Blood Pressure and Heart Rate Alterations through Music in Patients Undergoing Cataract Surgery in Greece

Kyriakoula Merakou[1], Georgia Varouxi[2], Anastasia Barbouni[1], Eleni Antoniadou[1], Georgios Karageorgos[1], Dimitrios Theodoridis[1], Aristea Koutsouri[2] and Jenny Kourea-Kremastinou[1]

[1]Department of Public and Administrative Health, National School of Public Health, Athens, Greece. [2]General Hospital of Livadia, Livadia, Greece.

ABSTRACT

INTRODUCTION: Music has been proposed as a safe, inexpensive, nonpharmacological antistress intervention. The purpose of this study was to determine whether patients undergoing cataract surgery while listening to meditation music experience lower levels of blood pressure and heart rate.

METHODS: Two hundred individuals undergoing cataract surgery participated in the study. Hundred individuals listened to meditation music, through headphones, before and during the operation (intervention group) and 100 individuals received standard care (control group). Patients stress coping skills were measured by the Sense of Coherence Scale (SOC Scale). Systolic and diastolic blood pressure and heart rate were defined as outcome measures.

RESULTS: According to the SOC Scale, both groups had similar stress coping skills (mean score: 127.6 for the intervention group and 127.3 for the control group). Before entering the operating room (OR) as well as during surgery the rise in systolic and diastolic pressures was significantly lower in the intervention group ($P < 0.001$). Among patients receiving antihypertensive therapy, those in the intervention group presented a lower increase only in systolic pressure ($P < 0.001$) at both time recordings. For those patients in the intervention group who did not receive antihypertensive treatment, lower systolic blood pressure at both time recordings was recorded ($P < 0.001$) while lower diastolic pressure was observed only during entry to the OR ($P = 0.021$). Heart rate was not altered between the two groups in any of the recordings.

CONCLUSIONS: Meditation music influenced patients' preoperative stress with regard to systolic blood pressure. This kind of music can be used as an alternative or complementary method for blood pressure stabilizing in patients undergoing cataract surgery.

KEYWORDS: blood pressure, heart rate, cataract surgery, meditation music, SOC, stress management

CITATION: Merakou et al. Blood Pressure and Heart Rate Alterations through Music in Patients undergoing Cataract Surgery in Greece. *Ophthalmology and Eye Diseases* 2015:7 7–12 doi: 10.4137/OED.S20960.

RECEIVED: October 23, 2014. **RESUBMITTED:** February 09, 2015. **ACCEPTED FOR PUBLICATION:** February 11, 2015.

ACADEMIC EDITOR: Joshua Cameron, Editor in Chief

TYPE: Original Research

FUNDING: Authors disclose no funding sources.

COMPETING INTERESTS: Authors disclose no potential conflicts of interest.

CORRESPONDENCE: kmerakou@esdy.edu.gr

COPYRIGHT: © the authors, publisher and licensee Libertas Academica Limited. This is an open-access article distributed under the terms of the Creative Commons CC-BY-NC 3.0 License.

Paper subject to independent expert blind peer review by minimum of two reviewers. All editorial decisions made by independent academic editor. Upon submission manuscript was subject to anti-plagiarism scanning. Prior to publication all authors have given signed confirmation of agreement to article publication and compliance with all applicable ethical and legal requirements, including the accuracy of author and contributor information, disclosure of competing interests and funding sources, compliance with ethical requirements relating to human and animal study participants, and compliance with any copyright requirements of third parties. This journal is a member of the Committee on Publication Ethics (COPE).

Published by Libertas Academica. Learn more about this journal.

