

Original
Article

Effect of Music Therapy on the Chronic Pain and Midterm Quality of Life of Patients after Mechanical Valve Replacement

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Objective: To evaluate the effect of music therapy on the chronic pain and midterm quality of life of patients after mechanical valve replacement.

Methods: Patients were divided into two groups according to whether or not they received music therapy. The patients in the music group received 30 minutes of music therapy every day for 6 months after the operation. The patients in the control group received standard treatment and had 30 minutes of quiet rest time every day in the same period. The short-form of McGill Pain Questionnaire (SF-MPQ) was used to evaluate the degree of postoperative chronic pain, and the SF-36 was used to evaluate the midterm quality of life of patients.

Results: In terms of the degree of postoperative chronic pain, the score of the pain rating index (PRI) emotional item in the music group was significantly lower than that in the control group. In the evaluation of the postoperative midterm quality of life using the SF-36, the emotional function score in the music group was significantly higher than that in the control group.

Conclusion: This study preliminarily showed that music therapy can effectively reduce chronic pain and improve midterm quality of life after surgery.

Keywords: music therapy, pain, quality of life, mitral valve replacement

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Introduction

Mechanical valve replacement is a common valvular heart surgery; patient hemodynamics are improved after the operation, and patients can obtain satisfactory survival with the correct anticoagulation therapy.¹⁾ However, patients often feel pain due to a variety of factors in the postoperative period, and this chronic pain may accompany the patient for a long time or even for life.²⁾ The pain will not only cause discomfort to the patient's body but also have different effects on their spirit, psychology, physique, etc., which directly affects the midterm quality of life of patients.³⁾ With the change of the medical model from a biological to a bio-psycho-social model, chronic pain has received increasing attention by

patients and medical staff. Music therapy is widely used in the field of medicine and has been proven to reduce the degree of anxiety and pain in patients at short-term follow-up.⁴⁾ However, there have been few studies on the effect of postoperative music therapy on chronic pain and the midterm quality of life of patients undergoing mechanical valve replacement. Therefore, we designed this study to explore the midterm management of patients after mechanical valve replacement.

Materials and Methods

Calculation of study sample size

According to the result of the pre-survey, the alpha value was set to be 0.05, and the power was set to be 0.90, the resulting minimum sample size was 39 patients in each group based on the calculation. Considering a 10% drop rate, the total sample size was set was 86 patients in this study. The patients were divided into two groups using a simple randomization method, and two numbers 0 or 1 were randomly generated by a computer. The patient who generated 0 was assigned to the music group (n = 43), and the patient who generated 1 was assigned to the control group (n = 43).

Patients

Patients who underwent mechanical valve replacement in our hospital from January 2017 to September 2018 were selected as the research participants. The demographic data of the patients are recorded in **Table 1**. Among them, 45 underwent a mitral valve replacement, 24 had an aortic valve replacement, and 17 had a double valve replacement. The inclusion criteria were patients with grade I postoperative cardiac function and not combined with serious diseases of other important organs. The exclusion criteria were as follows: secondary surgery, severe heart structure changes due to severe valvular disease and low ejection fractions, chronic pain syndrome, a significant history of mental illness, and unwillingness to sign the informed consent. The age of patients in the music group was 52.3 ± 3.7 years, and that in the control group was 51.8 ± 3.3 years. The study was approved by the ethics committee of our university and written informed consent was signed by every participant.

Music therapy

Patients chose a quiet room environment between 8 and 10 pm every night in which to rest in bed in a comfortable position and were asked what kind of music they liked.

The researcher provided several different types of music for patients to choose from, including but not limited to light music, folk songs, operas, pop music, etc. Patients in the music group used speakers or headphones to listen to music for approximately 30 minutes every night. The music was soft and soothing, and the volume control was appropriate. This method was completed by the researcher before discharge, and it was used as a guide for the patients' family members. After discharge, the patients could contact the researcher via WeChat if they had any problems.⁵⁾

Control group

Patients assigned to the control group chose a quiet room and had 30 minutes of quiet rest time between 8 and 10 pm every night. Patient instruction was completed by the researcher, and the family members assisted in this process. WeChat served as a real-time communication tool between the researcher and patients during the follow-up period.

Follow-up

Echocardiography

Patients were followed up at an outpatient clinic 6 months after the operation. Transthoracic echocardiography and electrocardiogram results were reviewed, and left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), left atrial diameter (LAD), right ventricular diameter (RVD), and left ventricular ejection fraction (LVEF) data were recorded.

