

# A music intervention to reduce anxiety before vascular angiography procedures

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*Patients scheduled for vascular angiography are often anxious and frightened. High levels of anxiety may result in more difficult and painful procedures. Past research has reported mixed results for anxiety reduction techniques in other procedures settings, such as education, cognitive-behavioral skills, coping and relaxation skills, combinations of techniques, and music. Music as an intervention for pre-procedural anxiety prior to vascular angiography has not been studied. A randomized controlled trial of 170 patients was undertaken to determine whether 15 minutes of self-selected music reduced pre-procedure anxiety. The State Trait Anxiety Inventory was used to measure patients' anxiety. One-hundred sixty-six men and 4 women comprised the sample with an average age of 66.8 years (SD 9.95, range 37 to 85 years). Patients who listened to music (n=89) reduced their anxiety score from 38.57 (SD 10.46) to 35.2 (SD 9.7), while those who did not listen to music (n=81) reduced their anxiety score from 36.23 (SD 10.54) to 35.1 (SD 10.59); the difference between the groups was statistically significant ( $t=1.95$ , df 161,  $p=0.05$ ). Pulse achieved a statistically significant reduction in the music group ( $t=2.45$ , df 167,  $p=0.02$ ). Music is a noninvasive nursing intervention that patients enjoy and reduces their anxiety and their pulse rate. Further research should address using music to reduce anxiety in other interventional vascular angiography settings with equal numbers of men and women and comparing self-selected versus investigator-selected music. (J Vasc Nurs 2006;24:68-73)*

Patients about to undergo diagnostic and/or interventional vascular angiography procedures are often anxious and frightened. A patient's anxiety and ability to cope with anxiety may influence his or her physiologic responses, such as respiratory rate, heart rate, blood pressure, myocardial oxygen consumption, and plasma concentrations of epinephrine and norepinephrine.<sup>1-3</sup> Physiologic and psychologic responses may increase the length of the procedure and the amount of sedation required. Similarly, a tense patient may find it difficult to cooperate with the team, thus adding technical difficulties to the procedure.<sup>4,5</sup> Therefore, interventional radiology nurses are challenged to reduce patients' fears and promote relaxation as patients anticipate and undergo vascular angiography procedures. Music has been used for reducing anxiety and promoting relaxation.

Munro and Mount<sup>6</sup> define music therapy as "the controlled use of music, its elements and their influences on the human

being to aid the physiologic, psychologic, and emotional integration of the individual during the treatment of an illness or disability." Music therapy is widely reported in the medical literature, and music interventions, as defined by listening to investigator-created or personal selections, have become popular for promoting anxiety reduction in persons during health care experiences. Thus, recent studies have promoted opportunities for patients to make their own music selections because of the individual nature of music. Nurse researchers have studied music interventions in all ages and in specialties such as intensive care, cancer care, maternity, pain management, dementia, palliative care, oncology, surgery, and procedural areas.<sup>7</sup> No studies to date have addressed music for patients undergoing vascular angiography, specifically. This area is important to investigate because of its invasiveness and the possibilities of poor diagnosis with the associated loss of limbs or life. Although the threats are similar to cardiac catheterization, the procedures are different. The procedure-related music studies have not been transferred between or generalized to other procedures. The purpose of this study was to test whether self-selected music could reduce pre-procedure anxiety in the interventional radiology waiting area wherein the comparison is the current standard of care.

## THEORETIC APPROACH

The current study is based on Spielberger's construct of anxiety and the assumption that state anxiety can be reduced

High State Anxiety associated with procedure + Self-Selected Music = Lower State Anxiety
High State Anxiety associated with procedure + No Music = High State Anxiety (same as or increased from pre-procedure)

Figure 1. Theoretic framework guiding music intervention.<sup>10</sup>

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through a music intervention (Fig. 1). Anxiety, as defined by Spielberger, is an emotional state consisting of feelings of tension, apprehension, nervousness, and worry, with activation or arousal of the autonomic nervous system. Spielberger differentiates between two related components of anxiety: state anxiety and trait anxiety. State anxiety is a transitory emotional state reflective of one's interpretation of a particular stressful situation. Trait anxiety is the relatively stable individual differences in anxiety proneness that are manifested in behavior and in the frequency with which an individual experiences elevations of state anxiety over time. Trait anxiety, the enduring personality trait, can be equated to one's propensity to experience elevations in state anxiety.<sup>8,9</sup> By using Spielberger's definitions, nurses can intervene to reduce state anxiety before a diagnostic angiography procedure.

