Cognitive-Behavioral Interventions
for IV Insertion Pain

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Patients preparing for surgery or other invasive procedures usually undergo insertion of a peripheral IV catheter. Insertion of an IV is painful; in studies of patients and research volunteers, mean pain scores on scales with endpoints of 0 (eg, "no pain") and 100 (eg, "worst pain imaginable") ranged from 14 to 70.5 in untreated groups.[1,2]

Pain management is an essential component of perioperative nursing practice and is linked to outcomes such as length of hospital stay and patient satisfaction.[3] Nonpharmacologic techniques for reducing pain and improving patient outcomes are gaining increased attention in perioperative nursing.[4,5] Nonpharmacologic interventions are suitable for procedures such as IV insertion that cause acute, transitory pain.[6-8] Cognitive-behavioral interventions (CBIs), which are nonpharmacologic interventions, are suitable for high-volume procedures because they are safe, inexpensive, easy to implement,[6,9] and can be performed independently by a nurse.[1]

Providing patients with a variety of CBIs to choose from as well as including an option for no intervention may increase the effectiveness of the intervention by increasing a patient's sense of control and by allowing him or her to choose a method that is consistent with his or her preferences.[10] Although studies of the effectiveness of CBIs in the perioperative period have been reported,[5,11] more research is needed on their effect on the pain of brief, invasive procedures such as IV insertion. This study was conducted to determine if using CBIs reduces pain during IV insertion and if participants who are allowed to choose from a variety of CBIs report less pain than those who are randomly assigned an intervention. Knowledge gained from this study will contribute to the body of nursing knowledge on the effects of CBIs on brief procedural pain.

Theoretical Framework and Literature Review

The theoretical framework for this study was based on the gate control theory. Variables related to CBIs and IV insertion pain were considered in relation to this theory.

Gate control theory. First proposed in 1965,[12] the gate control theory has undergone extensive empirical testing and remains the most commonly used theory to explain the pain experience.[13,14] According to the gate control theory, the pain experience is a result of tissue injury causing activation of nociceptors (ie, bushy networks of afferent nerve

ABSTRACT

- **INSERTION OF AN IV CATHETER is a commonly performed and painful procedure. The use of cognitive-behavioral interventions (CBIs) may decrease pain by diverting the patient's attention to stimuli other than pain.**
- **THIS RANDOMIZED, CONTROLLED TRIAL examined the effect of three CBIs—music, kaleidoscope, and guided imagery—on IV insertion pain in 324 patients.**
- **NO STATISTICALLY SIGNIFICANT differences in IV insertion pain were found among the treatment and control groups or between choosing versus being assigned a CBI. Insertion attempts were more difficult in women, and insertion difficulty was correlated with pain intensity and pain distress. Pain intensity was related to insertion site and catheter gauge. *AORN J* 84 (December 2006) 1031-1048. © AORN, Inc, 2006.**