Simplified McGill Pain Questionnaire (short-form of McGill Pain Questionnaire, SF-MPQ)

A simplified Chinese translation of the McGill Pain Questionnaire was used to assess patients' postoperative chronic pain at 6-month follow-up.⁶⁾ The SF-MPQ is a simplified version of the MPQ, consisting of only 11 sensory and 4 emotional descriptors for pain, as well as present pain intensity (PPI) and visual analog scales (VAS). For all descriptive words, we used 0 to 3 to indicate the different degrees of "none," "mild," "moderate," and "severe," respectively. Since the pain rating index (PRI) or total PRI can be obtained by classification, the SF-MPQ is suitable for limited detection time and other pain intensity information, such as VAS score results. Like the typical MPQ, the SF-MPQ is also a sensitive and reliable pain assessment tool. A lower score indicates less pain.

36-Item Short Form Survey (SF-36)

The standard Chinese translated version of the SF-36 questionnaire was used to assess patients' midterm

Table 1 Baseline characteristics of patients

Variable	Music group	Control group	P value
Gender			NS
Male	23 (53.5%)	19 (44.2%)	
Female	20 (46.5%)	24 (55.8%)	
Marital status			NS
Married	42 (97.7%)	41 (95.3%)	
Single	1 (2.3%)	2 (4.7%)	
Education level			NS
Junior high school and below	12 (27.9%)	15 (34.9%)	
High school	14 (32.6%)	13 (30.2%)	
Bachelor degree or above	17 (39.5%)	15 (34.9%)	
Monthly income			NS
<5000	6 (14.0%)	9 (20.9%)	
5000–10000	11 (25.6%)	14 (32.6%)	
10000–20000	16 (37.2%)	11 (25.6%)	
>20000	10 (23.2%)	9 (20.9%)	
Valve replacement			NS
Mitral valve	20 (46.5%)	25 (58.1%)	
Aortic valve	13 (30.2%)	11 (25.6%)	
Double valve	10 (23.6%)	7 (16.3%)	

quality of life at 6-month follow-up.⁷⁾ The SF-36 is mainly focused on eight dimensions: (1) PF: physical functioning; (2) RP: role physical; (3) BP: bodily pain; (4) GH: general health; (5) VT: vitality; (6) SF: social functioning; (7) RE: role emotional; and (8) MH: mental health. Each dimension is explored by different questions, and each question has response choices at different frequency levels with corresponding scores. The respondent must complete the questionnaire independently. Each dimension of the SF-36 scale ranges from 0 to 100 points. The higher the score, the better the condition of the dimension.

Statistical analysis

SPSS 25.0 statistical software (SPSS25.0, IBM Corp., Armonk, NY, USA) was used to analyze the data. Categorical data were expressed by n (%) and analyzed using chi-squared tests; measurement data were expressed by $\bar{x} \pm s$ and analyzed using t-tests. All data were tested with a normality test; a nonparametric test was used for data that did not have a normal distribution. The Mann–Whitney U test was used to analyze the differences in SF-MPQ and SF-36 scores between the two groups. $P < 0.05$ was considered statistically significant.

Results

The comparison of the baseline characteristics between the two groups of patients showed no significant differences

Table 2 Comparison of echocardiographic data between the two groups at postoperative 6-month period

Variable	Music group	Control group	P value
LVEDD (mm)	47.6 ± 5.8	47.8 ± 5.3	0.952
LVESD (mm)	29.8 ± 6.6	29.5 ± 5.3	0.993
LAD (mm)	41.9 ± 6.1	41.4 ± 5.7	0.772
RVD (mm)	20.6 ± 2.2	20.1 ± 2.2	0.316
LVEF (%)	67.4 ± 3.1	67.5 ± 3.0	0.866

LAD: left atrium diameter; LVEDD: left ventricular end-diastolic diameter; LVEF: left ventricular ejection fraction; LVESD: left ventricular end-systolic diameter; RVD: right ventricle diameter

($P > 0.05$, **Table 1**). At 6-month follow-up, a review of postoperative echocardiographic data showed that the cardiac function of both groups recovered well, and there were no significant differences between the groups in regard to LVEDD (47.6 ± 5.8 vs 47.8 ± 5.3 mm), LVESD (29.8 ± 6.6 vs 29.5 ± 5.3 mm), LAD (41.9 ± 6.1 vs 41.4 ± 5.7 mm), RVD (20.6 ± 2.2 vs 20.1 ± 2.2 mm), or LVEF (67.4 ± 3.1 vs $67.5 \pm 3.0\%$) ($P > 0.05$, **Table 2**). As shown in **Table 3**, in the comparison of SF-MPQ scores between the two groups, the score of the PRI sensory item in the music group was slightly lower than that of the control group, but there was no statistical significance. The score of the PRI emotional item in the music group was significantly lower than that of the control group ($P < 0.05$). The VAS and PPI scores in the two groups were comparable, which was not statistically significant. **Table 4** shows the comparison of SF-36 scores between the two groups; the role emotional (RE) score of patients in the music group was significantly higher