## LITERATURE REVIEW

The research literature includes studies about anxiety reduction through relaxation methods, some of which included music. Three studies examined anxiety reduction in cardiac catheterization. Anderson and Masur<sup>4</sup> used audiovisual methods of education specific for cardiac catheterization, cognitive-behavioral skills training, coping and relaxation skills training, combinations of education and training, and a neutral video as a placebo (N = 60). They found that subjects who received active treatment interventions demonstrated lower levels of physiologic arousal during the catheterization and reported less anxiety after the test than the control subjects. Similarly, Warner et al.<sup>5</sup> found that a relaxation technique in patients undergoing elective cardiac catheterization reduced their State Anxiety Inventory scores and amount of diazepam given during the procedure (N = 40). More recently, Hamel<sup>11</sup> found significant post-music reductions in State Anxiety Inventory scores after patients awaiting cardiac catheterizations listened to "Trance-Zendance" for 20 minutes (N = 51).

Mandle et al.<sup>12</sup> used a relaxation tape (N = 15), a contemporary instrumental music tape (N = 14), and a blank tape (N = 16) to measure relaxation response in patients with peripheral vascular disease who were undergoing femoral angiography. The subjects who listened to the relaxation tape had a statistically significant reduction in self-reported and observed anxiety and pain, and a marked reduction in use of pain-relieving and anti-anxiety medications.<sup>12</sup> To date, this is the only study of music as a relaxation intervention in a femoral angiography procedure; the sample size was small (N = 14), and the music was not self-selected. Music has been an understudied intervention specifically in patients undergoing vascular angiography. Patients undergoing femoral angiography and cardiac catheterization are known to experience anxiety; however, evidence has not been established to warrant the transfer of music intervention between them.

Two systematic reviews guide the use of music in practice and research to determine effectiveness. Evans<sup>7</sup> reviewed 19 small randomized trials published between 1990 and 1999 and found that patients in the hospital group have greater anxiety reduction than patients in the procedure group and that music does not impact patients' heart rate or systolic blood pressure. In fact, when two studies were combined to provide sufficient

numbers for analyses (N = 102), music did not reduce anxiety for persons undergoing invasive procedures. No one type of music was recommended because most studies offered opportunities to select from a menu. No vascular angiography studies were included in the procedure study review.

A systematic review of 12 randomized trials published between 1985 and 2004 focusing on music during waiting periods for surgery or invasive procedures reports anxiety reduction in 11 of the 12 studies.<sup>13</sup> Sample sizes ranged between 9 and 198. Inclusion of most recent studies and the nondifferentiation between patients in the hospital and procedure groups led to conclusions that differed from the prior review. Ten studies used Spielberger's State Trait Anxiety Inventory (STAI), four studies used both state and trait forms, and 11 studies measured physiologic data such as heart rate, systolic and diastolic blood pressure, and respiration rate. Ten studies reported reductions in state anxiety, one study reported no difference at baseline in trait anxiety, and 10 studies showed reductions in systolic blood pressure or respiration rate or pulse rate. Recommendations included the need for rigorous methods of continuing research and knowledge development about music during waiting times for procedures. Such methods include larger sample sizes, descriptions of sampling methods, reports of dropouts, and recruitment of culturally diverse groups. Although both reviews demonstrate that anxiety is defined and measured using both psychologic and physiologic indices, none of the studies in either review mentioned music before or during vascular angiography procedures. Clearly, both reviews demonstrate that anxiety is defined and measured using both psychologic and physiologic indices.