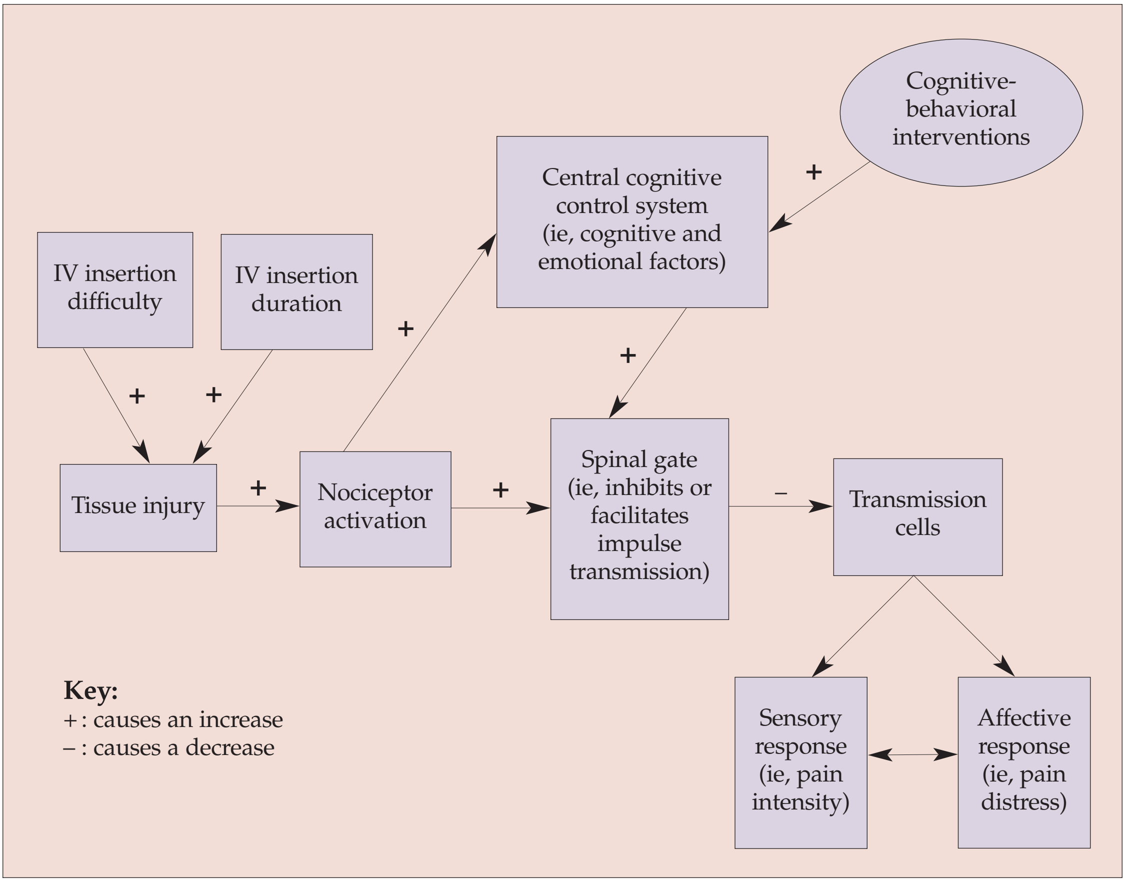

Figure 1 • Theoretical framework of the gate control theory and cognitive-behavioral interventions for IV insertion pain.

fibers in the skin). The impulse is relayed to the substantia gelatinosa, a group of interneurons in the dorsal horn of the spinal cord. These specialized cells function as a "gate," either inhibiting or facilitating transmission of the nerve impulse to the brain. The gating mechanism also is responsive to descending impulses from cognitive control centers in the brain.[15] The interneurons synapse with transmission cells originating in the spinal cord that transmit the pain impulse to the brain, where pain perception occurs (Figure 1).

Pain perception consists of sensory and affective dimensions. The sensory component accounts for the physical sensations of type (eg, burning, aching) and intensity of pain. The affective dimension encompasses reactions of emotional distress.[16] These components, though interrelated, can be separately perceived and reported.[17]

According to the gate control theory, cognitive and emotional factors exert a direct effect on the spinal gating mechanism, modulating the sensory input. Thus, certain states, such as anxiety or anticipation, may increase pain by facilitating impulse transmission in the spinal gate, and other states, such as distraction, may decrease pain by blocking it.[14]

CBIs. Cognitive-behavioral interventions reduce pain by activating cognitive controls that influence emotions and beliefs about pain and by providing a stimulus that competes for attention with the painful stimulus, thereby reducing pain perception.[10,18] Cognitive-behavioral interventions also may enhance a person's sense of control, which lessens the response to the painful stimulus.[19] For maximum clinical utility, CBIs should be brief and effective[20] as well as highly structured and easy to perform.[8,19] The CBIs used in this study include listening to music, viewing a kaleidoscope, and performing guided imagery.

Snyder and Chlan[21] reviewed more than 100 studies of the effects of music and concluded that it was effective in producing positive outcomes, including pain reduction. Listening to music may reduce pain perception via distraction by diverting attention to stimuli other than pain.[1,10] Allowing patients to choose from a variety of music selections may enhance its effectiveness by ensuring that the music is acceptable to the listener.[21]

Viewing a kaleidoscope during a painful procedure is a sensory intervention that provides a visual stimulus to compete with the painful stimulus, thus functioning as a distraction.[6] Cason and Grissom[6] examined the effect of kaleidoscope viewing on pain in a controlled, randomized study of 96 patients undergoing phlebotomy. Patients who viewed a kaleidoscope during phlebotomy reported significantly less pain on the FACES and Present Pain Intensity (ie, PPI) scales than those who received usual care. In addition, technicians performing phlebotomies noted that participants using the kaleidoscope seemed more relaxed and that their phlebotomies were easier to perform. Cason and Grissom suggested that the kaleidoscope intervention may have sufficient attentional demand to reduce the pain of other short-duration, invasive procedures, including IV insertion. No published studies using this intervention for IV insertion pain were located, however.

