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## CLINICAL STUDY

# The effect of music therapy during shockwave lithotripsy on patient relaxation, anxiety, and pain perception

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## Abstract

**Objectives:** To research the effect of listening to music during shock wave lithotripsy (SWL) on the patient's pain control, anxiety levels, and satisfaction. **Patients and methods:** The study comprised 400 patients from three hospitals. Half of patients listened to music during their first SWL session but not during their second session. The other half had no music for the first session but the second session was accompanied by music. During all sessions, with and without music, pulse rates, blood pressure, State-Trait Anxiety Inventory-State Anxiety scores (STAI-SA), Visual Analog Scale (VAS scores for pain), willingness to repeat procedure (0 = never to 4 happily), and patient satisfaction rates (0 = poor to 4 = excellent) were assessed. **Results:** There was no statistical difference between the two groups in terms of blood pressure and pulse rates. In both groups, the STAI-SA and VAS pain scores were lower in the session when music was listened to ( $p < 0.001$ ). The patients requested more SWL treatment be completed while listening to music and their satisfaction was greater. **Conclusion:** Music lowered the anxiety and pain scores of patients during SWL and provided greater satisfaction with treatment. Completing this procedure while the patient listens to music increases patient compliance greatly and reduces analgesic requirements.

## Keywords

Music, shockwave lithotripsy, stone, therapy

## History

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## Introduction

There are many invasive procedures performed on outpatients without administering anesthesia. One of these is shock wave lithotripsy (SWL) widely used to treat urinary tract stones for many years.<sup>1</sup> The success of this technique is closely related to factors such as the experience of the person using the machine, localization of the stone, urinary system anatomy, and stone composition, in addition to the patient's compliance with the procedure.<sup>2</sup> To ensure this compliance, it is important that the pain and anxiety of the patient be kept at minimal levels.

Some analgesic drugs used before the SWL procedure are NSAIDs (diclofenac, ketorolac, and piroxicam), opioids (morphine, fentanyl, and pethidine), anxiolytics (midazolam), and local anesthetic agents like EMLA (eutectic mixture of lidocaine 2.5% and prilocaine 2.5%). According to the Urolithiasis Guidelines prepared by the European Association of Urology, the pain control recommendation grade is C, with level of evidence 4.<sup>3</sup> However, these drugs

are not completely benign. Obstructive sleep apnea, respiratory depression, hypotension, tachycardia or bradycardia, temporary cognitive dysfunction, nausea-vomiting, and allergic reactions may be observed related to these drugs.<sup>4,5</sup> Additionally, it is necessary for patients to undergo a sufficient anesthetic assessment one day before the procedure. This along with consultation requests increases costs and lengthens the treatment process.

Many complementary therapy studies have been completed to ensure procedure compliance and pain control for outpatients.<sup>6–9</sup> One of these complementary techniques is music. This study evaluated the effect of music on anxiety and pain scores when listened to during SWL, without any drugs, by patients with upper urinary tract stones.

## Materials and methods

This prospective multicenter study was completed with permission from the Chair of Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (2013/20-04). Informed consent was obtained and patients voluntarily participated. Four hundred and seventy patients without preoperative pain, with no analgesic use before the procedure, with no ureteral stent inserted, with radio-opaque

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Table 1. Demographic data.

	Group 1 First session (no music) Second session (music)	Group 2 First session (music) Second session (no music)	Total n (%)
Gender			
Male	121 (30%)	120 (30%)	241 (60%)
Female	79 (20%)	80 (20%)	159 (40%)
Age (year) (mean $\pm$ SD)	38.1 $\pm$ 13	38.6 $\pm$ 13.5	38.4 $\pm$ 13.1
BMI (mean $\pm$ SD)	26.7 $\pm$ 4.3	28.1 $\pm$ 4.7	27.1 $\pm$ 4
Stone size			
Mean $\pm$ SD	11.8 $\pm$ 2.2	11.6 $\pm$ 2.4	11.7 $\pm$ 2.5
7–10 mm	48 (24%)	52 (26%)	100 (25%)
10–25 mm	152 (76%)	148 (74%)	300 (75%)
Stone location			
Upper calix	14 (7%)	20 (10%)	34 (8.5%)
Middle calix	20 (10%)	10 (5%)	30 (7.5%)
Lower calix	13 (6.5%)	23 (11%)	36 (9%)
Renal pelvis	70 (35%)	55 (27.5%)	125 (31.2%)
UPJ	15 (7.5%)	17 (8.5%)	32 (8%)
Upper ureter	68 (34%)	75 (37.5%)	143 (35.7%)
Stone laterality			
Right	115 (57.5%)	105 (52.5%)	220 (55%)
Left	85 (42.5%)	95 (47.5%)	180 (45%)
Lithotripter			
Dornier	60 (30%)	68 (34%)	128 (32%)
Siemens	70 (35%)	65 (32.5%)	135 (34%)
Elmed	70 (35%)	67 (33.5%)	137 (34%)

stones, and above the age of 18 years were included in the study. Seventy patients were excluded due to reasons such as procedures not completed due to the device or patient, development of complications (nausea-vomiting and analgesic requirements), refusing to listen to music, or not completing the second session.