Introduction

All kinds of surgeries provoke various degrees of anxiety for patients. Studies point out that, in their vast majority, patients experience elevated stress levels, particularly before surgery.[1] Anxiety concerning the anesthesia process, the fear of death, of being cut, of bad prognosis, of pain and of no access to pain medications after completion of the surgery, as well as the effects of postoperative nausea and vomiting constitute components of surgical experience.[2]

Music has long been used as an alternative method of treatment to relieve patients from anxiety symptoms.[3,4] During the Second World War, Harriet Ayer Seymour implemented music therapy visits in hospitals and trained more than 500 doctors for this purpose.[5] In the midst of the 20th century, music was used in psychiatry and psychology with positive health outcomes[6,7] The American Music Therapy Association promoted music as a means of treatment for many conditions such as Parkinson's disease, various affective disorders, pain, stroke, and dementia.[8] However, there is emphasis on the strong need for objective outcome data to establish the therapeutic efficacy of music.[9] A number of studies evaluating music therapy are hindered by multiple methodological problems, such as small sample sizes, lack of control groups, no randomization, selection bias, and nonstandardized protocols.[8] Music and heart health have a special relation. Selected music, through relaxation decreases respiratory pulse, heart rate, and arterial blood pressure.[10] Hamel points out that music in coronary units contributes substantially to stress reduction as measured by appropriate psychometric tools.[11] Music on the first postoperative day can decrease stress in patients who have undergone open heart surgery.[12] Vocal and orchestral music produce significantly better correlations with cardiovascular or respiratory signals compared to music with a more uniform emphasis.[5] Stress and anxiety can occasionally interfere with

the performance of invasive test procedures or surgeries and can induce hemodynamic instability, such as elevated blood pressure and heart pulse.[13]

The positive role of music as a therapeutic modality for the treatment of preoperative anxiety has been well documented.[14–19] It has been supported that music can substitute anesthetic medicines during surgeries.[20] Berbel et al pointed out that music is as effective as sedatives for reducing preoperative anxiety.[21] Also, Wang et al concluded that patients scheduled to undergo outpatient surgery and who listened to music reported less anxiety than those who did not listen to music.[8]

Moreover, meditation music as well as classical music may decrease stress levels and improve quality of life.[22,23]

The purpose of our study was to investigate the effects of meditation music on preoperative and intraoperative patients undergoing ophthalmic surgery for cataract, feel acute stress as a result of the increase of catecholamines in the body as illustrated through blood pressure and heart rate alterations. Before surgery, stress coping skills were measured in both the intervention and control groups.[24,25]

Methods

Sample and setting. A two-group comparison study was conducted over a 4-month period, from August to November 2009 in the Ophthalmology Clinic in the Livadia Hospital (Central Greece). The hospital serves a population of one hundred thousand people from the city and surrounding villages.

The population study sample consisted of the first 200 individuals who underwent 1-day surgery for a cataract in the General Hospital of Livadia (Central Greece). Patients with chronic diseases such as decompensate diabetes, recent myocardial infarction, chronic renal failure, stroke, psychiatric but not psychological problems, and deafness were excluded from the sample. Hypertension was not within the exclusion criteria. Therefore, 76 people (48 in the intervention group and 28 in the control group) diagnosed with hypertension took medication (48 diuretics and 28 ACE inhibitors) as prescribed by their cardiologist. These two categories of hypertension therapy are the most common therapies for hypertension in Greece, based on the Hellenic and European Cardiology Association Guidelines. The patients with hypertension did not interrupt their pharmacological therapy on the day of the surgery.

Patients were randomly assigned to both the music group (intervention group) and the nonmusic group (control group), ie, the first person who came in for surgery was included in the intervention group, the second person in the control group, the third in the intervention group, the next one in the control group, and so on. Those patients belonging to the intervention group (100 patients) listened to meditation music 15 minutes before and during the operation, while those in the control group (100 patients) did not.

