cultures, and is a part of everyday life. In this modern age, music has forged its way into different aspects of everyday life such as concerts, study sessions, and hospital settings. Music therapy in hospitals has gained prominent traction in recent years especially in the pediatrics department. Specifically, pediatric patients who have congenital heart defects have been known to have significant positive responses following music therapy integration. Congenital heart defects are abnormalities of the heart that developed in utero and are present at birth. There are numerous types of congenital heart diseases such as ventricular septal defect, tetralogy of fallot, and patent ductus arteriosus all of which causes a newborn's cardiopulmonary function to be compromised and must be corrected with medical or surgical intervention. Nurses, therapists, and other healthcare practitioners have turned to the use of music therapy as it has been known to "significantly decrease preoperative anxiety" as well as provide emotional support to not just the patients but to the family as well. (Huang et al.,2021) There has also been evidence that music therapy is an effective intervention in the postoperative setting as well as it has been known to stabilize vital signs, reduce risk of complications from anesthesia, and act as a non pharmacological method of reducing pain. (Huang, et.al. 2021)

Problem Statement

Pediatric patients who have congenital heart defects have shown tremendous positive outcomes post surgery and other procedures from music therapy itself. Congenital heart defects are known as defects or abnormalities found in the heart during birth. These defects can significantly impair a child's life in which a child with a congenital heart defect is likely to face

many routine surgeries and procedures which involve routine intensive care and extensive recovery paths. Studies have found that “ the environment in which these infants are cared for often includes excessive levels of light and noise and frequent interruptions from sleep which may affect a child’s physiologic responses and impact neurodevelopment.” (Yurkovich, J., Burns, D.S, and Harrison, T, 2018)

Purpose Statement

Music therapy can be used as a non invasive and non pharmacological method to reduce anxiety and improve physiological function in pediatric patients with congenital heart deformities. This particular research paper is aimed to study the effects of music therapy on pediatric patients with congenital heart issues during hospitalization. It also contributes to the Healthy People 2030 objective of improving the health and well being of children as this research can greatly help in the recovery of pediatric patients undergoing cardiac surgery. This research is significant to nursing practice as nurses and other health care practitioners can learn to implement music therapy, a nonpharmacological tool, when developing treatment plans for pediatric patients who have congenital heart anomalies in hopes of improving patient outcomes and recovery.

Research Question

How can music therapy be implemented in treatment plans in pediatric patients with congenital heart defects to yield effective recovery results in the pre and post operative setting?

Literature Review

The literature articles that were used to support this study consisted of articles that described the various effects of music therapy in pediatric patients with congenital heart defects.

The articles described physiologic factors such as heart rate, blood pressure, oxygen saturation levels, pain levels, and psychological factors such as anxiety in both the pre and post op settings. These six articles were found in CINAHL and google scholar databases using keywords such as congenital heart defects and music therapy. In these articles congenital heart defects are defined as an abnormality or deformity of the heart that is present before birth. Examples that are highlighted within these articles include ventricular septal defect, tetralogy of fallot, and patent ductus arteriosus Music therapy is defined as an intervention that involves music to improve the overall health of the individual.

Pre Operative Setting

In a study conducted in 2021 by Huang, et al., music therapy was highlighted to have a profound effect on pediatric patients with congenital heart defects undergoing cardiac surgery within the pre operative setting. The study used a randomized controlled clinical trial with ninety participants that were aged 3-12 years old that had simple congenital heart defects and normal mental and psychological status. Researchers used a control group who did not receive any music therapy before their surgery and their vital signs and anxiety levels were assessed with the Yale Preoperative Anxiety Scale Short Form while they were in the anesthesia waiting area. The control group was then compared to the group of patients who did receive music therapy in the preoperative setting. These patients “listened to music over the sound system for 30 minutes after entering the waiting area.” (Ya-Li Huang, et al. 2021) Both groups had elevated blood pressure and heart rate before entering the preoperative waiting area. However, researchers concluded and found that the group of patients that did receive music therapy experienced less preoperative anxiety and more stable vital signs which resulted in a decreased “risk of adverse events of

anesthesia induction.” (Ya-Li Huang, et al. 2021) This is significant as it was found that “the higher the preoperative anxiety level, the larger the amount of anesthesia needed” which can increase the chances of delirium during the immediate postoperative recovery thus making nursing care more strenuous and complicated. (Ya-Li Huang, et.al. 2021)

