ORIGINAL RESEARCH

THE EFFECTS OF HARP MUSIC IN VASCULAR AND THORACIC SURGICAL PATIENTS

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Context • *Music has been used in the acute clinical care setting as an adjunct to current treatment modalities. Previous studies have indicated that some types of music may benefit patients by reducing pain and anxiety, and may have an effect on physiological measures.*

Objective • *To evaluate the scientific foundation for the implementation of a complementary therapy, harp playing. The research questions for this pilot study were: Does live harp playing have an effect on patient perception of anxiety, pain, and satisfaction? Does live harp playing produce statistically and clinically significant differences in physiological measures of heart rate, systolic and diastolic blood pressure, respiratory rate, and oxygen saturation?*

Design • *A prospective, quasiexperimental, repeated measures design was used with a convenience sampling.*

Setting • *Orlando Regional Medical Center, Orlando Fla.*

Patients • *Subjects were eligible for the study if they were postoperative and admitted to a hard-wired-bedside–monitored room of the Vascular Thoracic Unit within the 3 days of the study period.*

Intervention • *A single 20-minute live harp playing session.*

Main Outcome Measures • *Visual analog scales (VAS) were used to measure patient anxiety and pain. Patient satisfaction was measured with a 4-item questionnaire. Physiological measures (heart rate, systolic and diastolic blood pressure, respiratory rate, and oxygen saturation) were recorded from the bedside monitor.*

Methods • *Visual analog scales (VAS) were completed just before harp playing, 20 minutes after harp playing was started, and 10 minutes after completion. Patient satisfaction with the experience was measured with a 4-item questionnaire. Physiological measures (heart rate, systolic and diastolic blood pressure, respiratory rate, and oxygen saturation) were recorded from the bedside monitor at baseline (5 minutes before study setup), at zero, 5, 10, 15, and 20 minutes after harp playing began, and at 5 and 10 minutes after harp playing stopped.*

Results • *Seventeen patients were used in this study, with a retrospective power of .91. Results indicate that listening to live harp music has a positive effect on patient perception of anxiety (P=.000), pain (P=.000) and satisfaction. Live harp playing also produced statistically significant differences in physiological measures of systolic blood pressure (P=.046), and oxygen saturation (P=.011). Although all values over time trended downward, the changes of other variables were not adequate to achieve statistical or clinical significance.*

Conclusion • *Subjects in this study experienced decreased pain and anxiety with the harp intervention, and slight reductions in physiologic variable values. It is not possible in this study to determine if the results were due to the harp music, the presence of the harpist and data collector, or both. Future research is recommended using a control group and comparison of live versus recorded harp music with a wider variety of diagnoses and procedures. (Altern Ther Health Med. 2002;8(5):52-60)*

Music has been used as a therapeutic agent for thousands of years and has engaged many forms.[1-3] Music therapy is defined by the National Association for Music Therapy as the "use of music in the accomplishment of therapeutic aims: the restoration, maintenance, and improvement of mental and physical health."[4] Music therapy involves a prescriptive, systematic, and purposeful approach in which a therapist establishes specific objectives for treatment. In this process, the therapist assesses, plans, intervenes, and evaluates responses to therapy. In music therapy, the relationship of the client to the therapist is central to the use of music in the therapy.[5]

In contrast, music in medicine is more often used to "influence the patient's physical, mental, or emotional states before, during, or after medical treatment."[6] The aim of music in medicine is to provide an adjunct to patient care, which may or may not have specific treatment goals. When music is used in medicine, the relationship of the client to the music is key, rather than with a therapist. In a hospital or similar clinical setting, the goal of using music is to improve how the patient feels during procedures or other clinical situations. Most research related to music in the clinical setting is focused on evaluating the effects of music on physiological and psychological status.

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REVIEW OF THE LITERATURE

A number of research studies have been conducted to determine the effects of music on a variety of clinical variables. Various care settings and patient types have been studied using different forms of music interventions.[1-4,7-9] In some studies, the investigator chose the music intervention; in others, the participants selected the music. In most cases, recorded music was played by audiotape or compact disc. Because of the wide array of measures, patient types, music, and its delivery, it is difficult to fully understand the efficacy of music and its clinical effects.