Measures. Stress coping skills were measured through the Antonovsky's Sense of Coherence Scale (29 items) (SOC Scale).[26] Individuals who score high SOC values are less likely to perceive a particular situation (cataract surgery) as threatening or *out of control* but rather consider it a challenging event and, thus, by viewing it in a positive manner are able to maintain their good health under stressful circumstances.[26] In Greece, the Antonovsky's SOC questionnaire has been validated and has shown a high degree of reliability and validity.[27]

For the assessment of patients' stress levels, we used the values of systolic and diastolic arterial blood pressure and heart rate measured by the electronic monitor EDAN im60. Both blood pressure and heart rate are affected in both men and women when experiencing acute emotional or physical stress as a result of the elevation of increased catecholamines, which in turn cause an increase in blood pressure and heart rate.[24,25]

No blind method was used in the measurements as it was not possible, the reason being that the participants in the music group were identifiable because of the headphones.

Ethical consideration. The research protocol was submitted to the Committee of Ethics of the Livadia Hospital, and the necessary permission to conduct the survey was obtained. The research was conducted in accordance with the Declaration of Helsinki. Also, patients gave their written consent before participating in the study, after being fully informed of the process.

Process. One week before surgery, patients came to the hospital for preoperative tests. At that time, researchers informed them about the study, and if they agreed to participate, they signed a written form of consent. Patients were then interviewed using the Antonovsky's SOC questionnaire, which was filled in by the researcher because patients' vision was limited. None of the people who were asked to participate in the study denied doing so.

On the day of the surgery and 20 minutes before the operation, all the patients in the study group agreed to put on headphones and listened to meditation music continuously, until the surgical procedure was completed. The music item was selected by the researchers because of its relaxing qualities. It was Peter Sterling's "The Angels Gift", its duration was 25 minutes and the instruments used included the harp, the flute, the violin, and background vocals with orchestral strings and soft nature sounds. Blood pressure and heart rate were measured before the surgery (15 minutes before initiation of the surgery while patients were lying down in their room), upon entering to the operating room (OR), and during the surgery (exactly before placing the intraocular lens). The usual duration of cataract surgery is about 15 minutes. Local anesthesia started 20 minutes before initiation of the surgery through the use of eye drops (tetracaine hydrochloride 0.5%), and all patients received oxygen therapy during anesthesia. During

surgery, all patients received doses of sedatives (alfentanil and midazolam).

Statistical analysis. Statistical analysis was performed by the Statistical program SPSS for Windows (version 16) statistical software (SPSS, Inc., Chicago, IL, USA). For the statistical significance between the two groups, χ^2, Mann–Whitney, and Yates correction tests were used. The same tests were used separately for people taking antihypertension medication and people who were not taking antihypertension medication. Statistical significance was defined for $P < 0.05$, while the test of normality was done through statistical trial Kolmogorov–Smirnov.

Results

In both the groups, 45% were women and 55% were men, aged 53–89 years, while 74% of the total number of patients were over 65 years old. Mean age in the intervention group and the control group was 71.4 and 70.9, respectively ($P = 0.153$). Of the respondents, 78.6% and 73.7% in the intervention and control groups, respectively, were married ($P = 0.175$). Elementary education was reported by 79% of the individuals in the intervention group and 71% of patients in the control group ($P = 0.275$). The majority of survey participants in both groups were pensioners (84% and 83% in the intervention and control groups, respectively) ($P = 0.355$).

There was no statistical difference between the two groups for any demographic data; however, statistical difference between the two groups was observed between those participants receiving antihypertension medication in the study group (48%) and those receiving antihypertension medication in the control group (28%) ($P = 0.04$). In order to overcome the possibility of introducing systematic errors into the research, stratified analysis was performed and the data were analyzed separately for those patients receiving antihypertension medication and for those patients who did not receive any.

Stress management skills between the two groups did not differ significantly. The mean value of the SOC Scale measuring patients' stress coping skills was 127.6 for the intervention and 127.3 for the control group ($P = 0.105$). Statistical analysis for SOC in stratified patients taking hypertension medication and participants not taking medication was not done, although this comparison would be particularly useful and should have been done.