Table 3 Comparison of SF-MPQ scores between the two groups at postoperative 6-month period

Variable	Music group	Control group	P value
PRI (sensory item)	3.28 ± 2.43	3.63 ± 2.53	0.492
PRI (emotional term)	3.77 ± 2.44	5.17 ± 2.88	0.021
VAS	3.02 ± 1.42	3.09 ± 1.67	0.752
PPI	1.60 ± 1.12	1.56 ± 1.20	0.841

PRI: pain rating index; SF-MPQ: short-form of McGill Pain Questionnaire; VAS: visual analog scales

Table 4 Comparison of SF-36 scores between the two groups at postoperative 6-month period

Variable	Music group	Control group	P value
PF	55.81 ± 8.99	56.63 ± 8.64	0.419
RP	59.30 ± 21.15	68.02 ± 20.65	0.063
BP	52.85 ± 14.34	54.07 ± 10.94	0.989
GH	52.67 ± 13.90	53.02 ± 11.35	0.193
VT	57.09 ± 10.76	53.84 ± 10.68	0.156
SF	58.69 ± 15.95	59.43 ± 15.04	0.577
RE	75.99 ± 18.29	42.63 ± 21.01	0.000
MH	77.77 ± 3.06	76.84 ± 3.96	0.315

BP: bodily pain; GH: general health; MH: mental health; PF: physical functioning; RE: role emotional; RP: role physical; SF: social functioning; VT: vitality

than that in the control group (75.99 ± 8.29 vs 42.63 ± 21.01), while the other items were not statistically significantly different.

Discussion

Heart valvular disease is one of the most common diseases in adult cardiac surgery.⁸⁾ In China, a large number of patients with rheumatic heart disease undergo valve replacement every year, and most patients choose mechanical valves because of economic and cultural factors. Mechanical valves have the advantages of a long life, low incidence of structural valve failure, and definite clinical effect. Close follow-up, timely treatment and a reasonable anticoagulation strategy can improve the long-term survival rate.^{9,10)} To date, many clinical research studies have focused on the mode of operation and surgical complications, while few studies have focused on patients' chronic pain and midterm quality of life. Crombie and colleagues first reported on postoperative chronic pain after surgery, which referred to continuous or intermittent pain lasting for at least 3 months after the operation.^{11,12)} Chronic pain has always been considered to be an important factor affecting patients' comfort and rehabilitation after cardiac surgery. Like other vital signs, changes in pain can cause a series of physiological, pathological, neurobiological, and

other related changes. Because of the relatively long operation time, long surgical incision, exposure of the surgical incision, numerous tissue injuries, steel wire friction, and other factors, some patients with mechanical valve replacement may feel pain for a long time, or this feeling may even last for a lifetime. According to statistics, approximately 30% of adults suffer from chronic pain, and a survey by the World Anesthesia Association showed that 54% of patients still had pain after cardiothoracic surgery and 10% had severe pain. Furthermore, approximately 50% of patients have postoperative pain for 1–2 years and 30% of patients have postoperative pain for 4–5 years.^{13,14)} Chronic pain affects patients' sleep, and some patients have a loss of appetite, which leads to nausea and vomiting. When patients suffer from moderate or severe pain, their daily life might completely change and their daily behavior and work could be seriously affected, which could cause negative emotions, such as depression and anxiety, affect the patients' quality of sleep, and have a serious impact on the patients' quality of life.^{15,16)} The corresponding chronic pain associated with valvular replacement should be a predictable postoperative adverse experience, but it has not received enough attention and does not have a specific symptomatic treatment. This pain might also have far-reaching adverse effects, including clinical and psychological changes, increasing perioperative management costs, reducing the quality of life, and delaying the recovery of patients. Pain control had become as important as surgical outcomes and has a significant impact on patients' perception of their hospital experience. Therefore, how to reduce the chronic pain after valve surgery has become an urgent problem.

