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ARAŞTIRMA YAZISI / RESEARCH ARTICLE

İNTRAOPERATİF MÜZİK TERAPİSİNİN İNTRAOPERATİF ANALJEZİK VE SEDATİF TÜKETİMİNE ETKİLERİNİN DEĞERLENDİRİLMESİ

EVALUATION OF THE EFFECTS OF INTRAOPERATIVE MUSIC THERAPY ON INTRAOPERATIVE ANALGESIC AND SEDATIVE CONSUMPTION

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ÖZET

AMAÇ: Bu çalışmanın amacı, diz protezi ameliyatı sırasında uygulanan müzik terapisinin hastaların anksiyete ve ağrı seviyelerine etkisini incelemektir.

GEREÇ VE YÖNTEM: Bu prospektif, randomize, kontrollü çalışma, Afyonkarahisar Sağlık Bilimleri Üniversitesi Etik Kurulu onayı sonrası, Afyonkarahisar Sağlık Bilimleri Üniversitesi anesteziyoloji ve reanimasyon bölümünde gerçekleştirildi. Spinal anestezi altında elektif diz protezi ameliyatı uygulanan 42 hasta, müzik grubu (Grup M, n=21) ve kontrol grubu (Grup K, n=21) olmak üzere iki gruba ayrıldı. Grup M, operasyon sırasında Türk klasik müziği dinlerken, Grup K yalnızca ameliyathane ortam seslerine maruz kaldı. Hastaların anksiyete seviyeleri Beck Anksiyete Ölçeği ile preoperatif ve postoperatif dönemde ölçüldü. İntraoperatif sedasyon, OAA/SS ile ağrı ise VAS skorları ile değerlendirildi ve intraoperatif midazolam ve fentanil gereksinimleri kaydedildi.

BULGULAR: Grup M, intraoperatif dönemde Grup K'ya göre daha az miktarda midazolam gereksinimi gösterdi (p=0,002). Grup M'de fentanil ihtiyacı olan hasta sayısı daha az olmasına rağmen, fentanil kullanım miktarı gruplar arasında benzer bulundu (p=0,891). Postoperatif dönemde Grup M'nin anksiyete skorları Grup K'ya göre anlamlı şekilde düşük bulundu (p=0,003). Grup M'de nabız değerleri operasyon sırasında ve sonrasında tekrarlayan ölçümlerde daha düşük seyretti (p<0,05).

SONUÇ: İntraoperatif müzik terapisi, spinal anestezi altında uygulanan diz protezi ameliyatlarında analjezik kullanılan hasta sayısını ile ek sedatif ajan ihtiyacını düşürmek için etkili bir yöntemdir.

ANAHTAR KELİMELER: Anksiyete, Müzik terapi, Spinal anestezi, Diz protezi, Sedasyon, Analjezi.

ABSTRACT

OBJECTIVE: The aim of this study was to investigate the effect of music therapy on patients' anxiety and pain levels during knee replacement surgery.

MATERIAL AND METHODS: This prospective, randomized, controlled study was performed at the Afyonkarahisar Sağlık Bilimleri University "Department of Anesthesiology and Reanimation After approval was obtained from the Afyonkarahisar Sağlık Bilimleri University Ethics Committee. Forty-two patients who underwent elective knee replacement surgery under spinal anesthesia were divided into two groups: music group (Group M, n=21) and control group (Group K, n=21). Group M listened to Turkish classical music during the operation, while Group K was exposed only to operating room ambient sounds. Anxiety levels of the patients were measured preoperatively and postoperatively with the Beck Anxiety Inventory (BAI) Intraoperative sedation was assessed with OAA/SS and pain was assessed with VAS scores, and intraoperative midazolam and fentanyl requirements were recorded.

RESULTS: Group M required less amount of additional sedative during the intraoperative period than Group K (p=0.002). Although the number of patients that required additional fentanyl was less in Group M, the amount of fentanyl use was similar between the groups (p=0.891). In the postoperative period, anxiety scores of Group M were significantly lower than Group K (p=0.003). Pulse rate values were lower in Group M during and after the operation.

CONCLUSIONS: Intraoperative music therapy is an effective method to reduce the number of patients using analgesics and the need for additional sedative agents during knee replacement surgery performed under spinal anesthesia.

KEYWORDS: Anxiety, Music therapy, Spinal anesthesia, Knee prosthesis, Sedation, Analgesia.