As expected, the values of the blood pressure and heart rate in both groups were at their lowest before the surgery, increased upon entering the OR, and peaked during the operating procedure and exactly before the setting of the intraocular lens (Table 1). As shown in Table 2, the rise in systolic and diastolic pressure was lower in the intervention group and presented statistical significance between the two groups upon both time periods of assessment. Heart rate did not present any statistical difference between the two groups.

Regarding patients taking antihypertension medication, statistically significant differences between the two groups were observed in the increase of systolic blood pressure before and upon entering the OR and before and during the surgery. As shown in Table 3, the mean increase in systolic blood pressure at both recordings was significantly lower in the intervention group compared to the control group. Heart rates did not present any statistical difference between the two groups at any time during the assessment (Table 3).

On the other hand, patients not receiving antihypertension medication (Table 4) had statistically significant differences in the increase of systolic blood pressure at both times during the assessment in favor of the intervention group ($P < 0.001$ and $P < 0.001$ respectively). The increase in diastolic pressure for the intervention group also presented a statistical significance only before and upon entering the OR ($P = 0.021$) in relation to the control group. Again no statistical significance was observed in the heart rate for both groups at any time during the assessment.

Discussion

Our results prove that meditation music may have effects in stabilizing blood pressure caused by stress during cataract surgery.

Table 1. Recordings of blood pressure and heart rate of both groups at 3 different times of assessment.

MEASURES	TIME OF ASSESSMENT	INTERVENTION GROUP MEAN RATE/95% CI	CONTROL GROUP MEAN RATE/95% CI
Systolic blood pressure (mmHg)	Before surgery	139 (136–142)	139 (136–141)
	Entrance O.R.	143 (139–146)	157 (154–160)
	During surgery	140 (137–144)	160 (157–163)
Diastolic blood pressure (mmHg)	Before surgery	77 (76–78)	75 (74–76)
	Entrance O.R.	81 (79–82)	81 (80–83)
	During surgery	80 (79–82)	82 (80–84)
Heart rate (Beats/min)	Before surgery	64 (61–66)	63 (60–65)
	Entrance O.R.	67 (65–69)	66 (64–68)
	During surgery	66 (64–68)	66 (64–68)

Notes: Time of assessment: Before surgery indicates 15 minutes before the surgery, while the patients were waiting in their rooms. Entering OR indicates upon entering the OR. During surgery indicates exactly before the setting of intraocular lens.

Table 2. Statistical test Mann–Whitney indicating mean increase values for blood pressure and heart rate in both groups.

MEASURES	TIME OF ASSESSMENT	INTERVENTION GROUP MEAN INCREASE/SD	CONTROL GROUP MEAN INCREASE/SD	*P*
Systolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	3.9 (13.2) 1.2 (8.7)	18.6 (14.5) 21.7 (16.9)	$P < 0.001$ $P < 0.001$
Diastolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	3.9 (9.5) 3.8 (9.5)	6.2 (7.3) 7.1 (8.7)	$P = 0.026$ $P = 0.013$
Heart rate (Beats/min)	Before and upon entrance O.R. Before and during surgery	3.0 (8.7) 2.3 (8.1)	3.8 (7.8) 3.8 (7.1)	$P = 0.572$ $P = 0.160$

Notes: Before surgery indicates 15 minutes before the surgery, while the patients were waiting in their rooms. Entering OR indicates upon entering the OR. During surgery indicates exactly before the setting of intraocular lens.

Table 3. Statistical test Mann–Whitney indicating mean increase values for blood pressure and heart rate in patients taking antihypertensive medication in both groups.

