Original Article

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The Effect of Listening to Music on Reducing Anxiety and Pain During Extracorporeal Shock Wave Lithotripsy; A Randomized Controlled Study

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Abstract

Aim: Many patients experience anxiety during their first shock wave lithotripsy (SWL) experience. We investigated the effect of music therapy on anxiety and pain during SWL.

Methods: This study was designed as a randomized controlled trial between June 2021 and December 2021. A total of 100 patients were evaluated prospectively. Fifty patients were assigned to each group using a simple randomization method. The study group was exposed to music therapy, while the control group was not exposed to it. Demographic data (age, gender, and body mass index), stone characteristics (size, location, and laterality), and SWL characteristics (SWL duration, energy, and number of shock waves) were recorded. The state-trait anxiety inventory (STAI) was used to assess anxiety, and the visual analog scale (VAS) was used to assess pain. After the SWL, general patient satisfaction and willingness to repeat the procedure were evaluated.

Results: Baseline STAI-state (STAI-S) and STAI-T values measured before SWL were similar between the groups (p=0.51 and p=0.46, respectively). STAI-S after SWL was statistically significantly lower in the music group (p=0.02). In the music group, satisfaction and willingness to repeat were higher, while the VAS was lower (p=0.04, p=0.03 and p=0.03, respectively).

Conclusion: Music therapy during SWL is an inexpensive and effective method to reduce patient anxiety and the patient's perception of pain.

Keywords: Music, lithotripsy, pain, anxiety

Introduction

Shock wave lithotripsy (SWL) treatment for kidney and ureteral stones has recently become more popular due to advantages such as being less invasive than other surgical treatments, being performed without anesthesia, being relatively inexpensive, and having the option of outpatient treatment (1). The success rate of SWL is between 50 and 80%. In addition to factors such as stone location, size, and composition, skin-to-stone distance, and patient compliance, other factors also affect the success rate (2,3).

SWL is considered a stressful and painful procedure. Patient anxiety and pain are factors that affect patient compliance and procedure tolerability (4). While the pain reduces the effectiveness of SWL by defocusing attention due to excessive respiratory activity and undesirable movements, it also reduces the rate of continuation of the procedure (5). To reduce pain perception and anxiety during SWL, pharmacological treatments (non-steroidal anti-inflammatory drugs, opiate agents, and anxiolytics) and non-pharmacological distraction techniques such as aromatherapy, hypnosis, acupuncture, biofeedback, and reflexology have been suggested (6). Another non-pharmacological method is music therapy, which has been known for its relaxing effect since ancient times (7). It has been reported that music therapy has a positive effect on pain perception and anxiety in various non-urological

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procedures (8). Therefore, we investigated the effect of music therapy on anxiety and pain during SWL.

Materials and Methods

Compliance with Ethical Standards

This study was designed as a randomized controlled trial between June 2021 and December 2021 in University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital in patients with kidney and upper ureteral stones who were planned for SWL, after the approval of the University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital Local Ethics Committee (approval number: 2021.04.64, date: 28.04.2021).

Study Design

Patients aged <18 years with solitary kidneys, kidney anomalies, hearing problems, illiteracy, non-opaque stones, previous SWL history, the presence of a ureteral stent, anxiolytic drug use, or an anxiety disorder were excluded from the study. All patients included in the study were selected from patients who received the first session of SWL.

Demographic data such as age, gender, body mass index (BMI), stone size, stone location, and SWL process data (during, energy, and number of shock waves) were collected from medical records. The patients were asked to fill out the forms [state-trait anxiety inventory (STAI), visual analog scale (VAS), willingness to repeat the procedure, and patient satisfaction]. Informed consent was obtained from all patients, both for the SWL procedure and for participation in the study. All patients received SWL treatment from an experienced technician who was unaware of the study. An electromagnetic SWL (Multimed EM, Elmed Medical Systems, Turkey) was used for the SWL procedure for all patients.

A simple randomization method was applied to avoid intervention contamination. Randomization was decided by tossing a coin at the beginning of each day. While the patients who applied were given music therapy (the music group) for one day in accordance with the randomization, the other group was not given music therapy (the control group). The patients in the music group were given a playlist where they could find the type of music they wanted during SWL, and they were given the freedom to choose the type of music they preferred. It is also possible to change the volume of the music.

STAI-trait (STAI-T) and STAI-state (STAI-S) questionnaires were completed in all patients before the procedure, and STAI-S, VAS (0=no pain, 10=maximum possible pain), overall patient satisfaction (0=extremely dissatisfied, 4=extremely satisfied), and willingness to repeat the procedure (0 never, 4=willing) questionnaires were completed after the procedure. Anxiety levels were measured using STAI. The STAI-S scale measures anxiety at a given time, whereas the trait anxiety (STAI-T) scale measures long-term anxiety levels. STAI-S and STAI-T involve 20 items. It involves a four-point Likert type scale where the items can be scored between 1 and 4. The reverse statements' total weighted score is subtracted from the direct statements' total weighted score. Then, a constant value is added to this number. The values are 50 and 35 for STAI-S and STAI-T, respectively. The scale's maximum possible score is 80, while its minimum possible score is 20 (9).

