Effects of Jazz on Postoperative Pain and Stress in Patients Undergoing Elective Hysterectomy

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ABSTRACT

Context • Anesthesiologists use various medications to provide surgical patients with pain relief in the postoperative period. Other modalities, such as music, could be used in conjunction with opioids and nonsteroidal anti-inflammatory drugs (NSAIDs) to decrease pain and lower heart rate and blood pressure. Our hypothesis was that patients listening to jazz in a postanesthesia care unit (PACU) would have lower heart rates and blood pressures and reduced pain and anxiety.

Objective • The study objective was to determine if listening to jazz music in the PACU, when compared to wearing noise-canceling headphones with no music playing, would decrease heart rate, blood pressure, pain, or anxiety in patients undergoing a hysterectomy.

Design • The research design was a prospective, randomized study.

Setting • The study was conducted in the PACU at the Penn State Hershey Medical Center in Hershey, PA, USA.

Participants • A total of 56 patients, aged 18-75 y, who were categorized as status 1 or 2 according to the American Society of Anesthesiologists (ASA) Physical Status Classification System, and who were undergoing elective laparoscopic or abdominal hysterectomies, were enrolled in the study.

Intervention • Patients were randomly assigned either to listen to jazz music where the beats per min (BPM) was <100 (experimental group, n = 28) or to wear noise-canceling headphones (control group, n = 28) for 30 min while in the PACU after their surgery.

Outcome Measures • Heart rate was the primary outcome, and secondary outcomes included systolic and diastolic blood pressure, an anxiety score, and a pain score. All outcome measures were initially recorded at baseline upon the patient’s arrival in the PACU. Heart rate and blood pressure were recorded postoperatively every 5 min for the initial 30 min that a patient was in the PACU. Pain was checked every 10 min during the 30-min period; anxiety was checked at 30 min.

Results • Heart rates of patients in the noise-cancellation group were significantly lower when compared with baseline (P < .05), at all time points. For patients in the jazz group, heart rates were significantly lower at 15, 20, 25, and 30 min when compared with baseline. The pain scores were significantly lower (P < .05) in the noise-cancellation group compared with the jazz group at 10 min into the recovery period.

Conclusion • Overall, the results showed that patients responded not only to music but also to silence in the PACU. Using music and/or noise reduction could decrease opioid administration, promote relaxation, and improve patient satisfaction. (Adv Mind Body Med. 2015;29(1):6-11.)

Surgery, with its associated surgical pain, can be an anxiety- and stress-inducing experience, both emotionally and physiologically. Anxiety can be defined as an unpleasant emotional sensation in anticipation of a stressful event, whereas stress can be defined as a physiological response to a specific situation. Anxiety, stress, and pain are interrelated in that anxiety and stress can affect the perception of pain and pain can trigger emotional and physiological responses that can increase anxiety and stress. Therefore, modalities that can decrease anxiety, stress, and pain have potential benefits for surgical patients during the perioperative period. Analgesics are effective for management of postoperative pain; however, their
It was decided to use jazz as the music genre for the preferred type of music instead of being assigned a specific one. The hypothesis was that listening to jazz music (BPM < 100) that has been shown to create a relaxing effect for patients would significantly decrease the postoperative heart rate, blood pressure, pain, and anxiety of patients undergoing elective laparoscopic or robotic hysterectomies.

Methods

Participants

The current prospective, randomized study was conducted in the PACU at the Penn State Hershey Medical Center in Hershey, Pennsylvania, and was approved by the medical center’s institutional review board. Potential participants (ie, women who were scheduled to undergo elective laparoscopic or robotic hysterectomy) were identified from daily operating-room schedules. A total of 56 patients aged 18 to 75 years, who were categorized as status 1 or 2 according to the American Society of Anesthesiologists’ (ASA) Physical Status Classification System and who had consented to participate, were enrolled in the study. Patients were excluded from the study if they had (1) a hearing impairment or ear abnormalities; (2) self-reported, pre-existing issues with substance abuse, anxiety, or depression; or (3) been diagnosed with any other psychiatric disorders.

Outcome Measures

The primary outcome measure was heart rate, and secondary outcomes included systolic and diastolic blood pressure, an anxiety score, and a pain score. All outcome measures were initially recorded at baseline upon the patient’s arrival in the PACU. Heart rate was monitored with a standard pulse oximeter, at intervals of 5 minutes, for a 30-minute period. Blood pressure was measured with a pneumatic blood-pressure cuff at intervals of 5 minutes for 30 minutes. Each patient’s anxiety was measured at baseline and at 30 minutes through a self-assessment using a verbal rating scale (VRS) of 0 to 4, with numbers representing no, low, moderate, high, and extremely high levels of anxiety, respectively. The anxiety VRS was modeled after those used to assess pain. Pain was recorded every 10 minutes based on the patient’s self-assessment using the numeric rating scale-11 (NRS-11), which ranged from 0 to 10, with 0 corresponding to no pain and 10 indicating terrible pain. The nursing staff in the PACU obtained the pain and anxiety scores and documented the physiological measurements.