Providing patients with choices about aspects of their care enhances their feelings of control and thus may reduce the pain of invasive procedures such as IV insertion.

Guided imagery involves generation of self- or practitioner-guided, positive, sensory (eg, taste, vision, smell) and affective (eg, calm, happy) mental images. The goal is usually to evoke a state of psychological and physiologic relaxation to promote healing changes throughout the body.[22-26] Like the actual sensory experience of listening to music or viewing the kaleidoscope, attention to the imagined experience can serve as a distraction from the painful stimulus, thereby lessening the pain response.[27] Besides being standardized for purposes of comparison in research, audiotape-led guided imagery is less labor-intensive, more flexible, and less costly than live instruction.[28] Few studies have been reported that assess the effectiveness of guided imagery in pain management and most of those have methodological flaws such as lack of a control group.[29] These studies as well as case reports suggest a need for further investigation of guided imagery as an intervention for reducing acute pain.[23]

PATIENT'S CHOICE OF INTERVENTION. Surgery patients experience or anticipate feelings of loss of control, which can increase pain. Providing patients with choices about aspects of their care enhances their feelings of control and thus may reduce the pain of invasive procedures such as IV insertion.[30,31] Jacobson[1] speculated that the beneficial effects of music on IV insertion pain may have been due in part to participants' ability to make choices about the type and volume of music to which they listened. DePalma and Weiss[30] reviewed several research reports on the effects of control on pain that support this notion. Weisenberg[31] suggested that providing people with a choice of strategies for coping with pain is more important than the type of strategy.

Cognitive-behavioral interventions employing different senses (eg, sight, smell, sound) have been developed. Matching patient preference to type of CBI by allowing the patient to choose from a "menu" of different interventions may enhance treatment outcomes by generating a sense of control[10] and increasing motivation for the intervention to be successful.[32] Thus, having patients choose from among a variety of

CBIs may produce better pain relief than assigning a specific intervention.

IV INSERTION PAIN. Most studies of IV insertion pain have focused on the effectiveness of pharmacologic agents, such as intradermal lidocaine[33] or topical eutectic mixture of local anesthetics (EMLA).[34] Although pharmacologic agents are effective at reducing IV insertion pain, several factors limit their usefulness. They incur increased cost with each application, often cannot be used independently by a nurse,[1] and have been associated with vasoconstriction and blanching as well as increased insertion difficulty.[35-37] A minimum of one hour is required for EMLA to be effective.[38] Intradermal agents such as lidocaine require an injection before the IV insertion, which can itself be painful,[33,39] and the resulting bleb can obscure the vein, impeding successful cannulation.[35]

Patients and practitioners may prefer not to use pharmacologic interventions for IV insertion pain; in one study, only 12% of 509 patients who underwent IV insertions reported that they would prefer local anesthesia for future insertions.[40] Studies have shown that nurses and physicians use local anesthesia for IV insertion less than half the time.[41,42]

Only one study has been reported that examined the effect of a CBI (ie, self-selected music) on IV insertion pain.[1] Patients undergoing IV insertion (N = 110) were randomly assigned to receive an intradermal injection of unpreserved normal saline solution, listen to self-selected music via headphones on a compact disc (CD) player, or undergo IV insertion by the usual method with no pretreatment. There were no statistically significant differences in pain intensity and pain distress by treatment group; however, IV insertion difficulty was significantly positively correlated with higher pain intensity and distress in all but the music group, suggesting that music blocked the effect of IV insertion difficulty on pain.

IV-RELATED VARIABLES AND INSERTION PAIN. Application of the gate control theory suggests that variables related to the IV catheter and its insertion may influence insertion pain. Difficult IV insertions may be associated with increased tissue injury resulting from extensive and repetitive probing. Increased tissue injury would increase activation of nociceptors. In a study of the effect of listening to music versus intradermal saline injection on pain of IV insertion in 110 adult patients, insertion difficulty scores were significantly positively correlated with pain intensity scores in the intradermal saline group ($r = 0.36$) and usual care group ($r = 0.42$) and with pain distress scores in the saline group ($r = 0.62$).[1]

Variables related to IV insertion, such as insertion difficulty and duration, may influence insertion pain.