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INTRODUCTION

The noise level in operating rooms is typically range between 70 and 80 dB, and noise levels above 80 dB have been found to be harmful to operating room staff and patients (1,2). Noise levels can vary between 95 and 106 dB due to the instruments used in orthopedic operating rooms (3,4). Prolonged exposure to high noise levels in such environments can cause anxiety and pain (1,4). Nowadays, non-pharmacological methods such as hypnosis, acupuncture and music therapy are also used in the perioperative period for anxiety and pain in addition to pharmacological treatment options (5). Music therapy is an effective non-pharmacological treatment option since it is painless, safe, cost-effective , and quick to implement. It also has the added benefits of being a soothing technique that can reduce anxiety and stress (6).

In most studies conducted with awake patients using music therapy, anxiety was observed to decrease in the perioperative period (7,8). In addition to its anxiolytic and sedative effects, it shortens the postoperative recovery period and reduces analgesic consumption (9).

The purpose of this study was to investigate the effect of music therapy on patients' anxiety and pain levels during knee replacement surgery under spinal anesthesia.

MATERIALS AND METHODS

The study comprised 42 patients who were 45 years of age or older, in the American Society of Anesthesiologists(ASA) I–III risk groups, and scheduled for elective knee replacement surgery under spinal anesthesia. Patients who had contraindications for spinal anesthesia, a history of psychiatric illness or substance abuse, hearing impairment, refusal to wear headphones, or an aversion to instrumental Turkish Classical Music were excluded from the study.

After obtaining written consent from the patients, the sealed envelope method was used to randomly divide them into two groups. The music group (Group M, n=21) consisted of patients who were exposed to instrumental Turkish Classical Music during the operation, while the control group (Group K, n=21) consisted of patients who were exposed to operating room sounds. Beck Anxiety Inventory (BAI) was applied to all patients in the preoperative preparation room before the operation. Each of the 21 questions on the scale has a score ranging from 0 to 3 (10) **(Table 1)**.

Table1: Beck Anxiety Score

		Not at all	Mildly but it didn't bother me much.	Moderately- it wasn't pleasant at times.	Severely- it bothered me a lot.
1	Numbness or tingling	(0)	(1)	(2)	(3)
2	Feeling Hot	(0)	(1)	(2)	(3)
3	Wobbliness in legs	(0)	(1)	(2)	(3)
4	Unable to relax	(0)	(1)	(2)	(3)
5	Fear of worst happening	(0)	(1)	(2)	(3)
6	Dizzy or lightheaded	(0)	(1)	(2)	(3)
7	Heart pounding/racing	(0)	(1)	(2)	(3)
8	Unsteady	(0)	(1)	(2)	(3)
9	Terrified or afraid	(0)	(1)	(2)	(3)
10	Nervous	(0)	(1)	(2)	(3)
11	Feeling of choking	(0)	(1)	(2)	(3)
12	Hands trembling	(0)	(1)	(2)	(3)
13	Shaky/unsteady	(0)	(1)	(2)	(3)
14	Fear of losing control	(0)	(1)	(2)	(3)
15	Difficulty in breathing	(0)	(1)	(2)	(3)
16	Fear of dying	(0)	(1)	(2)	(3)
17	Scared	(0)	(1)	(2)	(3)
18	Indigestion	(0)	(1)	(2)	(3)
19	Faint/lightheaded	(0)	(1)	(2)	(3)
20	Face flushed	(0)	(1)	(2)	(3)
21	Hot/cold sweats	(0)	(1)	(2)	(3)

Spinal anesthesia with 0.5% heavy bupivacaine was applied to both groups under aseptic conditions after standard anesthesia monitoring (non-invasive arterial pressure, ECG and SpO2) in the operating room. Lower extremity motor muscle strength loss was assessed with the Bromage scale, and sensory evaluation was assessed with the dermatomal pinprick test. Operation was initiated in patients with Bromage scale score 3 (no hip, knee and ankle joint movement) and sensory loss reaching the T12 dermatome level. After deciding on the suitability of spinal anesthesia, all patients were oxygenated with a nasal cannula at a flow rate of 2L.min- before the operation began. Group M patients were made to listen to instrumental Turkish Classical Music (https://www.youtube.com/watch?v=E_5vi-J-djbc) from an Moving Picture Experts Group Layer-3 Audio (mp3) device using headphones covering the entire ear. The music volume was adjusted to a level that patients felt comfortable with under the supervision of the researcher and continued throughout the operation.