In sum, a gap in music studies in vascular angiography includes self-selected music for pre-procedure anxiety reduction with a large homogeneous sample size. On the basis of our methods used in the gastrointestinal (GI) procedure area with 198 patients who listened to music that included veterans' preferred music categories and selections, we conducted a pre-procedure anxiety reduction study of self-selected music intervention in vascular angiography.<sup>10</sup>

## STUDY AIMS

The study aim was to evaluate whether music reduced patients' anxiety before their vascular angiography procedures. The research question was, "Will listening to music for 15 minutes before vascular angiography reduce patients' anxiety?"

On the basis of past research suggesting physiologic changes are impacted from music, secondary analyses were computed to test the following: Will listening to music for 15 minutes before vascular angiography decrease patients' blood pressure, pulse rate, or respiration rates?

## METHODS

### *Design*

This study used a quasi-experimental design with randomization to experimental and control groups. Patients were assigned using a table of random numbers to either the music or control group. The patients and staff were not blinded to assignment.

## Sample and setting

The study was conducted in the Interventional Radiology Department at an urban, West coast, university-affiliated Veterans Affairs Medical Center. The institutional review board approved the study, and all participants signed informed consents.

Patients were included if they were undergoing vascular angiography of the abdomen or lower extremities, 18 years of age or older, English-speaking and able to read at the fifth-grade level, able to sign the consent, and interested in participating. They were excluded if they had documented diagnoses of active psychosis or dementia, unable to consent to the study, or could not listen to music for a 15-minute period before their procedure.

## Sample size

Our sample size of 170 patients was based on the feasibility of retaining at least 85 persons in each group. According to past literature, Mandle and colleagues<sup>12</sup> reported a mean difference of 5.2 in state anxiety scores (with a large amount of variability, standard deviation [SD] 14.8) after 14 patients listened to investigator-selected music during femoral angiography. On the basis of Mandle et al.'s finding with large variability, we approximated the effect size at 0.55. With the use of a one-sided *t* test, the sample size needed for power set at 0.80 with alpha (one-sided) set at 0.05 and beta set at 0.10 is 81 per group.<sup>14</sup> We planned to recruit up to 200 participants per group to ensure the likelihood of having at least 81 persons in each group.

## Procedures

The Interventional Radiology Charge Nurse and Co-investigator (C.S.) screened patients from the vascular radiology list in an effort to identify potential candidates. The research team then approached them the day of their procedure to explain the study and offer an opportunity to sign the consent. This was an efficient way to recruit eligible patients because most patients were either unscheduled or arrived the day of their procedures.

Patients who consented to participate were then given a number that had been preassigned by a table of random numbers to either group. Patients became aware of their assigned group after they signed the consent. They were then given a demographics questionnaire and the STAI forms. They were instructed to take the state and then the trait tests before the 15 minutes of the study. Those assigned to receive music were offered a choice of the selections after the forms were completed.

Music selections had been purchased based on a prior study in the GI Department investigating patients' preferences for the types of music and the specific pieces in those categories. Five categories included classical, jazz, rock, country western, and easy listening; all were timed to play for 15 minutes. Patients listened to their selections using a standard "boom box"-style CD player without earphones. We provided approximately five selections per category.

Radiology nursing staff distributed and collected all of the forms, accompanied the patients to their procedures, offered the music selections, timed the listening period, and took vital signs. On completion of all study procedures, patients were taken immediately into the procedure room. There were no delays between the intervention and the procedure.

## Experimental group

The experimental group participants selected their music and were taken to the procedure area to listen to the music for 15 minutes. Before and immediately after they listened to the music, their blood pressure, heart rate, and respiration rate were taken. They were also given the State Anxiety Inventory and the Music Enjoyment Scale after the 15 minutes. They were given the option to continue listening to music for the duration of their procedure.

## Control group

The control group received standard care, which included 15 minutes of quietly waiting in the procedure area. Before and immediately after the 15 minutes, the subjects' blood pressure, heart rate, and respiration rate were taken. They were also given the State Anxiety Inventory after the 15 minutes. They were given the option to listen to music for the duration of their procedure.