Nonsteroidal anti-inflammatory drugs are one of the most commonly used painkillers, but excessive use may damage liver function and cause the tendency to bleed.¹⁷⁾ Opioid receptor drugs can easily cause drug addiction, so they are not commonly used in unconventional situations.¹⁸⁾ With the transformation of the medical and health models, painless and noninterventional music therapy has become widely used in various clinical departments.¹⁹⁾ Music therapy is a new subject that integrates music, medicine, and psychology, which can promote patients' physical and mental health, eliminate psychological obstacles, relax the body and mind, and calm the mood of patients to improve patients' ability to control pain and to alleviate anxiety, depression, and other bad emotions. As a specific nursing intervention, other advantages of music therapy are harmlessness to patients, minimal risk, low cost, and ease of operation,

which means that music therapy has a great potential for reducing pain. Studies have shown that music therapy can relieve chronic pain, anxiety, and depression in cancer patients.¹⁹⁾ However, it has rarely been reported that music therapy can improve the chronic pain and quality of life of patients after heart valve surgery.

In this study, we strictly excluded patients with severe heart disease, low ejection fraction, poor body condition, and poor heart function, and we re-examined echocardiographic function at the 6-month follow-up. The echocardiographic data for all patients were close to that of normal adults, and the difference between the two groups was not statistically significant, which indicates that the surgical results of our cases were satisfactory. In our comparative studies about the SF-MPQ, the PRI emotional item score in the music group was significantly lower than that in the control group, which means that patients showed a relief of chronic pain after receiving music therapy for a relatively long period of time. In theory, listening to music can release endorphins and reduce the level of catecholamine.²⁰⁾ Choosing corresponding music and using the harmonious audio generated by the music can coordinate the various vibratory activities of the human body. Daily pain can be forgotten because of a concentration on music, and can be weakened by continuous music therapy. Many pharmacological interventions for the treatment of pain are accompanied by adverse effects. It is safe to provide music therapy after surgery, which can help reduce the use of pain medications and is relatively cheap and easy to implement.

Due to the economic and social development conditions in China, many patients with rheumatic heart disease often seek treatment only when the heart function is severely damaged and the quality of life is significantly decreased. In such cases, heart valve replacement has become the first and only choice for treatment. With the change of the medical model, people pay increasing attention to whether a treatment method can give patients a better quality of life. Quality of life refers to the experience of individuals in different cultures and with different value systems about their living conditions related to their life goals, expectations, standards, and concerns, including four aspects of individual physiology, psychology, social function, and material state. In this study, we used the SF-36 to assess patients' postoperative quality of life, which comprises all aspects of the definition of quality of life.²¹⁻²³⁾ Therefore, the research results were relatively reliable. Hilliard's study confirmed that music therapy can improve the quality of life of terminal cancer

patients with pain.²⁴⁾ Another study showed that persistent chronic pain after surgery might affect the quality of life after mechanical valve replacement surgery.²⁵⁾ From the SF-36 scores in this study, it could be concluded that the SF-36 RE score of the music group was higher than that of the control group. We think that music therapy had a significant effect on the patients who underwent mechanical valve replacement and improved the mid-term quality of life of these patients. The improvement in the quality of life of patients after the operation not only helped patients recover physically but also allowed patients to more quickly integrate into a productive society.

Limitations

Our research had some limitations. The sample size included in this study was relatively small and was limited to patients after mechanical valve replacement, so it might be unreasonable for our results to be applied to other surgical patient groups. To a certain extent, the curative effect of music therapy was also affected by some factors, such as the inherent content of music (rhythm, melody, timbre, etc.) and the listener's acceptance level (age, education level, etc.). Our study data might have been subjectively influenced by patients and might have been biased in the recording process. We did not further study the relationship between chronic pain and patients' postoperative quality of life. We studied the postoperative quality of life of patients, but the article did not study the patients' cultural status, economic level, hospital stay, overall cost, or other factors, so the conclusion has a certain deviation. In the future, it will be necessary to consider a variety of factors and complete a study with a larger sample size and longer follow-up to demonstrate the conclusion.

Conclusion

The preliminary results of this study showed that music therapy can be safe and effective when used in the care of patients after mechanical valve replacement. Music therapy reduced patients' chronic pain and improved their quality of life to a certain extent.

Authors' Contributions

Z-wL, S-tH, NX, and QC designed the study, performed the statistical analysis, participated in the operation, and

drafted the manuscript. L-wC and HC collected the clinical data. All authors read and approved the final manuscript.

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Disclosure Statement

The authors declare that they have no competing interests.

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