Intraoperative sedation was assessed using the "Observer's Assessment of Alertness/Sedation

Scale (OAA/SS)" **(Table 2)** (11). Just before the operation, all patients were administered 0.01-0.02 mg.kg- midazolam for sedation. Sedation was targeted to achieve an OAA/SS score of 4-5 throughout the surgery, and additional sedation was applied accordingly if necessary. Hemodynamic data and OAA/SS values of the patients were recorded intraoperatively at 15 minute intervals. The presence of pain was monitored using a visual analog scale (VAS) (0=no pain, 10=very severe pain) and 0.5 µg.kg- fentanyl was administered as an additional analgesic if the intraoperative VAS score was 4 or higher. It was recorded whether additional analgesia or sedation was administered during the operation. Postoperative hemodynamic data, pain and anxiety scores were recorded in the postoperative anesthetic care unit.

Table 2: Observer's assessment of alertness/sedation scale (OAA/SS)

Score	Degree of sedation
1	Does not respond to painful trapezius squeeze
2	Responds only after mild prodding or shaking
3	Responds only after name is called loudly, repeatedly both
4	Responds lethargically to name spoken in normal tone
5	Responds readily to name spoken in normal tone

Ethical Committee

This prospective randomized controlled trial was performed at the Afyonkarahisar Sağlık Bilimleri University Department of Anesthesiology and Reanimation, after approval from the Afyonkarahisar Sağlık Bilimleri University Ethics Committee (date: 06.11.2020, decision no: 487).

Statistical Analysis

The statistical analysis was conducted using IBM SPSS Statistics version 20. The data were presented as mean±SD or median (min-max), and ratio. Kolmogorov-Smirnov test, skewness kurtosis values and histogram were used to assess the variables' conformance to the normal distribution. Continuous variables were compared using the Mann Whitney U or Student T test, while categorical variables were compared using the Chi-square test. The intra-group comparison was done using the Paired Samples T test. A result of $p<0.05$ was deemed statistically significant. G-Power 3.1.9.2 package program was used to determine the number of observations. The sample size was determined as 42 using the Beck Anxiety Inventory (BAI) scores in the study of Zamanifar et al. (12) as a reference (music group: 39.74±8.45, control group: 51.37±9.58) at a minimum sample size of 95% power and an error level of $\alpha = 0.01$.

RESULTS

Three patients-two from Group M and one from Group K-were eliminated from the study because they were moved to general anesthesia during the procedure, out of the 42 patients who were included in it. Statistical analysis was performed on 39 patients **(Figure 1)**.

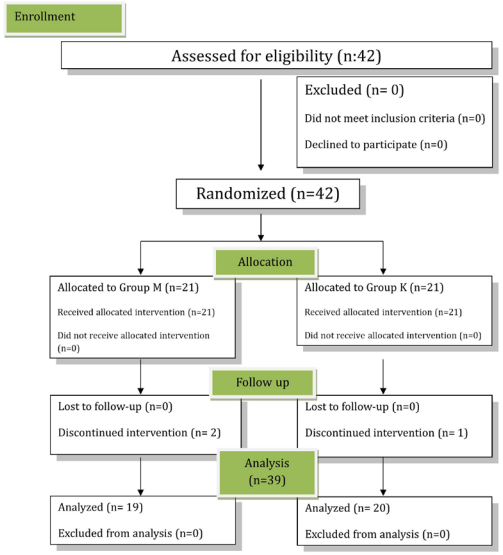

Figure 1: Consort diagram

There were no significant difference between the groups in the demographic data (gender, age, body mass index, ASA scores and presence of comorbidity) **(Table 3)**.

Table 3: Demographic data of patients

	Group M (n=19)	Group C (n=20)	Total (n=39)	p
Gender, F/M, n	16/3	15/5	31/8	0.476*
Age, year	63.26±10.27	64.4 ±10.21	64.09±10.89	0.347€
BMI, weight/height^2	30.47 (26.67-44.44)	31.21 (24.97-39.06)	30.48 (24.97-44.44)	0.214#
ASA Scores, n (%)				0.796*
I	1 (5.3)	2 (10)	3 (7.7)	
II	13 (68.4)	14 (70)	27 69.2)	
III	5 (26.3)	4 (20)	9 (23.1)	
Comorbidity, presence/absence, n, (%)	16 (84.2)/ 3 (15.8)	18 (90)/ 2 (10)	34 (87.2)/ 5 (12.8)	0.589*

Data are expressed as number of patients (%), mean ± SD (standard deviation), median (minimum-maximum).