The study was completed in the stone units of three hospitals by an urologist and accompanying technician. Lubricant gel was spread on the region for SWL at both sessions. The intervals between the sessions were 10–14 d. The patients were divided into two groups: the first did not listen to music during the first session but did during the second session, while the second group listened to music during the first session but not during the second session. Patients listened to Turkish folk, classical, popular, or slow music according to their preference. No medication was given in both the sessions. Demographic data about the patients and the procedure, anxiety and pain scores, willingness to repeat procedure (0 = never to 4 = happily), and patient satisfaction rates (0 = poor to 4 = excellent) were recorded. Additionally pre- and post-procedure pulse rates and blood pressures were measured. Anxiety was measured according to the State-Trait Anxiety Inventory-State Anxiety form while pain was measured by a visual analog scale filled in by the urologist.

### Anxiety and pain scoring system

Psychological evaluation was made using the STAI-SA form.<sup>10</sup> Anxiety points were calculated in the following manner: of the 20 questions on the form, questions 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 were reverse statements. The total points obtained from the reverse statements were subtracted from the total points of remaining direct statements. The result had 50 points added (fixed value) to calculate the

anxiety score. This score was a minimum of 20 and maximum of 80. High scores show greater anxiety.

To assess pain: the visual analog scale for pain (VAS pain = 0–10) was used. While a value of zero described “no pain”, a value of 10 described “unbearable pain”. The patient was asked to state the degree of pain felt.

### Statistical analysis

Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 19.0 for Windows (SPSS Inc., Chicago, IL). Normal distribution of continuous variables was tested with the Kolmogorov–Smirnov test. To show which scale points showed changes between the 1st and the 2nd test for variables with normal distribution, the paired samples *T* test was used. To determine differences between the two groups, the *t* test was used for variables with normal distribution while the Mann–Whitney *U* test was used for non-normal variables. *p* < 0.05 was accepted as significant.

### Results

The average age of 400 patients was 38.4 (18–70) years with a male/female ratio of 5/3. The minimum stone size was 7 mm with the maximum stone size of 25 mm (mean 11.7 mm). Two-thirds of the stones were located in the pelvis renalis and upper ureter (Table 1). There was no difference between the two sessions in terms of numbers of shock waves, duration of lithotripsy and SWL power settings (*p* > 0.05). Hematuria requiring transfusion was not seen in any patient. Pulse rates and blood pressures were similar in both sessions.

In the first group, music was not listened to during the first session and was listened to in the second session. The anxiety scores fell from 48.1 to 40.2 (*p* < 0.001) (Table 2). The VAS score regressed from 6.3 to 2.6.

Table 2. Data from group 1.

	Group 1		<i>p</i> Values
	First session (no music)	Second Session (music)	
Hematuria requiring transfusion	–	–	NS
SWL duration (min)	25.3 ± 4.8	25.1 ± 4.6	0.7
SWL power settings (joule)	17.04 ± 2.07	17.71 ± 2.59	0.1
Number of shock waves (total)	2710 ± 551	2724 ± 492	0.7
Preprocedure pulse rate (no./min)	80.7	81.2	0.6
Postprocedure pulse rate (no./min)	80.2	81	0.4
Preprocedure blood pressure (mmHg)	115/82	121/78	0.7
Postprocedure blood pressure (mmHg)	122/79	119/74	0.7
Patient satisfaction rate (0 = poor to 4 = excellent)	1.12	3.76	<0.001
Willingness to repeat procedure (0 = never to 4 happily)	1.2	3.81	<0.001
VAS (0 = no pain to 10 = unbearable pain)	6.39	2.62	<0.001
STAI-State Anxiety Score (min = 20 to max = 80)	48.1	40.2	<0.001

Table 3. Data from group 2.