Further success of the intervention of music therapy in the preoperative setting was in a study conducted by Atiye Karakul, et al. in 2022. Similarly to the previous study mentioned, these researchers used a group of thirty six patients aged 7-18 years old who were undergoing cardiac catheterization which is a procedure that can be seen being performed in patients with congenital heart defects. The study used a randomized blind control study which allocated these participants into three groups which were the control group, a group with classical music, and a group that had self-selected music. The researchers found that those who were able to listen to music in the preoperative setting experienced better outcomes postoperatively in terms of “the reduction of pain, fear and anxiety levels and stabilization of vital signs” in contrast to individuals who did not receive any music therapy. (Karakul, et al. 2022) This simple intervention that can be adopted by nurses and integrated into treatment plans can greatly improve patient outcomes in the preoperative setting.

Post Operative Setting

The success of the intervention of music therapy is not only seen in the preoperative setting but in the postoperative setting as well. A study was conducted by Sayed Kaoud Abd-Elshafy, MD, et al. in 2015. In this randomized double blind controlled clinical trial, fifty pediatric cardiac patients who were ages between 4-12 years old and who were undergoing surgery to repair a congenital heart defect. Likewise these patients were divided into a control

and an intervention group where vital signs and stress markers such as blood glucose and cortisol levels were measured and compared during each phase of surgery. During the preoperative setting and before the administration of anesthesia, patients in the intervention group received music therapy which continued throughout surgery and in the postoperative setting. Their vital signs and pain levels were monitored and compared along with their blood glucose and cortisol levels during the surgery and in the postoperative phase. Additionally, a survey was sent home to the participants' parents with questions regarding how their child was doing post discharge which accounts for further postoperative recovery data. With these findings Sayed Kaoud Abd-Elshafy, MD, et al. were able to conclude that “listening to pleasant music by children undergoing repair for congenital heart disease reduced surgery-associated stress responses: plasma cortisol level, blood glucose level, postoperative pain, child post-traumatic stress disorder, and negative postoperative behavior changes.” (Abd-Elshafy, et al. 2015)

Further success of music therapy in the postoperative setting can be observed in the study conducted by Thamine P. Hatem,¹ Pedro I. C. Lira,² Sandra S. Mattos³ in 2006 which specifically observed pain levels in pediatric patients following cardiac surgery. This study was conducted using a randomized clinical trial with 84 children aged 1 day to 16 years old. 63 patients were given classical music as music therapy intervention and 21 patients were used as the control group who did not receive music therapy prior to cardiac surgery. These researchers found that those individuals with music therapy intervention had a decrease in heart rate and blood pressure along with a decrease in respiratory rate which is significant because these physiological properties can affect postoperative healing. The findings of this study were that “music acted to reduce the pain and anxiety of patients during the immediate postoperative

period” which supports the idea of the success of music therapy during the postoperative setting.

(Thamine P. Hatem,¹ Pedro I. C. Lira,² Sandra S. Mattos³, 2006)

Psychological Effects in the Perioperative Setting

Music therapy has not only been known to have physiological effects on the body but it has also been known to have positive psychological effects as well. In a study conducted by Levan in 2016 the research found that music decreased anxiety in pediatric patients in the perioperative setting. The study discusses that “ increased perioperative anxiety results in increased analgesic requirements and delayed discharges.” (Levan, 2016 pg. 89) Levan found that integrating music therapy in the perioperative setting reduced stress and anxiety levels in pediatric patients undergoing surgery which decreases anesthesia and analgesia requirements, increased postoperative recovery, and improved patient outcomes. She concluded this by assessing factors that induce stress and anxiety in pediatric patients when undergoing surgery such as face mask induction of anesthesia and invasive procedures and noted agitation and anxiety levels in these patients. From there she compared the effects of implementing music therapy during these anxiety inducing procedures and compared patient responses to the therapy.

Another study that exemplifies how music therapy can have positive psychological effects in pediatric patients undergoing surgery is a study conducted by Ben- Zvi in 2023. When stress or anxiety is induced, “cortisol is triggered to create a fight or flight response in the brain causing stress levels to further increase.” (Ben-Zvi., 2023) However, this study found that music can be used to reduce anxiety in pediatric patients undergoing surgical procedures as the author describes how “music triggers a response in the brain that allows children to be more at ease.” (Tzipora Ben-Zvi, R.T., 2023) The study describes that music therapy can be integrated during

the pre and postoperative hospital setting in order to decrease anxiety before and after surgery which promotes better patient outcomes.