The duration of an IV insertion may contribute to pain through prolonged nociceptor activation. The relationship between duration of IV insertion and pain has not been reported in studies published to date.

PURPOSE

The purpose of this study was to determine if simple, low-cost CBIs reduce the pain of peripheral IV insertion, and if the participant's choosing from a variety of different interventions would reduce pain more than receiving a randomly assigned intervention. A secondary goal of the project was to determine the acceptability of the CBIs to the participants. The interventions tested were listening to self-selected music, viewing a kaleidoscope, and performing guided imagery. The difficulty and duration of an IV insertion may increase its painfulness, so data on these

Does the patient's ability to choose among cognitive-behavioral interventions affect his or her rating of the acceptability of the intervention?

variables were collected to control for their potentially confounding effects on the interventions.

HYPOTHESES. The following hypotheses were proposed.

- Patients who are randomly assigned to use one of the three CBIs—listening to self-selected music, viewing a kaleidoscope, or performing guided imagery—during peripheral IV insertion will experience less pain intensity and distress than patients who receive usual care (ie, no extra treatment) for IV insertion.
- Patients who choose a CBI (ie, self-selected music, kaleidoscope, guided imagery) or usual care for IV insertion will have less pain intensity and distress than those who are assigned to receive the CBI or usual care without choice.

RESEARCH QUESTIONS. The following research questions were asked.

- In patients receiving a CBI, do gender and the ability to choose among interventions affect the patient's rating of the acceptability of the intervention?
- Do gender and age influence choice of the type of CBI?

METHOD

The researcher used a posttest-only experimental design. The research assistants recruited patient participants from two same-day surgery units and one endoscopy unit in two urban hospitals in the same Midwestern city. The institutional review boards of both hospitals and of the principal investigator's university approved the study proposal.

SAMPLE. A power analysis was conducted using SPSS's SamplePower.[43] Effects were specified as 0.2 for treatment type and choice main effects. Alpha for a two-tailed test was set at 0.05. For these parameters, a sample size of 320 resulted in a power of 0.94 for treatment and a power of 0.85 for choice.

Nurses starting IVs for the study were enrolled as research participants because their insertions were timed and they were asked to provide data about the IV insertion difficulty. The principal investigator and research assistants recruited 41 nurse participants during visits to the hospital units. Inclusion criteria for the nurse sample were being an RN or licensed practical nurse whose usual practice included inserting peripheral IVs and who had at least six months experience with inserting IVs.

Patients admitted to one of the nursing units were invited to participate if they

- were 18 years of age or older;
- spoke English;
- had medical orders for peripheral IV therapy;
- had no previous IV insertion attempt this admission; and
- had no obvious or reported sensory, cognitive, or motor impairment that would limit participation in the interventions or the ability to complete the pain assessment instruments.

Those agreeing to participate signed consent forms.

PROTOCOLS FOR CBIs. A board-certified music therapist with a doctoral degree in music education and a guided imagery specialist with a bachelor's degree in health education and a master's degree in education who was board certified in clinical hypnotherapy participated in developing and refining the CBIs (ie, music, kaleidoscope, guided imagery). Two RN research assistants were trained by the principal investigator and consultants to deliver the interventions and collect the data in a standardized manner according to written protocols. The consultants and the principal investigator supervised a "dress rehearsal"[44] of the protocols and data collection, with graduate nursing students simulating IV insertions on nursing students acting as patients. In a debriefing after the dress rehearsal, the consultants, principal investigator, and research assistants

TABLE 1
Music Categories and Example Compact Discs (CDs) in Self-Selected Music Intervention

Music category	Example CD
Classical	Various artists, *Bubble Bath Classics* (Westmount, Quebec: Direct Source Special Products, 2001)
Country	Faith Hill, *Breathe* (New York: Warner Brothers Records, 1999)
Easy listening	Natalie Cole, *Stardust* (New York: Elektra/Wea, 1996)
Folk/R & B	John Denver, *The Best of John Denver* (New York: EMI-Capitol Music, 1998)
Gospel/religious	Mahalia Jackson, *16 Most Requested Songs* (New York: Sony, 1996)
Jazz/big band	Sarah Vaughn, *Soft and Sassy* (Burbank, Calif: Hindsight Records, 1994)
New age	Yanni, *In the Mirror* (New York: Private Music, 1997)
Opera/Broadway	Pavarotti, *Pavarotti & Friends* (New York: Decca, 1992)
Pop/rock/classic rock	Beatles, *One* (London: Toshiba EMI, 2002)

reviewed the procedures and made final revisions. The principal investigator supervised the first two days of data collection for both research assistants and visited the data collection sites periodically thereafter to ensure adherence to intervention and data collection protocols.