MEASURES	TIME OF ASSESSMENT	INTERVENTION GROUP MEAN INCREASE/SD	CONTROL GROUP MEAN INCREASE/SD	*P*
Systolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	4.5 (13.5) 1.7 (17.4)	20.3 (15.2) 23.7 (18.1)	$P < 0.001$ $P < 0.001$
Diastolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	4.8 (10.4) 5.0 (10.0)	6.3 (7.3) 7.0 (8.3)	$P = 0.586$ $P = 0.338$
Heart rate (Beats/min)	Before and upon entrance O.R. Before and during surgery	2.2 (8.7) 2.0 (8.4)	3.4 (7.8) 3.7 (7.3)	$P = 0.695$ $P = 0.290$

Notes: Before surgery indicates 15 minutes before the surgery, while the patients were waiting in their rooms. Entering OR indicates upon entering the OR. During surgery indicates exactly before the setting of intraocular lens.

Table 4. Statistical test Mann–Whitney indicating mean increase values for blood pressure and heart rate in patients not taking antihypertensive medication in both groups.

MEASURES	TIME OF ASSESSMENT	INTERVENTION GROUP MEAN INCREASE/SD	CONTROL GROUP MEAN INCREASE/SD	*P*
Systolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	2.2 (13.5) −0.3 (13.7)	14.3 (11.8) 15.0 (10.0)	$P < 0.001$ $P < 0.001$
Diastolic blood pressure (mmHg)	Before and upon entrance O.R. Before and during surgery	3.4 (8.8) 3.1 (9.4)	6.8 (5.8) 7.3 (10.1)	$P = 0.021$ $P = 0.104$
Heart rate (Beats/min)	Before and upon entrance O.R. Before and during surgery	3.0 (9.0) 1.8 (8.1)	5.0 (7.6) 3.8 (6.8)	$P = 0.203$ $P = 0.215$

Notes: Before surgery indicates 15 minutes before the surgery, while the patients were waiting in their rooms. Entering OR indicates upon entering the OR. During surgery indicates exactly before the setting of intraocular lens.

Coping skills were similar for both intervention and control groups, as measured by the Antonovsky's SOC Scale.[26] The lower the SOC score, the more prone the patient was to negative health outcomes and quality of life as a result of psychological stress.[27,28] In a systematic review on Antonovsky's SOC and its relation to health, Eriksson and Lindstrom indicate that population distribution of the SOC-29 showed a range of means from 100.50 (standard deviation [SD] 28.50) to 164.50 points (SD 17.10).[29] In our study, both groups had a mean value of 127 points meaning that the specific population's SOC is within this range.

There are few published reports on the beneficial effects of listening to music during ophthalmic surgery. To our knowledge, this is the first study on the effects of meditation music on the blood pressure and heart rate of patients undergoing cataract surgery. Our intervention group's patients reported pleasant feelings and relaxing experiences. Bellan and colleagues reported that patients undergoing cataract surgery while listening to music before initiation of the procedure had decreased anxiety.[20] Cruise et al reported that a cohort of 121 patients undergoing cataract surgery were more satisfied with their experience of having been offered the choice to listen to relaxing music as opposed to having had the surgery without being able to listen to music.[30] A similar study from Camara et al.[31] points out that elderly patients who had undergone cataract surgery felt more satisfied because they were able to listen to relaxing music. The authors indicated a significant decrease in the preoperative blood pressure and heart rate of

patients exposed to live piano music during ophthalmic surgery.[31] The participants in the control group were exposed to environmental noises and there is a possibility that hearing the communications between surgeons and nurses may have been soothing for them and had an effect on heart rate stabilizing.

The findings of the present study confirm that entering the OR as well as the surgical intervention itself were stressful processes that caused blood pressure to increase in the control group. It appears that meditation music helped in stabilizing systolic and diastolic blood pressure in the music group while heart rate values remained at similar levels for both groups. Other clinical studies indicate that music can lower blood pressure and pulse rate, limit stress levels, and change stress hormone levels in blood.[32–34]

Many studies advocate the effect of music in preoperative stress reduction. Some studies support that the use of relaxation music is more effective than presurgical medication midazolam in lowering stress levels in a preoperative environment.[3,4] Miluk-Kolasa et al point out that patients listening to music exhibited a marked reduction in salivary cortisol level, and after 1 hour, the relative decrease was similar to that observed in the control group (nonsurgical) patients.[33]