Theoretical Framework

After a thorough review of the literature, the appropriate theoretical framework to support the topic of the effects of music therapy on pediatric patients with congenital heart defects in the pre and postoperative settings would be the theory of how music affects the right side of the brain. The brain is divided into two halves known as the right and left hemispheres. The right hemisphere of the brain is known to be the side that is responsible for creativity and emotions whereas the left side of the brain is responsible for analytical and logical characteristics. When music is introduced to an individual, “music can function as a mediator, which, via the autonomic nervous system, can influence physiological responses such as heart rate, blood pressure, respiratory rate, body temperature, skin conductance, and muscle tension.” (Reybrouck M, Podlipniak P, Welch D., 2021) This relationship between music and the right hemisphere of the brain is the driving framework for the theory behind music therapy and its physiological effects on the human body which can yield positive recovery results. This concept also relates to a nursing theory known as the Health Promotion Model created by Nola Pender. This nursing theory model promotes positive health behaviors and creates an emphasis on how individuals engage with their health. Music therapy can be used as a health promotion tool that encourages pediatric patients to participate in activities that improve their overall well being which contributes to a better quality of life.

Research Design

This quasi-experimental design study utilized a randomized control trial (RCT) to measure the effects of music therapy in pediatric patients with congenital heart defects in the pre and postoperative settings. The study aimed to collect data on the specific target population of pediatric patients with congenital heart defects undergoing surgery in a San Francisco pediatric cardiac unit. The independent variable of this study would be defined as those who are receiving music therapy in both the pre and postoperative setting and those who are receiving standard care without music therapy in the pre and postoperative setting as well. The groups who would be receiving music therapy were defined as the experimental group and the groups who were not receiving music therapy would be defined as the control groups. This study will be analyzing and comparing pre op and post op vital signs, preoperative anxiety, and postoperative pain levels between four different groups of pediatric patients with congenital heart defects on the cardiac unit.

Research Study Objectives

Listed below are the research objectives that this study aimed to meet through the implementation of music therapy.

- Obtain and compare vital signs from pediatric patients with congenital heart defects during the preoperative setting with music therapy intervention versus pediatric patients with congenital heart defects in the preoperative setting who did not receive music intervention.
 - Obtaining and comparing these vital signs from the preoperative setting would give a comparison of how music can affect heart rate, blood pressure, respiratory rate, etc. When these parameters are outside of the defined limits, there is an

increased risk for surgical complications and increased need for anesthesia and analgesia requirements.

- Conduct a preoperative anxiety assessment using the Yale Preoperative Anxiety Scale
 - Preoperative anxiety can lead to an increase in heart rate, blood pressure, and respiratory rate which can be a risk factor for complications and a need for an increase of anesthesia requirements.
- Obtain and compare vital signs from pediatric patients with congenital heart defects in the postoperative setting with music therapy intervention versus pediatric patients with congenital heart defects in the postoperative setting who did not receive music therapy intervention.
 - Obtaining and comparing postoperative vital signs with and without music therapy intervention can give a comparison on how music can have a physiological effect on heart rate, blood pressure, and respiratory rate. When these parameters are out of range, it can lead to postoperative complications and delayed recovery times.
- Conduct a postoperative pain assessment using the Wong Baker Face Scale in the experimental groups that both had music therapy and in the control groups that did not have music therapy.
 - Assessing postoperative pain and comparing these results from patients from the postoperative setting who either received music therapy or did not is a method to analyze the effects of how music therapy can have a nonpharmacological influence on pain.

Methodology

The sample population, data collection procedures, instrument, and data management are described below as follows.

Sample Population

The sample population of interest for this quantitative study are pediatric patients in a San Francisco Hospital ages 1 day to 10 years old who were diagnosed with congenital heart defects and who are undergoing cardiac surgery in order to treat the heart abnormality. Data would be extracted from 80 pediatric patients with congenital heart defects who were admitted to the hospital to undergo cardiac surgery. This sample population was a convenience sample as the patients were already in the pediatric cardiac unit at the hospital and diagnosed with a congenital heart defect. For the purpose of this study, nurses who were willing to participate in the study and dedicate their time and effort as well as being a current perioperative nurse and or post anesthesia care unit (PACU) nurse would be delegated the role of research facilitators as these nurses work closely with these patients especially during the pre and postoperative phases. Their responsibility is to obtain and record vital signs along with assessing anxiety and pain levels in each study participant.