Statistical Analysis

The statistical plan and sample-size justification were based on the results of a previous study comparing the change in heart rate (before surgery vs after surgery) between a music and a control group. A sample size of 28 patients for each group, for a total of 56 participants, was deemed necessary to find a significant difference between the groups. This number was required to determine a mean change in heart rate (before surgery vs after surgery) of 1.5%, using a 2-sided, 2-sample t-test with 80% power and a significance level of 0.05.
level of .05. The sample size was calculated to detect a projected difference of 10% between the groups, for a type 1 error of .05 and a power of 0.9. Continuous variables were summarized with means and standard deviations and categorical variables were summarized with frequencies and percentages.

For each participant in the PACU, the values of heart rate and blood pressure measured at baseline were subtracted from those measured at the particular time point (5, 10, 15, 20, 25, and 30 min) to obtain the difference in heart rate and blood pressure at that time point. The differences for all participants within a group (noise-cancellation or jazz) at each time point were averaged to obtain the mean difference for the group at that time point. Mean differences were then compared within each group at different time points and between groups at the same time point, using a linear mixed-effects model, which accounts for the correlation between repeated measures made on the same participant, and with and 95% confidence intervals were determined. The Bonferroni correction was used to adjust the P values and confidence intervals for multiple assessments for within-group and between-group comparisons to maintain the group-wise error rate of .05. Because the raw-pain score was not normally distributed, an alternate approach was used in calculating the change from baseline as the outcome. The model included factors for group, time, and the interaction between group and time, and the fit of the model was checked using the residuals. SAS, version 9.3 (SAS Institute, Cary, NC, USA) was used to perform all analyses.

RESULTS
For both the jazz group and the noise-cancellation group, at each 5-minute interval when measurements were taken, the mean change in heart rate—from the baseline rate measured when the patient arrived in the PACU—was negative, indicating a slowing of the heart rate (Figure 1, Table 1). Comparisons within each group indicated that these differences reached the level of significance ($P < .05$) at 15, 20, 25, and 30 minutes for the jazz group and at all times for the noise-cancellation group (see Table 1 for specific $P$ values). Interestingly, the noted decreases were greater for the noise-cancellation group than for the jazz group at 5, 10, 15, 20, and 25 minutes (Figure 1, Table 1), although the level of significance ($P < .05$) was not reached for comparisons between the groups.

No significant differences occurred in systolic or diastolic blood pressures when compared with baseline, within the jazz or noise-cancellation group, or between the 2 groups (Figures 2 and 3, Tables 2 and 3).
Table 2. Comparison of Systolic Blood Pressure Changes for the Noise-cancellation and Jazz Groups

<table>
<thead>
<tr>
<th>Time After Baseline Measurement (min)</th>
<th>Mean Difference in Systolic Blood Pressure From Baseline (mm Hg) (95% confidence interval)</th>
<th>Noise-cancellation Group</th>
<th>Jazz Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-0.75 (-6.34 to 4.84)</td>
<td>1.54 (-4.06 to 7.13)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-0.39 (-7.03 to 6.24)</td>
<td>1.29 (-5.35 to 7.92)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>-1.11 (-8.85 to 6.63)</td>
<td>-0.82 (-8.53 to 6.89)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>-0.45 (-7.51 to 6.60)</td>
<td>-1.76 (-8.81 to 5.30)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>-1.19 (-9.22 to 6.85)</td>
<td>-0.13 (-8.14 to 7.88)</td>
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</tr>
<tr>
<td>30</td>
<td>-1.71 (-10.15 to 6.72)</td>
<td>-2.25 (-10.68 to 6.18)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: mm Hg, millimeters of mercury.

*For each participant, systolic blood pressure, in mm Hg, was measured at each time point and compared with the baseline rate upon the patient’s arrival in the PACU. Averages are shown above. Negative values indicate that the systolic blood pressure decreased from baseline, and positive values indicate that the systolic blood pressure increased. No significant differences occurred. Adjusted P values are shown (see Methods section). No significant differences from the baseline value were noted as the adjusted P value (see Methods section) was 1.0 for all comparisons represented in this table.

Table 3. Comparisons of Diastolic Blood Pressure Changes for the Noise-cancellation and Jazz Groups

<table>
<thead>
<tr>
<th>Time After Baseline Measurement (min)</th>
<th>Mean Difference in Diastolic Blood Pressure From Baseline (mm Hg) (95% Confidence Interval)</th>
<th>Noise-cancellation Group</th>
<th>Jazz Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-2.54 (-6.45 to 1.38)</td>
<td>1.49 (-7.06 to 0.78)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-4.39 (-8.85 to 0.06)</td>
<td>0.55 (-4.70 to 4.20)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>-4.03 (-8.79 to 0.72)</td>
<td>0.14 (-5.77 to 3.70)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>-3.72 (-9.00 to 1.57)</td>
<td>0.35 (-6.32 to 4.25)</td>
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</tr>
<tr>
<td>25</td>
<td>-4.86 (-10.34 to 0.61)</td>
<td>0.11 (-8.67 to 2.22)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>-3.00 (-8.39 to 2.39)</td>
<td>0.80 (-7.89 to 2.89)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: mm Hg, millimeters of mercury.