Statistical Analysis

Statistical analysis was performed using the IBM SPSS Statistics 22 (SPSS Inc., Chicago, IL, USA) software. A normal distribution of the quantitative data was checked using the Kolmogorov-Smirnov test. Descriptive statistics for continuous variables were expressed as mean ± standard deviation. The number of cases and percentages were used as categorical data. For intergroup comparisons, the chi-square test was used for categorical variables, and the Student's t-test was used for continuous variables. A p-value less than 0.05 was considered statistically significant.

Results

A total of 100 patients were prospectively evaluated by assigning 50 patients to each group. Demographic data (age, gender, and BMI), stone characteristics (size, location, and laterality), and SWL characteristics (SWL duration, energy, and number of shock waves) were similar in both groups (Table 1).

There was no statistically significant relationship between the groups between the baseline STAI-S (43.89±7.63 and 42.5±4.77, respectively) and STAI-T (38.1±3.37 and 37.06±4.97, respectively) values measured before SWL (p=0.51 and p=0.46, respectively). STAI-S after SWL (42.89±9.24 and 35.42±4.52, respectively) was statistically significantly lower in the music therapy group (p=0.02) (Figure 1). While VAS (6.66±2.19 and 5.19±2.23, respectively) was statistically significantly lower in the music group (p=0.03), satisfaction (1.55±0.69 and 2.06±0.93, respectively) and willingness to repeat (1.52±0.78 and 2.19±0.98, respectively) scores were statistically significantly higher in the Music group (p=0.04 and p=0.03, respectively) (Table 2).

Discussion

There are various factors that can cause patients' perceptions of pain to increase and cause high anxiety during SWL. Patients may feel pain from the direct effect of shock waves on cutaneous pain receptors, muscles, and skeletal structures such as the ribs, as well as from the

Table 1. Demographic data, stone, and SWL characteristics			
	Control group (n=50)	**Music group (n=50)**	**p-value**
Age (years) (Mean ± SD)	43.24±10.61	41.78±11.23	0.56[a]
Gender n (%)			0.8[b]
Male	29 (58%)	31 (62%)	
Female	21 (42%)	19 (38%)	
BMI (kg/m^2) (Mean ± SD)	26.63±3.16	26.4±2.48	0.83[a]
Stone size (mm) (Mean + SD)	10.53±3.37	10.19±3.84	0.69[a]
Stone location n (%)			0.68[b]
Renal pelvis	30 (60%)	33 (66%)	
Upper ureteral	20 (40%)	17 (34%)	
Stone laterality n (%)			0.52[b]
Right	14 (28%)	18 (36%)	
Left	36 (72%)	32 (64%)	
SWL duration (min.) (Mean ± SD)	30.64±3.40	31±2.39	0.69[a]
SWL energy (kV) (Mean ± SD)	18.77±3.73	17.73±3.29	0.41[a]
Number of shockwaves (Mean ± SD)	2707.4±303.73	2662.5±368.74	0.71[a]

[a]: Student's t-test, [b]: Chi-squared
BMI: Body mass index, SWL: Shock wave lithotripsy, SD: Standard deviation

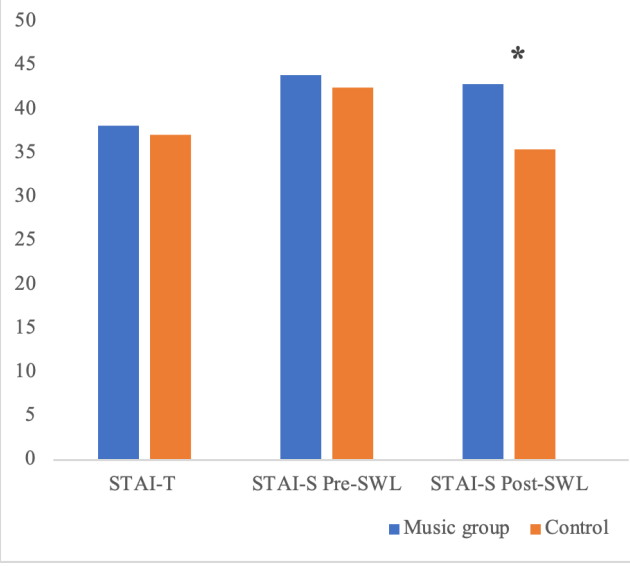

Figure 1. Comparison between groups; STAI-T, STAI-S pre-SWL and STAI-S post-SWL scores. *: Statistically significant difference between groups (p<0.05)
SWL: Shock wave lithotripsy, STAI-S: State-trait anxiety inventory-state, STAI-T: State-trait anxiety inventory-trait

formation of tension in the kidney capsule (10). Patients may feel anxious and stressed as the procedure is held alive by the SWL device (11). High anxiety may cause irregular breathing, which may be difficult to focus on the stone and prevent the maximum energy transmission, while pain may affect patient tolerability and patient comfort (5). Patients with high anxiety tend to have higher pain scores, and they affect each other indirectly (12). Many

