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The Effect of Live Classical Piano Music on the Vital Signs of Patients Undergoing Ophthalmic Surgery

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Abstract

Context: Music and surgery.
Objective: To determine the effect of live classical piano music on vital signs of patients undergoing ophthalmic surgery.
Design: Retrospective case series.
Setting and Patients: 203 patients who underwent various ophthalmologic procedures in a period during which a piano was present in the operating room of St. Francis Medical Center. [Note: St. Francis Medical Center has recently been renamed Hawaii Medical Center East.]
Intervention: Demographic data, surgical procedures, and the vital signs of 203 patients who underwent ophthalmic procedures were obtained from patient records. Blood pressure, heart rate, and respiratory rate measured in the preoperative holding area were compared with the same parameters taken in the operating room, with and without exposure to live piano music. A paired *t*-test was used for statistical analysis.
Main outcome measure: Mean arterial pressure, heart rate, and respiratory rate.
Results: 115 patients who were exposed to live piano music showed a statistically significant decrease in mean arterial blood pressure, heart rate, and respiratory rate in the operating room compared with their vital signs measured in the preoperative holding area ($P < .0001$). The control group of 88 patients not exposed to live piano music showed a statistically significant increase in mean arterial blood pressure ($P < .0002$) and heart rate and respiratory rate ($P < .0001$).
Conclusion: Live classical piano music lowered the blood pressure, heart rate, and respiratory rate in patients undergoing ophthalmic surgery.

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Introduction

Listening to music has been shown in published studies to have many beneficial effects on patients. A meta-analysis from the Cochrane Database Systems Review evaluated 51 randomized clinical trials on the effect of music on any type of pain. The authors reported that patients exposed to music were 70% more likely to have pain relief than unexposed patients. They concluded that listening to music reduces pain intensity and opioid requirements.[1]

The use of prerecorded music has been found to relieve anxiety in patients undergoing various surgical procedures.[2-7] Several studies have shown that sedative amounts are decreased for procedures when music is played before or during the procedure.[8-10]

Patients undergoing ophthalmologic procedures also benefit from listening to music. Bellan and colleagues[11] reported

a large-scale study of 144 patients undergoing cataract surgery and found that listening to music before surgery was associated with decreased anxiety. Cruise and coworkers[12] reported that a cohort of 121 patients undergoing cataract surgery under retrobulbar block were more satisfied with their experience if they heard relaxing music rather than operating room noise alone during the surgical procedure.

This study compared the mean arterial blood pressure (MAP), heart rate (HR), and respiratory rate (RR) of patients who were exposed to live classical piano music before ophthalmic surgery with patients who were not exposed to music.

Materials and Methods

A Roland Model KR-107 Digital Piano was placed in the ophthalmology operating room (OR) from May 2005 to August 2005 at the St. Francis Medical Center, where the study was conducted. [Note: *St. Francis Medical Center has recently been renamed Hawaii Medical Center East.]

A classically trained pianist who was also the study surgeon played the piano. Each patient had been informed beforehand that the surgeon would be playing relaxing classical piano music for them before they were sedated for the procedure.

The surgeon played the piano as patients were being transported into the OR from the preoperative holding area. The preoperative holding area was located in another section of the hospital beyond auditory range of the music. The patients were exposed to a random selection of music chosen from the piano pieces shown in Table 1 .

The study group consisted of the patients on which the senior author (JGC) operated during the study period (Table 2).

A statistical analysis using an independent paired *t*-test was conducted to determine whether group 1 and group 2 were demographically similar. The results indicated that the differences in age ($P = .32$), MAP ($P = .45$), HR ($P = .46$), and RR ($P = .49$) between groups 1 and 2 were not statistically significant.

After Institutional Review Board approval (RP#07-104-2-HMC1E), the authors performed a retrospective, nonrandomized case-series study. A chart review was done to compare MAP, HR, and RR of the 115 patients undergoing various ophthalmic surgical procedures before and after exposure to the piano music (group 1). The study included only those patients having surgery for the first time. A demographically similar group of 88 consecutive patients from the senior author's practice who had had surgery in the preceding 4 months was used as the control (group 2) and was not exposed to the live piano music. The surgeon performed all procedures for both groups in the same operating room.

Two sets of measurements were taken at 2 distinct intervals in group 1 and group 2. The first set of measurements of MAP, HR, and RR were taken while the patients were in the preoperative holding area. Patients given anxiolytic medications in the preoperative holding area were excluded from the study. The second set of measurements was taken after the patients had been transported into the OR and had been exposed to at least 10 minutes of the piano music and before administration of anxiolytic medications.