Inclusion criteria for participants:

- Ages 1 day to 10 years old
- Diagnosis of congenital heart defect
- Admission to hospital for cardiac surgery
- No pre existing psychological disorders such as diagnosed depression or anxiety
- No other pertinent health issues such as liver or renal disease.

Exclusion criteria for participants:

- Adult patients
- Pediatric patients on other units
- Pediatric patients who do not have CHD
- Pediatric patients with hearing impairments
- Pediatric CHD patients over the age of 10 years old
- Pediatric CHD patients who have pre existing psychological disorders and other pertinent health issues
- Emergency surgeries
- No parental consent given/ refusal

Instrument

A tool that would be used within the study is music played through an ipad during preop and postop. The genre of music is left up to the patient's discretion such as Disney songs or current songs that the patient seems to enjoy. For infants and toddlers who cannot verbalize what kind of music they would like to listen to due to their current developmental stage, the parents would be able to choose music to their child's liking. Music of choice is played during pre op procedures and upon entry into the operating room during anesthesia induction. When the procedure is done, the same genre of music would be played in the PACU (post anesthesia care unit) as the patient is recovering from anesthesia until they are transferred to the ICU or medical surgical unit for further postoperative recovery and care.

Another essential tool that would be used in the study was the Wong Baker Face Scale to assess the pain levels in each of the patients during postoperative recovery by PACU nurses.

Nurses are to use their assessment skills to score each child on the Wong Baker Face Scale in regards to pain levels after surgery. Along with the pain scale, perioperative nurses would be asked to assess preoperative anxiety levels in each study participant using the Yale Preoperative Anxiety Scale which is the same tool that was used in the study conducted by Ya-Li Huang et al.

Data Collection Procedures

80 pediatric patients diagnosed with a congenital heart defect and needing cardiac surgery would be randomly selected from the cardiac unit to participate in the study with parental consent. Perioperative and PACU nurses who would be involved in the study would have essential roles in gathering the data necessary. Perioperative nurses who were involved in the care of each patient were given an ipad to play music from for their patient if their patient was randomly selected for the experimental group. Once the patient was ready to undergo preoperative procedures such as lab draws, potential IV starts, and transfer to the operating room, music therapy was initiated with the chosen genre of music played while these tasks were being completed with the patient. The nurse would then take vital signs and assess the patient's preoperative anxiety levels using the Yale Preoperative Anxiety Scale and record the findings. The same procedure would be done with the control group without any music intervention.

In the preoperative setting, music of preference would be played from the ipad in the PACU while the patient was recovering from anesthesia up until transfer to another unit for further recovery. The PACU nurse would also be responsible for obtaining vital signs. However, in this setting the PACU nurse was also responsible for assessing the child's pain levels using the Wong Baker Face Scale once the patient was recovered from anesthesia. This same procedure was done with the control group with no music therapy intervention. The control group would go

though the standard postoperative procedures without any music therapy and vitals and pain assessments would be conducted as well using the same pain assessment tool. All results would be recorded and analyzed accordingly.

Ethical Considerations

This study was approved by the Institutional Review Board for the Protection of Human Subjects of Dominican University of California. In regards to the sample population, parental consent and extensive information about the study was given to the parents since all study participants were under legal age. It was also taken into consideration that patient confidentiality would be of utmost importance as well as ensuring that no harm was being done to the patients.

In regards to the nurses who would be collecting vital signs and anxiety/ pain assessments it was important to ensure that obtaining these data would not interfere with their workflow and schedule. Vital signs would be able to be obtained with the use of a dynamap (vital signs machine) would give these results comprehensively on the screen which allowed for the nurse to easily record these results in a timely manner which should not impede workflow. In addition, ipads were found to be the most suitable instrument for music intervention due to it being a small portable device that is relatively easy to use.