In 1986, Standley[7] conducted a meta-analysis on the use of music in medicine and dentistry. She identified 55 dependent variables in 30 studies in which the effects of music were measured during treatments. Most of the studies used taped music for listening. Findings indicated that music was used most often in clinical areas for audioanalgesia, anxiolysis, or sedation. Implications for clinical practice were that music might be useful as an adjunct to reduce pain and anxiety in the hospital setting. Watkins[2] reviewed clinical research related to the effect of music on anxiety, blood pressure, and heart rate, and found similar clinical indications for music. Snyder and Chlan[3] reviewed studies on music interventions from 1980-1997. Their review concluded that, overall, music was found to be effective in producing positive outcomes over a broad range of variables. Henry[1] summarized 6 research studies related to pain and anxiety in the intensive care unit. Music was found, in most cases, to be helpful in reducing pain, anxiety, and physiological variables, such as heart and respiratory rates. All reviews recognized that studies varied in the type of music, choice, length, and frequency of the music intervention, and outcomes measures used. Often, small sample sizes of different patient types were used with variable controls. These factors limit generalizability and determination of specific recommendations for the type and length of time music should be played in the clinical setting.

Seventeen studies related to music and its effect on hospitalized patients were reviewed for this study. In these studies, 7 types of music therapy were used; sample sizes ranged from 9 to 272. Twenty-nine different dependent variables and 13 different types of patients were investigated. Studies related to the effects of music on anxiety, pain, and satisfaction, and physiological variables that have direct relevance to the present study.

Music and its Effects on Humans

Music has a potential for a variety of effects on individuals, including psychological and physiological mechanisms. Many aspects of music may play a role in these effects. Examples include the volume, tempo, pitch, type of music, self-selected versus preselected, the instrument used, rhythm, and the composer for some.[2] The type of vibrations produced by music may affect different areas of the body, and these may be used as a therapeutic intervention.[10] Music is a complex blend of expressively organized sound with elements of rhythm, melody, and harmony.[9]

Effects of Music on Relaxation and Anxiety

Music therapy is known to have relaxing effects on humans and has been used in clinical situations to reduce stress and release tension. The type of music may affect the degree of sedation or anxiety in humans. Slow and sedative music, such as new age or Baroque styles, may result in relaxation.[6] Watkins[2] reported that anxiolytic music has a simple, repetitive rhythm, low pitch, slow tempo, consonant harmony, uses strings, and no percussion instruments. Standley[7] also reported that slow, quiet, nonvocal music reduced stressful physiological responses. Music with slow, steady, and repetitive rhythms is thought to exert a hypnotic effect that results in cognitive quieting and altered states of consciousness.[11,12] The pitch of music also is thought to affect body tension.[4] Higher pitches are associated with more tension, whereas lower pitches result in relaxation. Music may affect anxiety through distraction from stressful stimuli or direct action on the autonomic nervous system to reduce the stress response.[13-15]

Many studies have been conducted on the effect of music on anxiety.[2,7] Results have indicated a positive effect on anxiety and relaxation with music interventions. Staum and Brotons[16] tested 3 levels of music amplitude on the relaxation response and heart rate in 140 college students. They found an overwhelming self-reported preference for softer music for relaxation, though men demonstrated a higher preference for louder music than women. There was no difference in heart rates with music amplitude found in this study.

Rhythm, or the pattern of the movement of music, is one of its most important aspects.[9] The tempo of the music also may affect tension levels. Iwanaga and Moroki[17] conducted a study in which excitative and sedative music selections were played for subjects. They found that sedative music eased tension, compared to excitative selections, which aroused vigor and tension. Physiological responses were greater during excitative music than during sedative music. They found that favorite music, regardless of type, lowered tension. They concluded that the dominant factor in an emotional response was the music type rather than preference.