	Group 2		<i>p</i> Values
	First session (music)	Second session (no music)	
Hematuria requiring transfusion	–	–	NS
SWL duration (min)	26.2 ± 4.5	26.8 ± 4.9	0.7
SWL power settings (joule)	17.5 ± 2.2	17.8 ± 2.4	0.1
Number of shock waves (total)	2802 ± 481	2777 ± 506	0.7
Preprocedure pulse rate (no./min)	81	79	0.6
Postprocedure pulse rate (no./min)	77	80	0.4
Preprocedure blood pressure (mmHg)	117/78	125/83	0.7
Postprocedure blood pressure (mmHg)	120/81	122/80	0.7
Patient satisfaction rate (0 = poor to 4 = excellent)	1.2	3.8	<0.001
Willingness to repeat procedure (0 = never to 4 happily)	1.3	3.7	<0.001
VAS (0 = No pain to 10 = unbearable pain)	2.83	6.43	<0.001
STAI-State Anxiety Score (min = 20 to max = 80)	40.5	49.1	<0.001

In the second group, music was listened to in the first session and not listened to during the second session. Differences in VAS, STAI-SA, willingness to repeat procedure and satisfaction rates were statistically significant compared between the two sessions. The mean STAI-SA score rose from 40.01 to 48.85 in the second session. An increase of  $8.8 \pm 4.09$  units was recorded and this was statistically significant ( $p < 0.001$ ). When pain is assessed, the mean VAS score was 2.83 in the first session and rose to 6.43 in the second session. The increase of 3.7 points was statistically significant ( $p < 0.001$ ) (Table 3).

The majority of patients stated they would choose SWL sessions accompanied by music ( $p < 0.001$ ). Additionally, listening to music during stone crushing increased the patient's satisfaction ( $p < 0.001$ ) (Table 3).

## Discussion

Procedures such as SWL, MRI, and colonoscopy require patients to wait without moving in a certain position for a certain length of time. The irritating noise and impacts from the SWL device, especially, may cause the patient to feel pain, worry and begin to move. Complementary therapies to decrease the pain and anxiety during SWL are becoming more popular day by day. These therapies include music, transcutaneous electrical nerve stimulation, acupuncture, and

auricular acupressure. The least invasive of these therapies is music. Music is broadcast in enclosed and open venues to benefit from the relaxing and restful characteristics of music. Music is not just broadcast in exhibition halls, on the metro, or between meetings, but currently is broadcast in hospital corridors and operating rooms. However, in operating rooms where the SWL device, which has an irritating noise, is located, nothing is done.

In the literature, there are three studies on listening to music during SWL. The first two studies used the synthetic opioid analgesic drug alfentanil. A study published in 1998 found that the requirement for alfentanil reduced significantly in the music group.<sup>11</sup> However, another study published in the same year stated that music provided minimal effect, however, it did not reduce the requirement for alfentanil.<sup>12</sup> In this study, with a limited number of patients, morphine and ketorolac were used before the procedure in addition to alfentanil.

Another study which provided music or midazolam during SWL found that music was at least as effective as midazolam with similar STAI-SA and VAS scores.<sup>7</sup> However, the common characteristic of these three studies is that the control group was given analgesics and anxiolytics. In our study, no patient was given any drugs.

A study showing the efficacy of listening to music during transrectal ultrasound-guided prostate biopsy procedures

found that headphones alone were not sufficient to block the irritating sounds of the environment. Anxiety and pain only reduced statistically in the group which listened to music.<sup>13</sup>

In our study, as no analgesics or anxiolytics were used, our anxiety scores may be a little higher than the values stated in the literature. Previous studies have completed SWL using drugs such as preoperative non-steroidal anti-inflammatory drugs, alfentanil and midazolam and as a result the anxiety scores are lower.

A study by Liu et al.<sup>14</sup> on SWL performed on three groups using intravenous diclofenac, EMLA cream, and diclofenac gel found that the lowest VAS score was 3.6 (EMLA group). Similarly, another study administered SWL to three patient groups using EMLA cream, intramuscular diclofenac sodium (DS), and both together. This study found the lowest VAS score was 3.08 (EMLA + DS group). In the music group in our study, we obtained a VAS score (2.6) below the scores in both these studies. Another study comparing EMLA cream with placebo cream observed that both were effective against pain compared with the control group. However, EMLA cream did not appear superior to placebo.<sup>15</sup>

One of the limitations of our study is that stone analysis was not completed for our patients. The other limitation is that the stone-free rates were not compared between first and second sessions. However, this study did question satisfaction of the same person after both SWL sessions. Therefore, composition of the stones or stone-free rates did not seem important for this study. A third limitation may be the lack of a third group using only noise-canceling headphones. However, as stated by Tsivian et al., the effect on anxiety and pain of not hearing the irritating noise of the environment was at minimal levels.

## Conclusion

Listening to music was found to be a non-invasive, non-pharmacologic, safe, anxiolytic, and analgesic treatment in our study. The patient listening to music during stone crushing procedures significantly increased patient compliance and reduced analgesic requirements. In this way, costs reduce and patients are protected from unwanted side effects of drugs. As a result listening to music, during the SWL procedure should become standard. It is considered that installing such a system in current SWL units or producing new devices with the ability to broadcast music will increase patient comfort.

## Declaration of interest

The authors report no conflicts of interest.

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