*For each participant, diastolic blood pressure (in mm Hg) was measured at each time point and compared with the baseline rate measured upon the patient’s arrival in the PACU. Averages are shown above. Negative values indicate that the diastolic blood pressure decreased from baseline. No significant differences occurred as the adjusted P values (see Methods section) were all >.05.
Unexpectedly, at all time points, mean self-assessed pain scores were lower than the baseline values for the noise-cancellation group but were higher than baseline values for the jazz group (Figure 4, Table 4). The difference in pain scores between the 2 groups was significant only at the 10-minute time point ($P = .0363$); none of the within-group differences reached the level of significance (Figure 4).

**DISCUSSION**

Previous studies have shown that listening to music after surgery can decrease plasma cortisol levels, preoperative anxiety, and blood pressure and heart rate.1-11,14 The current results, which indicated that jazz music with fewer than 100 BPM reduced the heart rate of patients in the PACU, are consistent with those findings.

Indeed, extraneous hospital noise is recognized as a detrimental factor for patients’ healing and satisfaction in various locations in a hospital.15-19

Surprisingly, beneficial effects from wearing the noise-canceling headphones not only occurred, but exceeded those derived from listening to jazz music. For the noise-cancellation group, the ambient noise in the PACU was diminished, and that reduction appears to have been sufficient to cause beneficial changes in heart rate and pain scores. Studies have shown that noise can affect the ability of patients to rest and subsequently heal in the hospital.15-17 Thus, both groups could have benefited from the silence or at least the dampening of extraneous hospital noise, which would have relaxing and healing properties as well. Indeed, extraneous hospital noise is recognized as a detrimental factor for patients’ healing and satisfaction in various locations in a hospital.15-18 Hospitals are beginning to incorporate quiet time during which patients are able to rest without extraneous noise from staff. The finding that the mean pain scores for the jazz group were greater than those at baseline, although not significantly so, could be due to the jazz music acting as a stimulus that kept patients awake and potentially more aware of their pain.

**Limitations**

Only 1 type of elective surgery that encompassed 1 gender was included in the study. In addition, a relatively small number of healthy patients were enrolled, which did not allow the demographics of participants to be balanced between the groups. One of the bigger limitations of this study was the lack of a true control group. During the construction of the project, the focus was on the effect of music, and the possibility that noise-canceling headphones might produce a positive response in patients was not considered.

In addition, a Hawthorne effect could exist, resulting from the patients’ awareness of being treated or not being treated. In this study, patients were told that they would be listening to music or only wearing headphones with no music being played. If such an effect had occurred, it might be expected that the group that listened to music would have had a greater response, because the music would have been considered the treatment whereas the lack of music would have been no treatment. However, because the results of this study showed that the opposite happened (ie, the group that did not receive music had a greater response to the treatment) it seems unlikely that the response is attributable merely to a Hawthorne effect.

Because the goal was to study the effect of music as an adjunct therapy, this study did not incorporate a specific...
protocol for opioid administration, and some patients could have received more pain medication intra- and postoperatively than others. In addition, some participants might not enjoy jazz, which could have made their experiences more stressful than relaxing. Studies have shown that patients who listen to music that they truly enjoy can have lower pain scores, anxiety, and systolic blood pressures.\textsuperscript{1,17}

**Future Studies**

Additional research should be conducted on the effect of personalized music and noise reduction in the PACU to further extrapolate their effects on pain management after surgery. Noise-canceling headphones should still be used as a way to deliver the music intervention, with a second interventional group of patients wearing the noise-canceling headphones with no music played through them; however, a true control group where participants do not use noise-canceling headphones at all should also be included. Additional research should incorporate all kinds of surgeries, as well as patients in varying degrees of health, because the current study looked only at healthy patients. Larger study groups would be required to match participants demographically within the treatment groups and with the control group. Future studies should consider using a standardized protocol for postoperative pain management or at least monitor the amount of narcotics used postoperatively, in both the treatment and control groups. Patients involved in a future study should be questioned about their musical preference before surgery and be allowed to bring in their own music if they so choose.

**CONCLUSIONS**

Overall, the results showed that patients respond not only to music but also to silence in the PACU. This finding implies that a patient’s environment affects his or her hemodynamic stability and psychological status. As hospitals continue to look for ways to improve patient care and satisfaction, physicians should consider incorporating strategies to reduce ambient noise and promote a quieter atmosphere. Music, particularly music that is personalized for each patient, is one way that this goal could be accomplished. Even an act as simple as giving patients noise-canceling headphones could improve their hospital experiences. Using music and/or noise reduction could decrease opioid administration, promote relaxation, and improve patient satisfaction.

**AUTHOR DISCLOSURE STATEMENT**
The authors have no conflicts of interest.

**REFERENCES**