The self-selected music intervention consisted of listening to a CD on a portable CD player with headphones. Participants chose a CD from a list that grouped 34 CDs according to nine categories of music representing the cultural and age ranges of the population (Table 1). The research assistants instructed participants in the technique of using music for distraction[8] by staring at a spot or closing their eyes and imagining a scene compatible with the music (eg, dancing); tapping out the rhythm; and controlling the volume of the music.

For the kaleidoscope intervention, participants looked through the eyepiece of an illusion kaleidoscope. The illusion kaleidoscope is lightweight, is easily held in one hand, and produces changing patterns without the viewer having to rotate the tube.[6]

The guided imagery intervention consisted of listening to a nine-minute CD recording of a script read by the guided imagery consultant with soft and soothing music in the background. The consultant developed the script and chose the background music for this study with the goal of producing relaxation and reducing painful sensations in the arms of the listener.

Participants assigned to the choice group were given a brief explanation of each of the three interventions. They then chose an intervention based on their preference. They also could choose to receive usual care for IV insertion with no added intervention.

DATA COLLECTION INSTRUMENTS. Nurse participants provided data including name, work unit, age, gender, years of nursing experience, and years experience in starting IVs. They also self-rated their skill at starting IVs on an 11-point numeric rating scale in which zero equaled “not skilled at all” and 10 indicated “as skilled as a nurse can be.” Patient participants’ demographic data consisted of age, gender, ethnic background, type and gauge of IV catheter, site of IV insertion, duration of insertion as timed with a stopwatch, and success of the IV insertion.

Participants indicated pain intensity

and pain distress of the IV insertion on each of two 11-point numeric rating scales. The numeric rating scale is a horizontal line marked in equal segments from zero to 10 with verbal anchors representing the extremes of the sensation printed on each end. For pain intensity, the zero and 10 anchors were "no intensity at all" and "most intense pain possible," respectively. For pain distress, the zero and 10 anchors were "no distress at all" and "most distressing pain possible," respectively. Numerous studies have demonstrated that patients can distinguish between these two components of pain and that various stimuli and interventions affect them differentially.[16,17] Numeric rating scales have been shown to be reliable and valid measures for pain intensity and pain distress.[45-47] Although the visual analog scale has been widely used to measure pain in research studies, numerous reports have identified difficulties with its use and suggest the numeric rating scale is superior for measurement of acute pain in clinical populations.[48-50]

Participants' acceptance of the intervention was assessed on a five-point numeric rating scale developed for this study that posed the question "How well did you like receiving the intervention?" The values for the scale ranged from zero (ie, "not at all") to four (ie, "extremely well").

The IV Insertion Difficulty Scale was completed by nurse participants to indicate the degree of difficulty of the IV insertion. The scale, adapted from the Intravenous Catheter Insertion Rating Scale,[1] consists of an 11-point numeric rating scale with the phrases "not at all difficult" and "as difficult as it could be" at the end points. Each IV insertion is a unique event, so measuring test-retest reliability of the IV Insertion Difficulty Scale would not be meaningful. Content validity of an earlier version of the IV Insertion Difficulty Scale was established by review of a panel of seven nurse experts.[1]

Data collection procedure. Participants were randomly assigned to a treatment group using a table of random numbers. Those assigned to the patient choice group were asked to select one of the three CBIs or usual care (ie, no extra treatment) for the study. Those in the investigator-assigned group received the randomly-assigned intervention or usual care without choice. Those in the usual care group had their IV inserted in the usual manner, with no extra treatment.

After the CBI began or no treatment was chosen, the nurse participants inserted the patients' IVs in their usual manner. The intervention continued until the IV was taped and the IV fluid was connected and infusing. The duration of the IV insertion was timed with a stopwatch, started immediately before the nurse began the insertion and stopped when the first piece of tape was placed to secure the catheter. Immediately after the IV was inserted and secured, participants ended the CBI and completed the Pain Intensity and Pain Distress Scales. Nurse participants completed the IV Insertion Difficulty Scale. If the first insertion attempt was unsuccessful, data were collected after the unsuccessful attempt and before additional attempts were made, and the case was included in the study.