It seems that the clinically measurable influence of music on factors such as arterial blood pressure is related to molecular changes regarding opiates and cytokine processes.[35] The psychophysiological mechanisms by which music can influence stress-related increases in blood pressure and heart rate are not fully understood; however, this as well as other studies have offered some insight to these procedures. The distraction that music offers from the surgical procedure has been reported as a favorable effect of music, which becomes even more valuable when patients listen to music of their preference.[17] This may offer them a sense of personal control and reminds them of a familiar home environment.[19]

For patients taking antihypertension medication, those in the intervention group had lower increases in systolic blood pressure while diastolic blood pressure and heart rate were not influenced by music. Other studies have shown that stress does not directly cause hypertension, but may be the leading cause in its development.[36]

Regarding patients not receiving antihypertension medication, the intervention group exhibited a significantly lower level of systolic blood pressure while diastolic blood pressure presented a significantly lower level only upon entering the OR, in relation to the control group. This finding is supported by a study by Allen et al, who investigated the normalization of hypertensive response through music in ambulatory patients without an established resting blood pressure (<140/90 mmHg) who had ophthalmic surgery. The authors point out that both groups (music and nonmusic) presented increased blood pressure and heart rate in preoperative recordings; however, in intraoperative recordings, both parameters of the music group had returned to the baseline data. The authors concluded that stress experienced before an operation by elderly patients is related to a clinical hypertension response, which may be improved by offering the patient a music option to listen to, during the operation.[19] However, a recent review showed that music selected by the researcher is most effective in reducing anxiety through consistent tempo and dynamics, stable rhythms, and smooth melodic lines, as stated by evidence-based studies.[37]

With regard to pulse rate, no statistical significance was observed between the two groups at any time during the assessment of our study. This statistical result led us to the conclusion that the parameter of heart rate was not influenced by preoperative stress. This finding is controversial to other researchers' conclusions. A recent survey indicated lower heart rate and variability in patients who listened to music when the authors evaluated its efficacy in relieving patients' anxiety before surgery.[38] In a review, 43% of the studies examined, investigating the relationship between listening to music and heart rate values, illustrated patterns of decreased heart rates.[32] Moreover, some researchers have indicated more significant changes in heart rates rather than blood pressure,[39] while in our study there was no change in heart rate.

Strengths and limitations. This is one of the first research papers in Greece investigating the correlation between meditation music and patients undergoing cataract surgery, and this is the main contribution of this study. Patients seemed to enjoy listening to music and the whole process was easy to implement and without any cost.

Our study also has a number of limitations. The major limitation was that no cortisol and serological tests were applied to patients; these tests are the most reliable indicators of stress measurement, but were impossible to measure as the hospital did not have the required laboratory facilities. Moreover, psychological evaluations were done only with the assessment of SOC, a scale measuring stress coping skills, and its score was not correlated statistically between stratified patients who took antihypertensive medication and those who did not. Another limitation was the generalizability of our findings, which is limited by the relatively small sample size and the inclusion of patients having had only one type of surgery. Also, we did not take into account the fact that the control group was exposed to white noise during the experiment (the level of noise in the OR was not easily controlled), a fact that may have an effect on blood pressure variation. Additionally, the selected piece of music was determined by the researchers but not by the patients themselves. However, an interesting follow-up of this study would be having patients select the pieces of music and comparing the effects of the same variables. Also, the fact that the investigators were not blinded to the experimental conditions may, due to subtle biases, have influenced the effect. Of course, there may be other salient factors that may influence stress and may not have been considered in this study.