Vital signs were measured in the preoperative holding area using the DINAMAP ProCare Ambulatory 300 Vital Signs Monitor (Anandic Medical Systems; Diessenhofen, Switzerland), and vital signs in the operating room were taken with the Ohmeda Modulus CD anesthesia system (Ohmeda; Kenner, Louisiana)

The MAP was calculated based on the following traditional formula: [SP + (2DP)]/3. A paired *t*-test was used to compare MAP, HR, and RR between the measurements taken in the preoperative holding area and those taken in the operating room for groups 1 and 2. An independent paired *t*-test was done to compare the data between groups 1 and 2 in the operating room. A $P < .05$ was considered significant.

Results

Groups 1 and 2 were similar in age and baseline preoperative variables (Table 3).

Group 1 (n = 115) demonstrated a statistically significant decrease in MAP, HR, and RR in the operating room compared with the measurements in the preoperative holding area ($P < .0001$) (Table 4 , Table 5 , Table 6).

Group 2 (n = 88) had a statistically significant increase in MAP, HR, and RR in the operating room compared with the measurements in the preoperative holding area. Significance levels were $P < .0002$ for MAP and $P < .0001$ for HR and RR (Table 7 , Table 8 , Table 9).

The Figure charts the comparison of the mean values of MAP, HR, and RR between group 1 and group 2.