Recent research has focused on the effect of music on anxiety levels in hospitalized patients. Three studies were conducted in patients with myocardial infarction.[17,18,19] All studies reported a reduction of anxiety and heart rate with a music intervention. Music played for preoperative patients also resulted in anxiety reduction.[20] Chlan has studied the effects of a music intervention on patients with mechanical ventilation[15,21] and found consistent reductions in heart rate, respiratory rate, and anxiety levels. Two studies were done to test the effect of music interventions during invasive medical diagnostic procedures typically associated with anxiety. Colt et al[22] reported that patients who listened to relaxing music while undergoing fiberoptic bronchoscopy did not have a decrease in procedure-related anxiety. In contrast, Palakanis[23] found that patients who listened to self-selected music during flexible sigmoidoscopy procedures demonstrated reductions in state anxiety scores and mean arterial pressures

compared to controls. Burns reported that the Bonny method of guided imagery and music proved effective in improving mood and quality of life in cancer patients.[24]

Physiological Effects of Music

The effects of music on physiological function have been studied in a variety of ways. Kumar et al,[25] evaluated the effects of 4 weeks of music therapy sessions on the concentration of neurotransmitter and neurohormonal substances, such as melatonin, catecholamines, and serotonin in patients with Alzheimer's disease. They found that music therapy stimulated increases in these substances and accompanied positive behavioral changes during the study period. Rider[14] found a decrease in corticosteriod levels during music, guided imagery, and progressive muscle relaxation techniques.

In Watkins' review of studies on the use of music therapy in clinical settings,[2] she found that relaxing music resulted in physiological effects of lowered blood pressures and heart rate, and decreased adrenocorticotrophic hormone levels. In her physiological framework, she describes 3 possible mechanisms that may be responsible for these responses. Sound or music may stimulate involuntary areas of the brain that cause physiological responses before a conscious emotional thought. The second possible mechanism is that music affects emotional centers in the brain before resulting in a physiological response. The third is that responses result from a combination of both mechanisms.

One interesting physiological phenomenon associated with music is known as "entrainment."[7,10-12] This process in music therapy is one in which the music rhythm synchronizes with internal body rhythms, such as heart rate and respiratory rate. This occurs when 2 similarly vibrating rhythms interact and resonate at the same frequency.[15] Slow, rhythmic pieces, such as those composed by Bach, Handel, and others from the Baroque period, duplicate the normal heartbeat.[10] Theoretically, one can adjust the rhythms of music to various rhythms of the body, such as the heart and breathing rates, and create a desired physiologic effect with entrainment. The process of entrainment is best accomplished at rates of 60-80 beats per minute, similar to the human heartbeat. This tempo decreases sympathetic nervous system output and dampens arousability in the central nervous system via the reticular activating system. This results in cognitive quieting as indicated by physiological indicators of relaxation, such as lower heart and respiratory rate, blood pressure if hypertensive, and oxygen consumption.[11,12]

Music and Pain Perception

Music is used by therapists to reduce acute and chronic pain and suffering in many types of patients.[25] Postoperative pain is common, particularly in major surgery and critical illness and has been recognized as being inadequately managed. The presence of pain is not without consequences. First, it has been rated as the highest human fear, second only to death.[1] Second, pain can result in deleterious physiological consequences, such as increased stress responses and catecholamine release, inadequate healing, tissue breakdown, and inadequate appetite and sleep. These factors may result in prolonged hospitalization and increased morbidity with its associated costs.[1,8] Analgesic medications also may result in additional costs, side effects, and potential dangers for patients. For these reasons, alternative and complementary therapies for pain relief are encouraged in the clinical setting.

A number of theories exist about the effect of music on the pain threshold. One explanation is that music competes as a distractive stimulus, thereby reducing the perception of pain, reducing anxiety, and increasing relaxation.[26] Another physiological explanation involves the gate-control theory. In this theory, the transmission of painful stimuli can be modulated by a gated mechanism in the spinal cord under the influence of another, competing stimulus.[26] An additional explanation is the role of secreted endorphins in response to music. Endorphins may reduce pain sensation by acting on pain receptors.[8,26]

Studies conducted to determine whether music interventions have an effect on pain have shown mixed results. In Good's review, most studies found that relaxation and music reduced postoperative pain, especially the affective component.[8] Studies on the effects of music in early postoperative patients by Hieser[27] and Taylor[28] found no significant differences in reported pain or effect on the use of analgesic medications. In contrast, Zimmerman[29] and Updike[30] found a reduction in reported pain in cancer patients and critical care patients, respectively.