Statistical/ Data Analysis

To analyze the data collected from this study, an ANOVA test would be the most ideal statistical test to draw conclusions from. This is because an ANOVA test is useful in comparing and analyzing multiple groups to determine statistical significance in vital signs, preoperative anxiety, and postoperative pain levels among the four comparison groups. Pre and post-operative

data will be analyzed for differences or changes in heart rate, blood pressure, and respiratory rate. Data analysis also includes pre and post-operative anxiety and pain levels.

Discussion

Music therapy has been found to have profound effects on pediatric patients with congenital heart defects who are undergoing cardiac surgery in both the pre and postoperative settings. In this study of 80 pediatric cardiac patients music therapy aided in reducing preoperative anxiety in the experimental group as well as reducing heart rate, blood pressure, and respiratory rate. Elevated vital signs in the preoperative setting can lead to an increased need for anesthesia and analgesia requirements which lead to further complications during the surgery. In regards to post op, music therapy would be able to reduce pain levels as well as lower heart rate, blood pressure, and respiratory rate in comparison to the postoperative control group. Music therapy has been known to be an effective non pharmacological method in pediatric patients especially during surgical procedures.

Implementing music therapy into nursing practice when caring for pediatric patients with congenital heart defects who are undergoing cardiac surgery can be a simple beneficial tool in aiding these patients with better overall recovery results that yield effective patient outcomes. Music therapy is a relatively low cost and effective tool that can be used in the pediatric nursing practice as a standard for non pharmacological methods of postoperative pain relief, lowering preoperative anxiety levels, and stabilizing physiological properties.

Study Limitations

As with any study, this study has various limitations that can be discussed. In this study, it would be difficult to find enough nurses who were willing to volunteer to take the extra time to

do an anxiety assessment as it was an extra assessment that they had to learn how to score and assess. Nursing shortages are a key factor in trying to find nurses that were willing to participate in the study. Furthermore, vital signs are specific towards the target population which are pediatric patients with congenital heart defects ages 1 day to 10 years old. This meant that these vital signs needed to be interpreted by age and that these patient's vital signs such as respiratory rate and oxygen saturation may be altered due to their cardiac issues which can affect data results. Comparing an infant's vital signs to a 10 year old's vital signs would look different and have different parameters which needed to be taken into consideration when comparing results.

Live music was also taken into consideration as a form of music therapy, however it was decided that not every hospital has funding and a budget to pay for live music and that an iPad was a more efficient and convenient tool to use. Another consideration is that the genre of music would be left up to the parents or the patients themselves due to the fact that not many children would be interested in listening to classical music or other genres that children do not typically listen to which could cause the patient to become uninterested or uncomfortable by the music choice that was predetermined for them.

Implications for Nursing Practice

A simple tool like music therapy can be used within the nursing practice to improve patient outcomes especially in the pediatric setting. Children are known to be creative and use their imagination as a natural instinct. Implementing music therapy as a standard tool in the pre and post operative setting can improve patient recovery outcomes what will aid nurses as these patients would be recovering effectively at higher rates as evidenced by their improved vital signs in pre op and post op as well and decreased anxiety levels during preoperative procedures

which reduces the risk for complications during surgery due to a decreased need for anesthesia requirements. This aids nurses in promoting better patient outcomes along with relieving some of the stressors that come with caring for pediatric cardiac patients like poor postoperative recovery results and other complications. Using music therapy in the nursing practice is proven to be a nonpharmacological intervention that can be low cost and easy to use especially when a child may not be due for pain medications. This can also decrease the chance of having drug interactions and toxicity which are another factor that nurses often experience when caring for patients.

Conclusion

Music therapy has been proven to be an effective tool in helping reduce preoperative anxiety, stabilizing vital signs, and lowering postoperative pain levels in pediatric patients with congenital heart defects undergoing cardiac surgery. Music therapy can be implemented into nursing practice by integrating music therapy into treatment plans for these patients to improve overall patient outcomes and reducing recovery times as well as preventing excessive need for anesthesia and analgesia requirements which can increase the risk for surgical complications. This study is meant to exemplify the effects of music therapy within the pre and postoperative settings. Using these potential results from this study can encourage the usage of music therapy as a standard in nursing practice when developing treatment plans for cardiac patients. The implementation of music therapy as a standard component of treatment plans in nursing practice for pediatric patients undergoing cardiac surgery can serve as a fundamental tool that can improve overall patient outcomes and improve overall health.

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