## Instruments

The STAI is a 40-item questionnaire, with 20 items each for state and trait.<sup>15</sup> With higher scores indicating more trait and state anxiety, trait anxiety questions ask about frequency of the negative feeling (e.g., 1 to 4 with 1 indicating "never" and 4 indicating "almost always"). State anxiety questions ask about intensity of the negative feeling (e.g., 1 to 4 with 1 indicating "not at all" and 4 indicating "very much so"). This tool has been used extensively in music studies,<sup>7,13</sup> and the published psychometrics include Cronbach's alpha of 0.92 for the state test and 0.90 for the trait test; test-retest correlations of 0.84 and 0.86 have been reported. State anxiety is situational, whereas trait anxiety is personality-related. Together the tests took approximately 5 minutes to complete.

The Music Enjoyment Scale is a two-item "yes-no" investigator-created questionnaire that asks the patient whether he or she enjoyed the music and whether it enhanced relaxation. It was used in the GI study and took less than 1 minute to complete.

Vital signs and demographics were collected. Demographics included the patients' age and gender, whether they listened to music and, if so, where, how they usually relaxed, and whether they took medications for relaxation. This form was investigator created and took approximately 7 minutes to complete.

The study was designed to be conducted in a clinical area with great effort to avoid interfering with the usual practices and protocols for interventional radiologic procedures. All of the patients were sedated for their procedures after they completed the second State Anxiety Inventory and the Music Enjoyment Scale (if assigned to the experimental group) and had their vital signs taken. The length of time for listening to music is to keep with the usual practices of the waiting time. Also, the literature has not established a "best practice" for the amount of time required to achieve maximum benefit. Both groups were told they would be able to listen to music after the study ended and for the duration of their procedures.

**TABLE I****MEAN BASELINE VALUES FOR GROUPS [MEANS (STANDARD DEVIATION)]**

<i>Demographic</i>	<i>Music n = 89</i>	<i>No music n = 81</i>	<i>Significance (df 1, 168)</i>
Age	67.01 (10.29)	66.65 (9.61)	t = 0.23, P = .816
Systolic BP	142.53 (26.52)	137.81 (22.02)	t = 1.25, P = .211
Diastolic BP	76.71 (14.17)	75.30 (9.94)	t = 0.74, P = .458
Pulse	67.04 (11.11)	69.01 (12.49)	t = 1.08, P = .279
Respiration rate	16.77 (4.49)	16.29 (4.11)	t = 0.72, P = .471
State anxiety	38.57 (10.46)	36.23 (10.54)	t = 1.45, P = .149
Trait anxiety	37.03 (9.56)	35.34 (8.50)	t = 1.21, P = .227

BP, Blood pressure.

**Data analysis**

Descriptive statistics were used to describe the sample and for scoring STAI forms and the Music Enjoyment Scale. To determine whether there were baseline differences between the intervention and control groups, independent sample *t* tests were computed on age; baseline state and trait anxiety scores; interest in music; and blood pressure, pulse rate, and respiration rate. There were no significant baseline differences between groups. A *t* test was computed to address the primary hypothesis that music is associated with a reduction in anxiety. The dependent variable for the *t* test was the subjects' difference scores, which were computed by subtracting the subjects' second anxiety score from the subjects' first anxiety score. Secondary analyses were conducted to determine whether physiologic measures were affected by the intervention; *t* tests were computed for difference scores computed for systolic and diastolic blood pressure, pulse rate, and respiration rate.

**RESULTS**

A total of 190 persons were recruited, 20 refused, and 170 persons completed the study. The control group comprised 81 persons, and the experimental or music group comprised 89 persons. The average age was 66.8 years (SD 9.95, range 37-85 years). There were 166 men and 4 women. Baseline values are included in Table I.

Ninety-eight percent of participants stated they listen to music regularly, with 48% listening at home and 25% listening in more than one location (e.g., car, work, other). Although many listed their hobbies for relaxation (e.g., fishing, woodworking, gardening, napping, painting), 18% described listening to music, 13% described reading, and 38% described watching television for relaxation. Seventeen percent described using narcotics regularly, and 10% described using sedatives or tranquilizers regularly.