Implications. These findings add to the many studies on the benefits of music during surgery and our findings could potentially form part of the foundation for the development

of specific interventions for preoperative stress management. Health professionals may be educated appropriately in order to address stress reduction through music for their patients and train them accordingly. Music is a nonpharmacological intervention, without side effects, enjoyable and inexpensive for patients and health care services. Especially in countries with limited resources and substantial decreases in the health budget, such as Greece, every intervention with cost-saving potential is not only welcome but also necessary.

Conclusion

According to the present findings, we may conclude that meditation music has a stabilizing effect on the systolic blood pressure of patients undergoing cataract surgery. Meditation music may be promising for patients who experience preoperative stress and has the potential to reduce blood pressure. Further research is essential, however, to investigate the effects of music therapy to presurgical stress in other types of anesthesia and surgeries.

Author Contributions

Conceived and designed the experiments: GV, KM, AB. Analyzed the data: AB, EA. Wrote the first draft of the manuscript: GV, EA, KM. Contributed to the writing of the manuscript: GK, DT. Agree with manuscript results and conclusions: DT, GK, AK, AB. Jointly developed the structure and arguments for the paper: KM, AK, EA. Made critical revisions and approved final version: JKK. All authors reviewed and approved of the final manuscript.

REFERENCES

1. Badner NH, Nielson WR, Munk S, Kwiatkowska C, Gelb AW. Preoperative anxiety: detection and contributing factors. *Can J Anaesth*. 1990;37:444–7.
2. Fitzgerald BM, Elder J. Will a 1-page informational handout decrease patients' most common fears of anesthesia and surgery? *J Surg Educ*. 2008;65(5):359–63.
3. Bringman H, Giesecke K, Thörne A, Bringman S. Relaxing music as pre-medication before surgery: a randomized controlled trial. *Acta Anaesthesiol Scand*. 2009;53(6):759–64.
4. Trappe HJ. The effects of music on the cardiovascular system and cardiovascular health. *Heart*. 2010;96(23):1868–71.
5. Davis WB. Ira Maximilian Altshuler: psychiatrist and pioneer music therapist. *J Music Ther*. 2003;40(3):247–63.
6. Lin ST, Yang P, Lai CY, et al. Mental health implication of music: insight from neuroscientific and clinical studies. *Harv Rev Psychiatry*. 2011;19(1):34–46.
7. Lou MF. The use of music to decrease agitated behaviour of the demented elderly: the state of the science. *Scand J Caring Sci*. 2001;14(2):165–73.
8. Wang SM, Kulkarni L, Dovel J, Kain ZN. Music and pre-operative anxiety: a randomized, controlled study. *Anesth Analg*. 2002;94:1489–94.
9. Marwick C. Music therapists chime in with data on medical results. *JAMA*. 2000;283(6):731–3.
10. Barnanson S, Zimmerman L, Nieveen J. The effects of music interventions on anxiety in the patient after coronary artery bypass grafting. *Heart Lung*. 1995;24(2):124–32.
11. Hamel WJ. The effects of music intervention on anxiety in the patient waiting for cardiac catheterization. *Intensive Crit Care Nurs*. 2001;17(5):279–85.
12. Nilsson U. The effect of music intervention in stress response to cardiac surgery in a randomized clinical trial. *Heart Lung*. 2009;38(3):201–7.
13. Shenefelt PD. Relaxation strategies for patients during dermatologic surgery. *J Drugs Dermatol*. 2010;9(7):795–9.
14. Thompson JF, Kam PC. Music in the operating theatre. *Br J Surg*. 1995;82:1586–7.