The Use of the Harp in Music Therapy

The harp is an acoustic stringed instrument with a wide pitch range.[10] This large range of pitches can vibrate the entire body, as opposed to low, bass instruments, which reverberate only the lower parts of the human body. Musical elements of drone, a slow rhythm, harmony, melody, and song form[10] are typically present in classical harp music. Many of the characteristics of harp music are recognized to have an anxiolytic and relaxing effect.

Therese Schroeder-Sheker has developed a method of music therapy called music thanatology.[31] In her Chalice of Repose program, the staff uses music intervention as part of the care for dying patients. Therapists in this program present live prescriptive music at the bedside, consisting solely of singing and harp playing. This live form of music emphasizes a dynamic and individualized approach for each patient. The recipients do not choose the type of music played; rather, the music consists of slow, melodic tunes that are probably not identifiable to them. This successful program has been in existence for more than 10 years in palliative care and has been incorporated as a standard component of supportive care for the dying at that facility. As opposed to music therapy and music in medicine, music thanatology is solely concerned with addressing the needs of dying patients who are only receivers of the music and have little connection, if any with the therapist. Harp music, combined with other toning techniques, allows the patient to unbind from the

physical body and literal time and move more peacefully toward the transition to death.

Music therapy has been used and studied by a variety of disciplines to promote positive outcomes in diverse patient populations. Findings from these studies demonstrate that listening to music produced statistically significant reductions in physiological parameters, anxiety level, and pain perception. However, some studies revealed no significant differences. Music therapies varied according to music types and methods. Previous studies have been limited due to small sample size, lack of sufficient power analyses, and controls. Because many types of patient populations have been studied under varying conditions, comparing findings between studies has been difficult. Music used in medicine is a safe, effective, and inexpensive form of adjunctive therapy that can be used to promote healing and provide a humane environment for the care of acutely ill patients.

RATIONALE AND PURPOSE OF THE STUDY

At the study institution, a healing arts program was implemented to provide value-added service to patients in the acute care setting. A harpist playing music in patient care areas and perioperative waiting rooms is one component of this program. The study team desired to evaluate the effect of harp playing on psychological and physiological responses of patients. The Vascular and Thoracic Surgery Unit was selected for study. Postoperative patients on this unit are subject to pain, anxiety, and physiological alterations owing to the nature of their major surgical procedures. The effect of live harp playing on this population had not been previously studied.

RESEARCH QUESTIONS

The study team asked the following questions:

1. Does live harp playing have an effect on patient perception of anxiety, pain, and satisfaction?

2. Does live harp playing produce statistically and clinically significant differences in physiological measures of heart rate, systolic and diastolic blood pressure, respiratory rate, and oxygen saturation?

METHODS

Protection of Human Subjects

The study institution's Nursing Research Committee and the university's Institutional Review Board approved the study. Informed consent was obtained and confidentiality of data maintained.

Design

A prospective, quasiexperimental, repeated measures design was used. Subjects served as their own controls.

Patient Inclusion and Exclusion Criteria

Patients were eligible for the study if they were postoperative and admitted to a private, hard-wired-bedside–monitored room of the study unit within 3 days of their surgery. Subjects were required to be sufficiently alert and cognizant to complete the visual analog scale (VAS) and questionnaire tools and sign informed consent. Patients were excluded if they could not see or hear, or if they were hemodynamically unstable.

Study Sample

Convenience sampling was used to enroll subjects who met inclusion criteria regardless of age or gender. Patients were approached by the investigators and invited to participate. Informed consent was obtained from those who agreed to participate. A retrospective power analysis was completed using the variance and effect size for the 17 subjects in the sample.[12] For a repeated measures design, 2-sided alpha of .05, and a desired moderate effect, the power of this sample was .91.

The Harp-playing Session

To standardize the music intervention used for the study period, the same harpist performed in every experimental session. The harpist employed at the study facility was a woman; her gender was not chosen intentionally as part of the intervention. To control for potential emotion-referenced responses related to the type of music played, the harp-playing session consisted of a series of slow, soft, melodies mostly composed by the harpist. Patients were not given a choice of music selection, somewhat due to the limited range of tunes composed by the harpist, and also because it would possibly disrupt the flow of the study period and timing.