According to the Spielberger's STAI for ages between 50 and 69 years, the state anxiety scale mean score ranges between 32.2 (SD 8.6) and 34.5 (SD 10.3); trait anxiety scale mean score ranges between 31.7 (SD 7.7) and 33.86 (SD 8.8).<sup>16</sup> Participants in the current study were somewhat more anxious than these

norms with a state anxiety scale mean of 37.4 (SD 10.5) and a trait anxiety scale mean score of 36.2 (SD 9.1).

The randomization procedure revealed that groups were well matched. There were no significant differences between the groups on any demographic or physiologic variables. Although the group who did not listen to music had a mean anxiety score that was lower than that for the music group, the difference was not statistically significant. Likewise, the groups were not significantly different for trait or state anxiety, so it was unnecessary to include trait anxiety as a covariate in the multivariate models. Three women and 86 men were assigned to music. Table I presents the baseline state and trait anxiety scores.

The findings from analyses of the research questions are shown in Tables II and III. The significance reported refers to differences between the intervention and control groups in their difference scores. Those persons who listened to music decreased their mean anxiety score from 38.57 (SD 10.46) to 35.2 (SD 9.7), whereas those who did not listen to music decreased their mean anxiety score from 36.23 (SD 10.54) to 35.1 (SD 10.59); the difference in anxiety reduction between the groups was statistically significant (*t* = 1.95, *df* 161, *P* = .05). Blood pressure and respirations did not decrease significantly in those who listened to music. However, those who listened to music decreased their mean pulse rate from 67 beats/min (SD 11.1) to 65 beats/min (SD 10.5), whereas those who did not listen to music decreased their mean pulse rate from 69 beats/min (SD 12.5) to 68.9 beats/min (SD 10.5); the difference in pulse reduction between the groups was a significant decrease (*t* = 2.45, *df* 167, *P* = .02).

All of the participants who listened to music in the experimental group stated they enjoyed it, and 98% stated they felt relaxed afterward.

**DISCUSSION**

This is the first study to test a music intervention for anxiety reduction in patients undergoing vascular angiography. This investigation contributes new knowledge to the literature with significant findings in a large sample in a newly explored setting.

TABLE II

## WILL LISTENING TO MUSIC FOR 15 MINUTES BEFORE VASCULAR ANGIOGRAPHY REDUCE PATIENTS' STATE ANXIETY? [MEAN (STANDARD DEVIATION)]

<i>Group</i>	<i>Baseline</i>	<i>Post-intervention</i>	<i>Difference between pre- and post-music or no music</i>	<i>Significance</i>
Music	38.57 (SD 10.46)	35.2 (SD 9.7)	3.37	$t = 1.95, df 161, P = .05$
No music	36.23 (SD 10.54)	35.1 (SD 10.59)	1.13	

SD, standard deviation.

TABLE III

## PHYSIOLOGIC VARIABLES [MEAN (STANDARD DEVIATION)]

<i>Group</i>	<i>Baseline systolic</i>	<i>Post-intervention systolic</i>	<i>Difference between pre- and post-music or no music</i>	<i>Significance of difference between groups (df 167)</i>
Music	142.53 (26.52)	143.9 (SD 26.15)	1.9	$t = 0.92, P = .36$
No music	137.81 (22.02)	136.9 (SD 20.97)	-0.1	
	Baseline diastolic	Post-intervention diastolic		
Music	76.71 (14.17)	75.16 (SD 13.13)	-1.55	$t = 0.88, P = .38$
No music	75.30 (9.94)	75.14 (SD 11.02)	-0.16	
	Pulse	Pulse		
Music	67.04 (SD 11.11)	65.24 (SD 10.54)	-1.8	$t = 2.45, P = .02$
No music	69.01 (SD 12.49)	68.9 (SD 10.54)	-0.11	
	Respirations	Respirations		
Music	16.77 (SD 4.49)	15.66 (SD 4.14)	-1.11	$t = 0.23, P = .82$
No music	16.29 (SD 4.11)	15.30 (SD 3.25)	-0.99	

SD, Standard deviation.