15. Cunningham MF, Monson B, Bookbinder M. Introducing a music program in the peri-operative area. *AORN J*. 1997;66:674–82.
16. Updike PA, Charles DM. Music Rx: physiological and emotional responses to taped music programs of preoperative patients awaiting plastic surgery. *Ann Plast Surg*. 1987;19:29–33.
17. Gaberson KB. The effects of humorous and musical distraction on pre-operative anxiety. *AORN J*. 1995;62:784–8.
18. Kaempf G, Amodei ME. The effect of music on anxiety: a research study. *AORN J*. 1989;50:112–8.
19. Allen K, Golden LH, Izzo JL Jr, et al. Normalization of hypertensive responses during ambulatory surgical stress by pre-operative music. *Psychosom Med*. 2001;63(3):487–92.
20. Bellan L, Gooi A, Rehsia S. The Misericordia Health Centre cataract comfort study. *Can J Ophthalmol*. 2002;37(3):155–60.
21. Berbel P, Moix J, Quintanta S. Music versus diazepam to reduce preoperative anxiety: a randomized controlled clinical trial. *Rev Esp Anesthesiol Reanim*. 2007;54:355–8.
22. Zhang XW, Fan Y, Manyande A, Tian YK, Yin P. Effects of music on target-controlled infusion of propofol requirements during combined spinal-epidural anaesthesia. *Anaesthesia*. 2005;60(10):990–4.
23. Trappe HJ. Music and health – what kind of music is helpful for whom? Music not? *Dtsch Med Woohenschr*. 2009;134(51–52):2601–6. [in German].
24. Hall JB, Schmidt GA, Wood LDH. *Principles of critical care*. 2nd ed. Chicago: McGraw-Hill; 1999:359.
25. Torpy JM, Burke AE, Glass RM. Acute emotional stress and the heart. *JAMA*. 2007;298(3):360.
26. Antonovsky A. *Health, stress and coping*. San Fransisco: Jossey-Bass; 1979:15.
27. Karalis I, Langius A, Tsirogianni M, Faresjö T, Nettelbladt P, Lionis C. The translation-validation of Sense of Coherence (SOC) Scale in Greece and its use in primary health care. *Arch Hell Med*. 2004;2:195–203. [in Greek].
28. Lundman B, Forsberg KA, Jonsén E, et al. Sense of coherence (SOC) related to health and mortality among the very old: the Umea 85+ study. *Arch Gerontol Geriatr*. 2010;51(3):329–32.
29. Eriksson M, Lindstrom B. Antonovsky's sense of coherence scale and the relation with health: a systematic review. *J Epidemiol Community Health*. 2006;60(5):376–81.
30. Cruise CJ, Chung F, Yogendran S, Little D. Music increases satisfaction in elderly outpatients undergoing cataract surgery. *Can J Anesth*. 1997;44:43–8.
31. Camara JG, Ruszkowski JM, Worak SR. The effect of live classical piano music on the vital signs of patients undergoing ophthalmic surgery. *Medscape J Med*. 2008;10(6):149.
32. Watkins GR. Music therapy: proposed physiological mechanisms and clinical implications. *Clin Nurse Spec*. 1997;11(2):43–50.
33. Miluk-Kolasa B, Obminski Z, Stupnicki R, Golec L. Effects of music treatment on salivary cortisol in patients exposed to pre-surgical stress. *Exp Clin Endocrinol*. 1994;102(2):118–20.
34. Bradt J, Dileo C. Music for stress and anxiety reduction in coronary heart disease patients. *Cochrane Database Syst Rev*. 2009;15(2):CD006577.
35. Stefano GB, Zhu W, Cadet P, Salamon E, Mantione KJ. Music alters constitutively expressed opiate and cytokine processes in listeners. *Med Sci Monit*. 2004;6:MS18-27.
36. Kulkarni S, O'Farrell I, Erasi M, Kochar MS. Stress and hypertension. *WIMJ*. 1998;97(11):34–8.
37. Gooding L, Swezey S, Zwischenberger JB. Using music interventions in perioperative care. *South Med J*. 2012;105(9):486–90.
38. Phipps MA, Carroll DL, Tsiantoulas A. Music as a therapeutic intervention on an inpatient neuroscience unit. *Complement Ther Clin Pract*. 2010;16(3):138–42.
39. Pittman S, Kridli S. Music intervention and preoperative anxiety: an integrative review. *Int Nurs Rev*. 2011;58(2):157–63.