Patients approached for inclusion in the study were in the early postoperative period and generally required frequent assessments and treatments over an hour's time. For this reason, the harp-playing session was limited to 20 minutes. This time period is the minimum thought to be effective to induce relaxation.[11] The 20-minute intervention would be least likely to interfere with other important patient care activities, yet be sufficient to yield a positive effect.

The Harp-playing Variable

In this study, a live harp-playing session was used rather than recorded music. Live harp music was chosen mainly because it is the form of music most often available through the healing arts program at the study facility. Evaluating the potential effects of this service was important because providing a musician for the facility requires managerial and monetary expenses. The harpist was not a therapist in this study; rather, she was providing music for the patient. The effects of live harp playing have not been previously studied in this population of patients.

Measurement Instruments

A VAS was used for patients to rank their degree of anxiety and pain. The scales consisted of a 100mm horizontal line with defined ends representing no pain or anxiety on one end, and extreme limits of pain and anxiety on the other. The VAS has been used in many studies and is a validated tool of

measurement.[44,45] Patient satisfaction with the music intervention was determined by a 4-question survey using a 5-point semantic rating scale (see Table).

Physiological measurements of heart rate (HR), systolic, diastolic, and mean arterial blood pressures, saturation of arterial oxygen (SpO_2), and respiratory rate were recorded by the Hewlett-Packard Viridia HPM1205A 26/24 Series bedside monitor (Andover, Mass). The accuracy of electrocardiogram (ECG) for heart rate measurements was within ±1% with a 30 ms signal delay. Respiratory rate accuracy was ±1 rpm at 60 rpm. The accuracy of SpO_2 measurements by the Nellcor Oxisensor II D-25 (Pleasanton, Calif) was 1 SD=±3% (70-100%). Arterial pressure measurement accuracy was ±3% full scale, 1 v/100 mm Hg with zero adjustment accuracy ±1 mm Hg and drift of 0.1 mmHg/°C. If direct arterial monitoring was not in place, manual blood pressure was taken and compared to the automatic blood pressure measurement. If the systolic pressures were within 10 mm Hg, the Hewlett-Packard automatic noninvasive blood pressure cuff (NIBP) by oscillometric method was used. The accuracy of the NIBP transducer system is ±3 mmHg, complying with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SPIO-1987). The automatic cuff also was used for blood pressure measurements on patients whose arterial waveform was inconsistent, or demonstrated dampening or catheter fling.

Data Collection

Patients were approached about participation in the study if they met inclusion criteria. After informed consent was obtained, demographic data were retrieved from the patients' medical records. The investigator explained the sequence to expect from the harp-playing session and the timing of assessments involved in the study. Subjects were instructed how to complete the VAS and questionnaire and were assessed regarding their need for reading glasses to complete these tools.

To provide an uninterrupted study period, the nurse assigned to the patient was consulted so that no interruptions would occur during the experiment. The room was prepared by reducing extraneous noise (no television, radio, or phone). To reduce distraction, a curtain was drawn between the patient and investigator to provide an inconspicuous place for data collection. Visitors were either asked to leave or to remain quietly on the other side of the curtain during the study period. A sign was placed on the door to prevent interruptions during the study period.

Responses to satisfaction questionnaire

Question	Mean (± SD)	Range
1. The harp music helped me forget about my illness or troubles for a while.	4.82 (±.39)	4-5
2. The harp music helped me improve how I feel or my general mood.	4.53 (±.62)	3-5
3. The harp music was an added, enjoyable experience for me.	4.88 (±.33)	4-5
4. I would rather not have the harp played during my hospitalization.	1.41 (±1.0)	1-4

The investigator assessed the adequacy of ECG and blood pressure, SpO_2, and respiratory waveforms, and replaced electrodes and probes as needed. If the patient's blood pressure was being measured with an arterial catheter, the transducer was zeroed and leveled to the phlebostatic axis. The patient was asked to maintain the same body position and prevent undue movement during the study period to avoid erroneous measurements in blood pressure or heart rate due to artifact. Baseline physiologic measures were then monitored.