Anxiety reduction with a music intervention was well established in research conducted between 1994 and 2004. In a recent review of 12 studies using music interventions, 10 used the STAI to measure anxiety and 9 reported a significant decrease after listening to music in procedural waiting settings.<sup>13</sup> One study in patients awaiting cardiac catheterization (a procedure that comes closest to vascular angiography) included 101 participants who listened to Halpern's "Trance-Zen dance" for 20 minutes and decreased their anxiety significantly compared with the control group who received usual care.<sup>11</sup>

We found that listening to music made no statistically significant impact on systolic or diastolic blood pressure or respiratory rate, but did significantly impact heart rate. These findings are similar to the results in Cooke and colleagues'<sup>13</sup> review of 5 of the 12 studies in waiting areas. Specifically, statistically significant decreases were evident in blood pressure in two studies, pulse rate in one study, and respiratory rate in two

studies. Contrary to our findings, Hamel's<sup>11</sup> study in patients undergoing cardiac catheterization showed statistically significant increases in blood pressure and pulse rate in the control group.

## LIMITATIONS

Study limitations included length of time for music intervention and participant gender. In a rapidly paced clinical environment, a 15-minute intervention was the most practical and effectively reduced anxiety in our prior study in the GI Department. Other studies report music interventions between 15 and 40 minutes with varying degrees of effect on anxiety.<sup>13</sup> Although listening to music more than 15 minutes may have reduced anxiety further, the delay in the procedure may have provoked more anxiety in these patients undergoing vascular angiography procedures. A strength of the study design is that there was no

waiting period between the intervention end and the procedure onset. Patients in the GI study were slightly less anxious at baseline (36.4 SD 8.6) than the patients in the vascular angiography interventional radiology study (37.45 SD 10.53).<sup>10</sup> Because this study was conducted at a VA hospital, most of the participants were men. As with the GI study, findings cannot be generalized to women.

This study used a quasi-experimental design with random assignment. Because of the nature of music, blinding is not possible. There is always the chance that staff or patient participants could instill their hopes for the effectiveness of music to reduce anxiety or feel disappointed if music was not assigned. To counter this bias, all patients were offered music for the duration of their procedure, after the study intervention period ended.

## IMPLICATIONS FOR PRACTICE AND RESEARCH

Findings from this study add to the body of literature that music reduces anxiety and heart rate before invasive procedures. Our study supported the proposed model using Spielberger's theory that an increased state anxiety can be decreased with self-selected music. This finding fits with the theory that state anxiety can be modified and is transient, related to the situation. The group who did not listen to music had insignificantly lower anxiety scores than the music group at baseline. Of note is that those in the group without music had slightly lower blood pressure, faster pulse rate, and equal respiration rates, although none of these differences reached statistical significance. Because we did not control for medication use, either group could have had the effect of taking or not taking their antihypertensive medication the day of the procedure. Indeed, none of the patients demonstrated extreme anxiety in their scores or their physiologic measures. What is important is that music successfully decreased the anxiety score and pulse rate, indicating some measures of relaxation.

Music is noninvasive, inexpensive, and easy to implement, and most patients enjoy listening to music they select. Although clinical utility limits lengthy music intervention, more research is needed to determine the "dose" of music that makes a difference in anxiety. From our two studies in GI and vascular angiography, 15 minutes was sufficient to make a significant difference in anxiety. Although other studies used varying amounts of time (15-40 minutes) with mixed results, no exact optimal dose of time has been established. Further research might address the best practice for the amount of time needed to relax patients undergoing vascular angiography and other procedures. On the basis of findings from this study, 15 minutes of music listening may be sufficient to stimulate relaxation before vascular angiography procedures in other settings.

The costs of this music intervention method included approximately \$100 for the CD player and approximately \$600 for 35 CDs. Multiple CDs in each music category provide patients with the opportunity to select at least one favorite CD. A less-expensive alternative and one that has not been studied is having patients use their own music before and during procedures to optimize relaxation. In sum, this study demonstrated that music is an ideal

intervention that nurses can easily provide to improve patients' comfort while awaiting vascular angiography procedures.

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