Participants indicated pain intensity and pain distress of the IV insertion on 11-point numeric rating scales.

Data analysis. Data were analyzed using SPSS 14.0 statistical software.[51] Descriptive statistics were computed for all variables, including mean (M) and standard deviation (SD) for continuous variables and frequencies and percentages for categorical variables. Alpha was set at 0.05 for all inferential procedures. Variations in sample size are due to infrequent occurrences of missing data.

RESULTS

Forty-one nurses (ie, 40 female, one male) performed 324 IV insertions for the study. The nurses' ages ranged from 27 to 62 years (M = 45, SD 6.7). Their average years of experience was 22 (SD 7.3), and they started an average of 19 IVs weekly (SD 13.5). They self-rated their IV skill from four to 10 (ie, "as skilled as a nurse can be"), with a mean skill rating of 8.8 (SD 1.5).

Differences among treatment groups were statistically significant only for the variables of gender and IV gauge.

Of the 324 patient participants, 160 were in the endoscopy units and 164 were in the surgery units. Sixty-four percent (n = 206) were female. The patients ranged in age from 18 to 93 years, with a mean age of 55 years (SD 16.0). Eight-nine percent were white, 10% were black, and 1% was other or unknown.

The equivalence of patient participants' age, ethnicity, and gender and of IV gauge and site across treatment groups was tested by conducting analysis of variance (ANOVA) and chi-square analyses for continuous and nominal variables, respectively. Differences among treatment groups were not statistically significant for any of the listed variables except gender (X^2_7 = 20.151, P = .005) and IV gauge (X^2_{14} = 30.169, P = .007). The gender variable was entered as a fixed factor along with the independent variables of treatment type and choice in the analysis examining the effect of treatment on pain intensity and pain distress. Although IV gauge was statistically significant, including this variable created cells with unacceptably low cell counts for the analysis and thus it was not included. An independent test of IV gauge effects is presented in "Other findings."

The theoretical model for the study suggested that IV insertion difficulty and duration may be covariates of the dependent variables, so correlations of insertion difficulty and insertion duration with the dependent variables of pain intensity and pain distress were examined before the research hypotheses were tested. The correlation of insertion duration was low (r = 0.191 and 0.199, P < .001) compared to insertion difficulty (r = 0.289 and 0.296, P < .001), and duration and difficulty were moderately correlated with each other (r = 0.473, P < .001). Only insertion difficulty, therefore, was included as a covariate in a three-way multivariate analysis of covariance (MANCOVA).

HYPOTHESES. The first hypothesis predicted that patients who were randomly assigned to receive a CBI during peripheral IV insertion would have less pain intensity and distress than patients who received usual care (ie, no extra treatment) for IV insertion. The second hypothesis predicted that patients who chose a CBI or usual care for IV insertion would have less pain intensity and distress than those who are assigned interventions or usual care. The hypotheses were simultaneously tested with a three-way MANCOVA on the dependent variables of pain intensity and pain distress. The independent variables were treatment (ie, music, kaleidoscope, guided imagery, usual care); choice (ie, intervention chosen versus intervention assigned); and gender (ie, to assess for interactions with the independent variables). The covariate was insertion difficulty. Box's M Test indicated heterogeneity of variance-covariance ($F_{45,24440}$ = 1.95, P < .001) and cell sizes were unequal (n = 6 to 34), so Pillai's Trace was used as the statistical

TABLE 2

Multivariate Analyses of Variance for IV Insertion Pain Intensity and Distress

Source	Pillai's Trace	F test	(*df*)	*P*	Multivariate η^2
Treatment	0.033	1.70	(6, 612)	.120	0.016
Choice	0.004	0.55	(2, 305)	.579	0.004
Gender	0.013	2.07	(2, 305)	.128	0.013
Gender x choice	0.006	0.927	(2, 305)	.397	0.006
Gender x treatment	0.016	0.844	(6, 612)	.536	0.008
Choice x treatment	0.026	1.342	(6, 612)	.236	0.013
Gender x choice x treatment	0.024	1.228	(6, 612)	.290	0.012

test.[52] The covariate significantly influenced the combined dependent variable (Pillai's Trace = 0.103, $F_{2,305}$ = 17.46, P < .001, multivariate η^2 = 0.103). The effects of the independent variables of treatment, choice, and gender as well as interactions among the three independent variables on the combined dependent variable were not statistically significant (Table 2). Thus, neither hypothesis was supported. Mean pain intensity and pain distress scores within groups are presented in Table 3.