Within 5 minutes of the harp-playing intervention, the patient was asked to rate anxiety level and pain using the VAS to establish baseline. The physiologic monitors were prepared and the harpist entered the room, facing the patient at the foot of the bed or chair. Before this time, the subject had not seen the harpist and minimal to no conversation occurred between the harpist and subject. Once the study period began, the harpist was cued to begin and the initiation time was recorded by marking "event A" electronically on the Hewlett-Packard bedside monitor. The automatic blood pressure module was set to measure blood pressure every 5 minutes in appropriate patients and synchronized with the beginning of data collection.

The harpist played at the bedside for 20 minutes. The data collector remained in attendance for the duration of data collection. At the end of the 20 minutes, "event B" was marked on the monitor and the patient was asked to repeat the VAS rating for pain and anxiety level. The harpist left and the patient remained quietly in the same position for the next 10 minutes. At the end of that period, the subject repeated the pain and anxiety VAS scores and completed a 4-question survey regarding his or her satisfaction with the experience.

During the harp playing, physiological variables (heart rate, blood pressure, respiratory rate, and oxygen saturation) were recorded via the "trend" mode on the Hewlett-Packard bedside monitor. Data were extracted and printed for each 5-minute measurement, including 10 minutes before, during, and for 10 minutes following harp playing.

Data Analysis

Descriptive and inferential statistics were used to describe the sample and to evaluate the research questions using SPSS statistical software (SPSS version 10.0, Chicago, Ill). The level of significance was set at $P=.05$ for this study.

RESULTS

Description of the Sample

Several patients declined to participate in the study for a variety of reasons. Examples included disinterest in harp music, fatigue, pain, and visitors. A number of patients indicated that

harp playing reminded them of "going to heaven" and death, and represented negative feelings about the music.

Ten men (58%) and 7 women participated with an age range from 35 to 70 years (mean 62.12, SD±12.04). The types of surgical procedures performed on this sample were thoracotomy (n=6), carotid endarterectomy (n=7), and 4 other major surgery types. Eight patients (47%) were receiving pain medication by a patient-controlled analgesia intravenous (IV) pump. Six (35%) had oral pain medications ordered, and others had intermittent IV dosing of narcotics as needed. Fifty-nine percent of patients (n=10) had a history of a previous surgical operation. The latest time of pain medication administration before the beginning of the study period ranged from 10 minutes to 14 hours, with a mean of 3.4 hours. One patient had received an anxiolytic drug within 2 hours of the study period.

The Effect of Harp Playing on Anxiety, Pain, and Satisfaction

The VAS scores for anxiety and pain were analyzed for differences in values from baseline, at completion of harp playing, and at 10 minutes following harp playing. Mean baseline VAS scores for anxiety were 38.82 mm, 8.53 mm at completion, and 9.35 mm at 10 minutes following harp playing. Repeated measures analysis of variance (ANOVA) testing demonstrated a statistically significant difference in anxiety ratings over the time periods ($F_{1,1}$=25.99, P=.000). Post hoc analysis by paired samples t-testing revealed that differences occurred between the baseline values and both the end of harp playing and 10 minutes afterward (P=.000). No significant differences in anxiety were found between the end of harp playing and at 10 minutes afterward.

The VAS scores for pain were similar to the anxiety scores. Mean VAS scores for pain were 41.47 mm before, 16.15 mm at completion, and 12.32 mm at 10 minutes after harp playing. These values were significantly different over the time periods ($F_{1,16}$=25.3, P=.000). Post hoc analysis revealed similar findings as with anxiety scores, with statistically significant differences between the baseline and both post–harp-playing scores. Figure 1 illustrates changes in pain and anxiety VAS scores over the 3 time periods.

Results from the satisfaction questionnaire indicated overall satisfaction with the harp playing session. The findings are described in the Table.

Effects of Harp Playing on Physiological Variables

Repeated measures ANOVA was used to determine differences in physiological variables over time, including the baseline, intervention, and postintervention periods (Figure 2). Mean baseline heart rate was 80.2 beats per minute, and the lowest mean heart rate during harp playing was 76.4 per minute. This decline did not achieve statistical significance over time ($F_{3,1}$=2.21, P=.098). Systolic blood pressure measurements were significantly different over time ($F_{3,3}$=2.77, P=.046). Mean systolic blood pressure declined from a baseline value of 149 mm Hg to the lowest mean reading of 142 mm Hg. No statistical differences were found in diastolic blood pressure (F_6=1.17, P=.329) and mean arterial pressure ($F_{2,8}$=1.99, P=.134). All blood pressure values decreased only slightly during the intervention period.