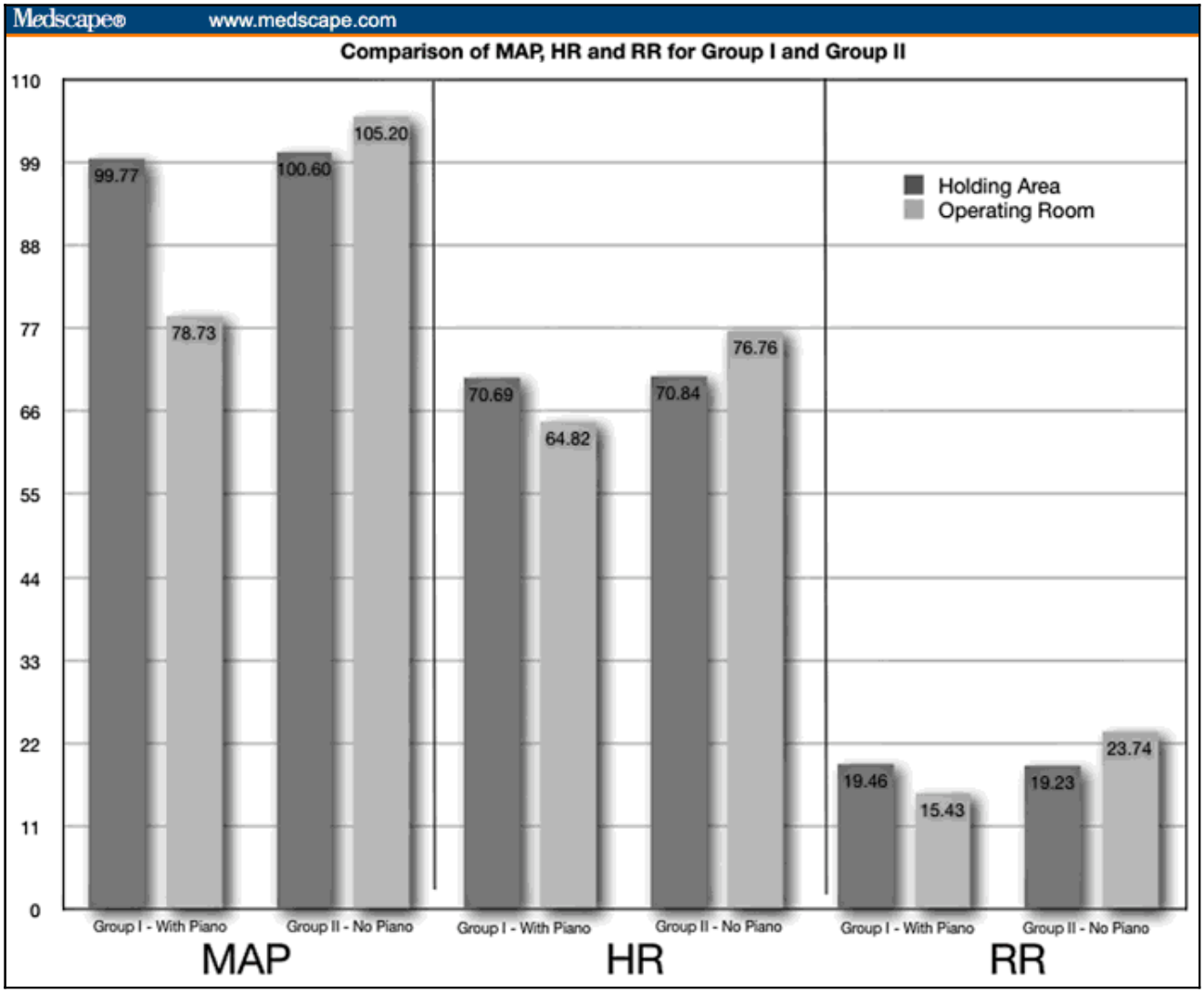

Figure.

Individual comparisons of MAP, BP, and RR for Group I (with piano) and Group II (no piano) in holding area and in operating room.

Discussion

Numerous studies have reported the benefits of music on patients undergoing various types of surgery. One such benefit is the relief of anxiety. Two randomized, controlled studies, based on the State-Trait Anxiety Inventory, measured preoperative anxiety in adults undergoing outpatient surgery. The first of these studies, published by Berbel and colleagues,[13] found that music is as effective as sedatives for reducing preoperative anxiety. The second study, by Wang and coworkers[14] concluded that patients scheduled to undergo outpatient surgery who listened to music reported less anxiety than those who did not listen to music.[14]

Another published benefit of listening to music before or during surgical procedures is reduced need for sedatives.[15-17] Reduced stress levels were also reported in studies done by Schneider and Leardi and their coworkers.[18-19] Reduced stress was measured by decreased plasma cortisol levels and decreased intraoperative levels of natural killer lymphocytes.

There are few published reports on the effects of listening to music during ophthalmic surgery. The studies done by Bellan and Cruise and their colleagues documented the benefits of music during cataract surgery based on the

patients' subjective feedback. To our knowledge, this is the first study on the effect of classical piano music on the vital signs of patients undergoing ophthalmic surgery. Furthermore, this study showed the effect of the classical piano music played live in the operating room. It was important to note that no complications occurred during or after surgery due to the presence of a piano in the OR.

Our bibliography lists numerous studies in which recorded music had an anxiolytic effect on patients. In this paper, the surgeon who was about to perform the operation played the piano. This may have added a further level of confidence in his surgical skill, which in turn may have alleviated the anxiety that is normally felt by patients about to undergo a surgical procedure. While no formal psychological testing was done in this study, the authors plan to compare recorded piano music versus live piano music in a future study.

In this study, we found a statistically significant decrease in the preoperative MAP, HR, and RR of patients exposed to live piano music. We also found a statistically significant increase in the preoperative systolic MAP, HR, and RR of patients who were not exposed to music.

This work adds to the many studies on the benefits of music during surgery. This study is unique in that the piano music used was live and played by the surgeon himself in the operating room.

The piano pieces used in this study were a classical or semiclassical genre chosen by the surgeon for their relaxing qualities. All arrangements were played in a slow to medium tempo to effect a relaxing mood. In addition, patients in both study groups were exposed to the usual operating room noise. Although music has repeatedly been shown to relax patients before, during, and after surgical procedures, only a few studies have considered the type of music used.

Ovayolu and colleagues[20] chose prerecorded Turkish classical flute music during colonoscopy. They reported decreased anxiety, pain, and dissatisfaction levels in the patients exposed to the music. A study done by Chan[21] used Chinese and Western classical music with slow beats on patients undergoing a C-clamp procedure. The study found that heart rate, respiratory rate, and pain scores were statistically reduced in the experimental group.

Certain styles of "classical" music can be interpreted as effecting a relaxing mood upon the listener. The reaction to any piece of music can vary widely among listeners. In this retrospective study, the music used had been chosen by the surgeon who played all the pieces at a tempo he considered relaxing or calming -- that is, at an "andante" (walking) tempo.