#Mann Whitney U, *Chi Square, €Student T-test

The number of patients who received additional analgesic was considerably lower in Group M than in Group K (p=0.016), but there was no sig-

nificant difference between the groups in terms of the number of patients who received sedation (p=0.136). While less amount of additional midazolam was given in Group M, the amount of fentanyl given was similar in both groups (p=0.002, p=0.891 respectively) **(Table 4)**.

Table 4: Comparison of Sedation and Analgesia Requirements and Other Data Between Groups

	Group M (n=19)	Group C (n=20)	Total (n=39)	p
Additional sedation usage presence/absence, n, (%)	17 (89,5) / 2 (10,5)	20 (100)/ 0	37 (94,9) / 2 (5,1)	0,136*
Additional analgesic usage, presence/absence, n, (%)	7 (36,8) / 12 (63,2)	15 (75) / 5 (25)	22 (56,4)/ 17 (43,6)	**0,016***
Midazolam, mg	2 (1-2)	2 (1-3)	2 (1-3)	**0,002#**
Fentanyl, µg	100 (50-100)	100 (50-150)	100 (50-100)	0,891#
Duration of operation, minute	120 (90-200)	95 (75-200)	120 (75-200)	0,687#
Length of hospitalization, day	7 (7-14)	8 (4-14)	7,5 (4-14)	0,923#

Data are expressed as number of patients (%),median (minimum-maximum).

#Mann Whitney U, *Chi Square Test

The median duration of operation was 120 minutes in Group M and 95 minutes in Group C. The median length of hospitalization was 7 days in Group M and 8 days in Group C. There was no significant difference in these two parameters between the groups (p=0.687, p=0.923, respectively), Table 4. Besides, there was no significant difference between the groups in terms of duration of operation and length of hospital stay (p=0,687, p=0,923, respectively).

Although both groups' mean arterial pressure(-MAP) values were comparable, Group M's pulse rate values were consistently lower than Group K's, with the exception of T1**(Figure 2 and 3)**.

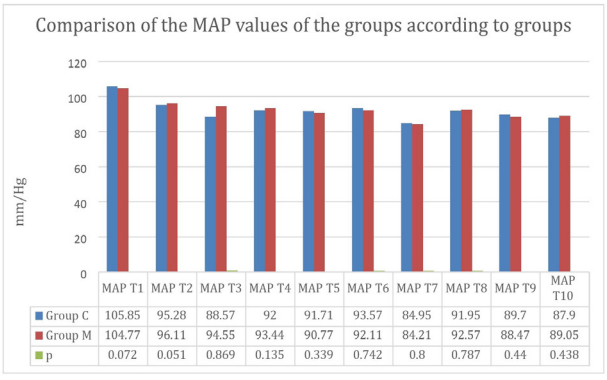

Figure 2: Comparison of the MAP values of the groups according to groups
Student T-testMAP: Mean Arterial Pressure
T1:preoperative, T2: 15th minute of surgery, T3:30th minute of surgery, T4:60th minute of surgery, T5:90th minute of surgery, T6:120th minute of surgery, T7:end of surgery, T8:arrival PACU, T9:15th minute of PACU, T10:30th minute of PACU

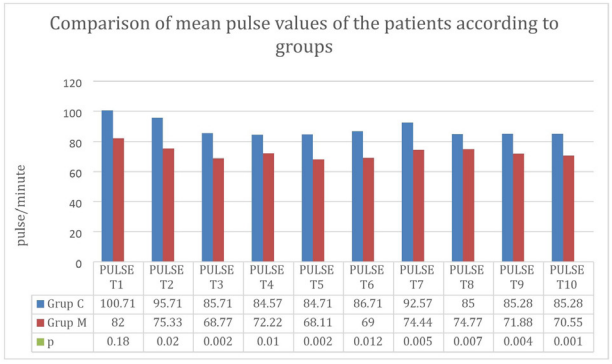

Figure 3: Comparison of mean pulse values of the patients according to groups
Student T-test,63, T1:preoperative, T2: 15th minute of surgery, T3:30th minute of surgery, T4:60th minute of surgery, T5:90th minute of surgery, T6:120th minute of surgery, T7:end of surgery, T8:arrival PACU, T9:15th minute of PACU, T10:30th minute of PACU

When the intraoperative OAA/SS scores of the patients were evaluated, the OAA/SS scores at 30 minutes and 60 minutes of surgery were significantly lower in Group M compared to Group K (p=0.021, p=0.009 respectively) **(Table 5)**.