Both SpO_2 and respiratory rate values declined slightly during harp playing. Oxygen saturation decreased significantly over time (F_6=2.95, P=.011) from a baseline mean of 96% to the lowest mean of 94.7%. Respiratory rate was not significantly different over time (F_6=1.46, P=.201). Oxygen saturation increased to baseline levels in the postintervention period, but respiratory rates remained at the intervention low of 17 per minute.

COMMENT

Results of this pilot study indicate that listening to a single session of live harp music had a positive effect on subjects' perception of anxiety, pain, and satisfaction. Additionally, a sustained psychological effect was demonstrated with continued lower values on the VAS 10 minutes after the intervention was

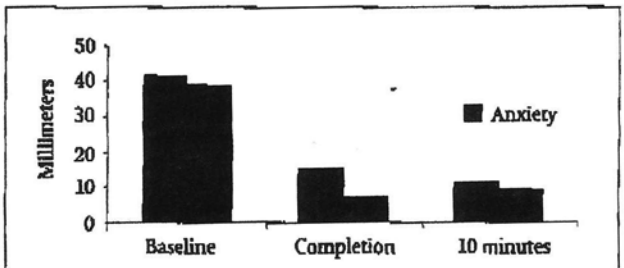

FIGURE 1 Visual analog scale scores for pain and anxiety (N=17)

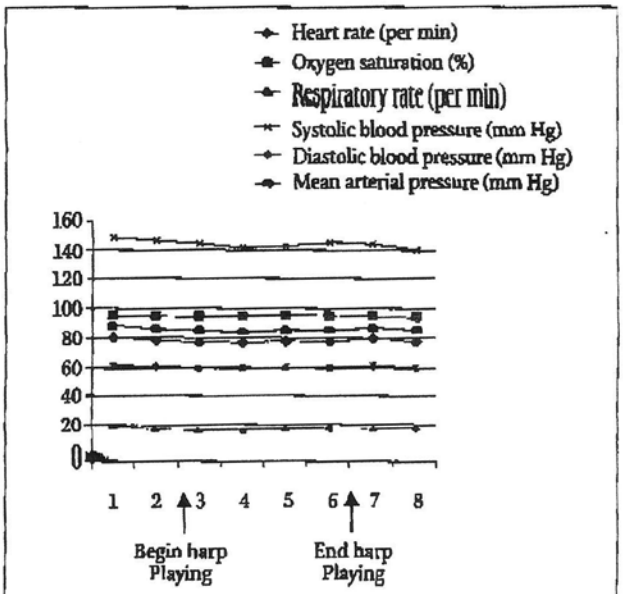

FIGURE 2 Changes in physiological variables with harp-playing intervention

completed. Some of the patients fell asleep during the harp playing and continued sleeping after the study period. Given that many of these patients were sleep deprived, promoting rest and relaxation in the acute postoperative patient may have benefit.

The findings of reduced pain and anxiety and increased satisfaction with the music intervention in this study was consistent with those found in the review of previous studies. Although pain reduction in postoperative patients with music interventions was inconsistent in some studies, it seems that a single live harp-playing session assisted in reducing pain in this population of patients after major surgical procedures.

In this study, achieving statistical significance was important, but clinical significance also was desired. The clinical significance of value differences in pain using the VAS has been studied. Kelly[35] reported a 9-mm (95% CI, 6 to 13 mm) and Todd, et al[36] indicated a 13-mm (95% CI, 10 to 17 mm) minimum change in VAS to be considered clinically significant. Both of these studies were done in patients with acute pain in an emergency department setting. In the present study, a mean of 25-29 mm change in pain and a 29-30 mm change in anxiety scores were found. This indicates a clinically significant difference in these parameters during the harp-playing intervention. This finding is key to establishing a potential psychological benefit for this mode of intervention. Increasing patient satisfaction with hospitalization is an important factor in establishing programs within a hospital system for many reasons. Findings from this study may further substantiate the use of harp playing as an added component of patient care.