It is common for surgeons to play music during surgery. Inasmuch as studies have demonstrated the beneficial effects of music during surgery, with regard to the type of music further studies may have to be done. In this study, that the surgeon was playing the piano before the procedure leads us to speculate whether the patients' cognizance of this fact influenced the profound decrease in their vital signs upon exposure to the live classical piano music (see video).[22] This paper would have been strengthened if it were done as a prospective study; however, the piano was available in the OR only for a finite amount of time. Although having a piano in the OR may be difficult for most settings, this study reiterates the beneficial effect of classical piano music on objective parameters, such as patients' vital signs.

In conclusion, this paper suggests that listening to live classical piano music has a beneficial effect on MAP, HR, and RR on patients undergoing ophthalmic surgery.

Table 1. Piano Pieces Performed by the Surgeon in the Operating Room

Piano Piece	Composer
Arabesque No. 1 in E Major	Claude Debussy
Etude in E Major, Op. 10 No. 3	Frederic Chopin
La Playera (Andaluza), Danza Espanola No. 5	Enrique Granados
Milonga del Angel	Astor Piazzolla
Sonata No. 14 in C# Minor "Moonlight", Op. 27 no. 2, Adagio Sustenuto	Ludwig van Beethoven
Nocturne in Eb, Op. 9 No. 2	Frederic Chopin

Pavane pour une Infante Défunte	Maurice Ravel
Polonaise in A Major, Op. 40 No. 2	Frederic Chopin
The More I See You	Harry Warren and Mack Gordon

Table 2. Demographic and Surgical Data

Variable	Group 1 With Live Piano Music (n = 115)	Group 2 Without Piano Music (n = 88)
Age (yr)	64 ± 15	65 ± 17
Male/Female (*n*)	34/81	32/56
Baseline MAP (mm Hg)	99 ± 11	100 ± 15
Baseline heart rate (beats/ min)	71 ± 11	71 ± 12
Baseline respiratory rate (beats/ min)	19 ± 1	19 ± 1

Table 3. Surgical Procedures

Ophthalmic Procedure	Group 1 With Live Piano Music	Group 2 Without Piano Music
Phacoemulsification of cataract with intraocular lens	66	41
Ectropion repair of the lower eyelid	0	2
Laser dacryocystorhinostomy	14	16
Entropion repair of the lower eyelid	2	13
Strabismus surgery	1	0
Levator recession upper eyelid	1	2
Reconstruction of lower eyelid	1	0
Removal of eyelid mass	1	3
Three wall orbital decompression	5	1
Repair of orbital fracture	1	1
Orbital exploration with removal of tumor	3	0
Pterygium excision with conjunctival transplant	15	1
Ptosis repair of the upper eyelid	5	8
Totals	115	88

Table 4. Paired *t-test* for Mean Arterial Blood Pressure with Exposure to Live Piano

Music

Location	Mean	SD	SE
Preoperative Holding area	99.77	13.59	1.27
Operating room	78.73	8.24	0.77
Difference	21.04	5.35	0.50

T = 18.57; *df* = 114
P < .0001
2-tailed

Table 5. Paired *t-test* for Heart Rate with Exposure to Live Piano Music

Location	Mean	SD	SE
Preoperative Holding area	70.69	11.07	1.03
Operating room	64.82	8.24	0.77
Difference	5.87	2.83	0.26

T = 6.11; *df* = 114
P < .0001
2-tailed

Table 6. Paired *t-test* for Respiratory Rate with Exposure to Live Piano Music

Location	Mean	SD	SE
Preoperative Holding area	19.46	0.97	0.09
Operating room	15.43	2.08	0.19
Difference	4.03	-1.11	-0.10

t = 19.36; *df* = 114
P < .0001
2-tailed

Table 7. Paired *t-test* for Mean Arterial Blood Pressure without Exposure to Piano Music

Location	Mean	SD	SE
Preoperative Holding area	100.02	14.89	1.59
Operating room	105.28	12.77	1.36
Difference	-5.26	2.21	0.23

t = -3.77; *df* = 87
P < .0002
2-tailed

Table 8. Paired *t-test* for Heart Rates Without Exposure to Piano Music

Location	Mean	SD	SE
Preoperative Holding area	70.84	12.21	1.23
Operating room	76.76	11.04	1.17
Difference	-5.92	1.17	0.06

t = -4.43; *df* = 87
P < .0001
2-tailed

Table 9. Paired *t-test* for Respiratory Rates Without Exposure to Piano Music

Location	Mean	SD	SE
Preoperative Holding area	19.28	1.03	0.11
Operating room	23.74	4.56	0.49
Difference	-4.51	-3.53	-0.38

t = -9.05; *df* = 87
P < .0001
2-tailed

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