Table 2. Comparison between groups; Pre-SWL STAI-T, STAI-S scores and post-SWL VAS, satisfaction, willingness to repeat, and STAI-S scores			
	Control group (n=50)	**Music group (n=50)**	**p-value**
STAI-T (Mean ± SD)	38.1±3.37	37.06±4.97	0.46[a]
STAI-S Pre-SWL (Mean ± SD)	43.89±7.63	42.5±4.77	0.51[a]
STAI-S Post-SWL (Mean ± SD)	42.89±9.24	35.42±4.52	0.02*[a]
VAS-Pain (0-10) (Mean ± SD)	6.66±2.19	5.19±2.23	0.03*[a]
Patient satisfaction (0-4) (Mean ± SD)	1.55±0.69	2.06±0.93	0.04*[a]
Willingness to repeat (0-4) (Mean ± SD)	1.52±0.78	2.19±0.98	0.03*[a]

*Statistically significant, [a]: Student's t-test
SWL: Shock wave lithotripsy, SD: Standard deviation, STAI-S: State-trait anxiety inventory-state, STAI-T: State-trait anxiety inventory-trait, VAS: Visual analog scale

studies have shown a positive effect of music therapy on pain, anxiety, and hemodynamic parameters in various procedures (13-16). We found that music therapy during SWL reduced anxiety and pain scores. We also found that patient satisfaction and willingness to repeat the procedure increased with music therapy.

We think that besides the relaxing and stress-reducing effects of music therapy, it reduces anxiety levels by masking the disturbing sounds of the device. Music therapy has previously been shown to reduce pain perception by activating the cingulofrontal cortex, and this pathophysiology explains the relationship between pain and music therapy (17,18). We can also say that

distracting has a positive effect. Pharmacological and non-pharmacological interventions were applied to increase patient compliance by reducing pain and anxiety levels that affect patient compliance. Although pharmacological methods such as anesthesia, sedative agents, opioids, and analgesics are effective, they have limitations such as cost, side-effect profiles, and addiction potential (19,20). Non-pharmacological methods have been found interesting because they have fewer side effects and because many studies have been conducted (6,21,22). We also examined the effect of music therapy, which can be an alternative to pharmacological methods. The lack of side effects and cost are the biggest advantages of this method. Additionally, while pharmacological pain-reducing methods only reduce pain, they do not have a direct effect on the patient's anxiety. However, we think that music has a direct effect on both anxiety and pain.

In one of the first studies to examine the effect of music therapy on SWL, it was shown to help significantly reduce the need for analgesia (alfentanil) (23). Yilmaz et al. (12) compared intravenous 2 mg midazolam with music therapy and reported the anxiolytic effect of music. Çift and Benlioglu (24) reported that STAI and VAS scores were significantly lower compared to the control group in their study, in which they had patients listen to different types of music with headphones. Karalar et al. (25) had the patients listen to Turkish classical music with and without noise-cancelling headphones during SWL, and they found a significant decrease in VAS and STAI scores in the groups that listened to music compared to the control group. They claimed that listening to music with headphones was more effective than listening to music without headphones. Dogan and Ceylan (26) reported that the application of music therapy before or during the procedure had a similar effect.

In most of these studies, music was played through a headset, and the type of music was generally determined by the researchers. However, listening to music with headphones changes according to people's listening habits. The weakness of these studies may be that the patients' music listening habits were not questioned. We think the headset itself can be an uncomfortable factor for some people. Another weakness was that researchers usually determined the type of music that patients would listen to. Music type preferences may vary from person to person, and many reasons, such as mood changes and socio-cultural level, may affect this preference. In our study, we did not use headphones to listen to music, as we thought that it might disturb the comfort of the patients. We left the type of music to be listened to and the adjustment of the music volume to the patients' preference. We believe that this way, the patients are more comfortable and their anxiety regresses more easily. Additionally, we believe that it should not be forgotten that it is not always possible to provide ideal standardization since the scales used to be measured in such studies are subjective criteria such as pain and anxiety.

Study Limitations

Firstly, we did not evaluate the relationship between music types. Secondly, we did not examine the effect of music therapy on stone-free rates. Third, although we found that patients' pain scores decreased with music therapy, we did measure their pain medication needs. Despite these limitations, our strength is that we selected all patients from those who received the first SWL session and formed a more homogeneous group.

Conclusion

Music therapy during SWL is an inexpensive and effective method to reduce patient anxiety and the patient's perception of pain. We think that adding this practical and effective method to the SWL procedure will increase the patient's compliance with the treatment.

Ethics

Ethics Committee Approval: The ethical permission for the research was obtained from the University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital Local Ethics Committee (approval number: 2021.04.64, date: 28.04.2021).

Informed Consent: Informed consent was obtained from all patients.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: M.B., Design: M.B., E.K., Data Collection and/or Processing: M.E., E.D., Analysis and/or Interpretation: M.B., O.C., H.L.C., Literature Research: M.B., O.C., Writing: M.B.

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