Live harp playing also produced statistically significant differences in physiological measures of systolic blood pressure and SpO_2. Decreases in respiratory rate remained for 10 minutes following the harp intervention, possibly demonstrating a sustained effect. As noted above, a number of patients fell asleep during the intervention. The gradual decline in respiratory rate may have been responsible for the change in SpO_2. The change in SpO_2 was not detrimental to the patient and remained within acceptable clinical parameters. This reduction in respiratory parameters may be associated with the reduced level of anxiety.

Subjects in this study had many reasons to have alterations in physiological values, including blood loss, preexisting conditions, medication usage, and surgery on the thorax and carotid artery. These factors may have influenced heart rate, blood pressure, and respiratory values by other physiologic mechanisms. In all cases, none of the physiological values increased and were never a threat to the patient. In fact, the physiological values either stayed the same or declined.

The research team performed the power analysis for the sample using a proposed moderate effect size. The desire was to ascertain clinically significant changes, not just statistical significance. Clinically significant changes in pain and anxiety levels occurred with the harp intervention. However, though the physiological values over time trended slightly downward, most of these changes were not clinically or statistically significant. Other studies found significant changes in physiological variables, or a trend downward.[13,18,31,37] Findings from this study indicated generally stable values in physiological variables over time. The findings support the safety of the harp intervention, as well as clinically significant reductions in pain and anxiety, but not physiological stress reduction. This is an area for further investigation, particularly with a control group and other more direct physiological measures.

Limitations of the Study and Recommendations for Future Research

This investigation was a pilot study with a small sample size in a specific postoperative patient population. Only an experimental group was studied, with subjects serving as their own controls. Increasing sample size and including a control and experimental group may strengthen findings. Only 1 harp playing session was used in this study. Including more than 1 session to determine if the findings could be reproduced may have been useful. Replication of this study in other populations also may be important.

Several factors related to the music intervention itself. One element of this study that was different from most others was that the music intervention was a personal performance by an artist at the bedside rather than recorded music. It is not possible to determine if the results were influenced by the harp music or the presence of the harpist or data collector. One opportunity for further investigation may be to compare responses of subjects with live versus recorded harp music. Future research comparing a control group with a human presence and no music intervention to one with a live music intervention may prove useful in determining the true effect of the music intervention alone. In this study, the effects of the single music intervention seemed to be sustained for 10 minutes afterward. Further investigation of the sustained effect beyond 10 minutes may aid in understanding the stress-, pain-, and anxiety-reduction phenomena over time. Another potential area of study with harp playing might include a choice of music selections or comparison of harp music with other types of music.

The type of music intervention used in this study may have affected findings. The harp music comprised slow, rhythmic, melodies with low volume. Music of this type employed with stringed instruments is thought to exert a relaxing or soothing effect on listeners. The investigator, rather than the subjects, selected the intervention, so the type of music used may have had different effects among patients. Some patients approached for inclusion indicated the harp music seemed inappropriate, as it might indicate a stereotypical symbol for death. Finally, men's and women's responses to both music and pain may affect the findings from this study. This aspect was not analyzed for this study, but makes an interesting option for future research in gender-related responses to harp playing. The harpist in this study was a woman, and potential responses of patients may be affected by the gender of the musician. This is another area for future investigation.

Conclusion

Study findings indicated that the intervention of live harp playing had a statistically and clinically significant effect on pain and anxiety reduction. Patients had overall satisfaction with the experience. Physiological variables of systolic blood pressure and saturation of arterial oxygen were significantly lowered during the intervention. Other physiological variables of heart rate, diastolic and mean arterial blood pressure, and respiratory rate were not significantly different during or after harp playing from baseline values. However, the values remained constant or had an insignificant clinical change. This indicates the safety of this intervention in postoperative patients following major surgery. Clinical implications of the findings from this study support music as a complementary therapy for hospitalized patients and supports the potential benefit for including these modalities as an option in acute care. Using harp music in clinical situations is an inexpensive and simple intervention, which may improve patients' psychological and physiological responses.

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