Table 5: Comparison of OAA/SS values of patients according to the groups

	Group M (n=19)	Group C (n=20)	p#
OAA/SS T15	4 (4-5)	4 (4-5)	0.258
OAA/SS T30	4 (3-5)	4 (3-5)	**0.021**
OAA/SS T60	4 (4-5)	4 (3-5)	**0.009**
OAA/SS T90	4 (4-5)	4 (3-5)	0.087
OAA/SS T120	5 (3-5)	4 (3-5)	0.475
OAA/SS T finish	5 (4-5)	5 (4-5)	0.113

Data are expressed as median (minimum-maximum).

#Mann Whitney U OAA/SS: Observers' Assessment of Alertness/Sedation Scale

VAS scores of the patients in PACU were similar in both groups **(Table 6)**. While there was no significant difference between the groups in the anxiety scores evaluated preoperatively (p=0.358), the anxiety scores evaluated postoperatively were significantly lower in Group M than in Group K (p=0.003, Table 6). Moreover when anxiety scores within the groups were compared, postoperative Beck anxiety levels were significantly lower in both groups compared to preoperative values (p<0.001, Table 6).

Table 6: Comparison of VAS Scores and BECK anxiety scores of patients according to groups

	Group M (n=19)	Group C (n=20)	p
VAS PACU enterance	3 (1-4)	3 (1-4)	0,792#
VAS PACU 15th min	3 (1-4)	4 (1-5)	0,411#
VAS PACU 30th min	3 (1-4)	4 (1-4)	0,496#
Preoperative BECK scores	16,36±5,20	17,90±5,05	0,358€
Postoperative BECK scores	9±4,60	13,80±4,75	**0,003€**
p@	**<0.001**	**<0.001**	

Data expressed as mean ± SD (standard deviation), median (minimum-maximum)

#Mann Whitney U, €Student T test, @Paired samples T test VAS: Visual Analog Scale PACU: Post Anesthesia Care Unit

DISCUSSION

Preoperative anxiety is a common condition with a rate of up to 80% (13). Music therapy is a non-invasive method that can be used to reduce anxiety (14). In our study, we applied the Beck anxiety scale to determine the preoperative anxiety levels of the patients and obtained a moderate level of anxiety in both groups. This result was consistent with the literature. Moreover we found that music therapy did not reduce the amount of additional analgesic consumed intraoperatively but did reduce the number of patients requiring analgesics.

In line with the findings of Lepage and colleagues, the amount of intraoperative midazolam required to achieve similar sedation levels was lower in Group M (15). Similarly, a study involving 117 patients undergoing elective inguinal hernia surgery demonstrated that music therapy effectively reduced anxiety, improved hemodynamic parameters after surgery (16). However, another study investigating the effects of music on preoperative anxiety found no significant changes in MAP or pulse rates, despite reductions in anxiety levels (17). Consistent with these findings, our study also showed no significant differences in MAP or preoperative pulse rates between the two groups. Nevertheless, intraoperative and postoperative heart rates were lower in Group M.

A study evaluating the effectiveness of music therapy in providing preoperative sedation using OAA/SS and bispectral (BIS) index measurements reported that the level of sedation increased and the BIS value decreased in the music group (18). In our study, we observed lower postoperative anxiety scores in the PACU compared to preoperative scores in both groups.

In a systematic review conducted by Do et al. on five studies in otolaryngological surgeries, it was found that music therapy reduced pain and anxiety scores (19). Another systematic review suggested that music therapy may be used to reduce preoperative anxiety, but it should be used with caution in postoperative pain management in patients without preoperative anxiety (20). In our study, both groups had moderate preoperative anxiety scores, and postoperative VAS scores were similar between the groups. However, we believe that music therapy reduced analgesic use in the intraoperative period.

As in the study by Patil et al., we did not find any difference in the amount of additional analgesic consumed intraoperatively (21). But music therapy reduced the number of patients that need for additional analgesic. In the study of Nilsson et al., they stated that intraoperative music reduces postoperative pain but we found similar postoperative pain scores (22). However, intraoperative fentanyl requirement was lower in the music group.

In conclusion, intraoperative music therapy decreased anxiety scores in patients under spinal anesthesia in the postoperative period and reduced the need for additional analgesic and sedative agents administered intraoperatively.

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