RESEARCH QUESTIONS. To answer the first research question regarding the influence of gender, choice, and treatment type on the acceptability of the intervention (ie, "How much did you like receiving the intervention?"), a three-way ANOVA was conducted on data from the participants who received one of the three CBIs (n = 249) (Table 4). Participants who received usual care were excluded from the analysis. Results showed significant main effects for gender ($F_{1,236}$ = 14.35, P < .001, partial η^2 = 0.057), with women having higher scores for acceptability and for type of intervention ($F_{2,236}$ = 7.88, P < .001, partial η^2 = 0.063). The Bonferroni adjustment revealed that music had higher acceptability than the kaleidoscope intervention, with no significant differences between guided imagery and music or guided imagery and kaleidoscope. There were no significant differences for choice ($F_{1,236}$ = 2.60, P = .108, partial η^2 = 0.011) or for interactions of the independent variables of choice by treatment type ($F_{2,236}$ = 1.73, P = .179, partial η^2 = 0.014); choice by gender ($F_{1,236}$ = 0.036, P = .850, partial η^2 < 0.001); treatment type by gender ($F_{2,236}$ = 2.69, P = .070, partial η^2 = 0.022); and choice by treatment type by gender ($F_{2,236}$ = 0.007, P = .993, partial η^2 < 0.001).

To answer the second research question regarding the influence of gender and age on choice of CBI, data from the participants in the group who were given a choice of intervention (n = 158) were analyzed. Chi-square analysis revealed a statistically significant difference of treatment choice by gender (χ^2 [3, n = 158] = 14.00, P = .003) (Table 5). Standardized residuals of the cell counts revealed that men chose usual care (ie, 36%, z = 2.3) significantly more frequently than women (ie, 13%, z = -1.9, P < .05). One-way ANOVA revealed no significant difference in mean age among the four treatment choices ($F_{3,152}$ = 2.32, P = .078, partial η^2 = 0.044) (Table 6).

OTHER FINDINGS. The effects of the treatment variables on the combined dependent variables of pain intensity and pain distress were not statistically significant, so data were pooled across treatment groups to examine other patterns among the variables. Specifically, variables with potentially confounding effects on the dependent variables that were not controlled in the study design (ie, nurse skill level, IV catheter gauge, IV insertion site) were analyzed. Gender effects on insertion difficulty and insertion success also were examined.

Pearson product-moment correlation was conducted to determine the

TABLE 3
Mean (M) and Standard Deviation (SD) of IV Insertion Pain Intensity and Pain Distress by Treatment Group, Gender, and Chosen Versus Assigned Cognitive-Behavioral Intervention (N = 324)

Treatment group	Chosen intervention (n = 158) Men (n = 64) M	SD	Women (n = 94) M	SD	Assigned intervention (n = 166) Men (n = 54) M	SD	Women (n = 112) M	SD
Pain intensity*								
Music	1.8	2.2	2.0	2.0	2.0	2.3	2.0	2.4
Kaleidoscope	2.7	2.0	2.8	2.2	2.0	2.5	2.5	2.7
Guided imagery	2.3	2.6	3.0	2.6	0.7	0.9	2.8	2.5
Usual care	1.0	1.3	1.7	1.6	1.3	1.6	3.1	2.8
Pain distress*								
Music	1.4	1.6	1.6	1.8	1.6	2.3	1.5	2.3
Kaleidoscope	3.0	2.8	2.0	2.2	2.1	3.0	2.4	2.8
Guided imagery	0.8	0.9	2.4	2.5	0.7	1.0	1.8	2.3
Usual care	1.1	2.2	1.0	1.4	1.4	1.9	3.0	2.7

** Pain intensity and pain distress are measured on 11-point numeric rating scales in which 0 = no intensity/ distress and 10 = most intense/distressing pain imaginable.*

TABLE 4
Mean (M) and Standard Deviation (SD) of Cognitive-Behavioral Intervention Acceptability* by Treatment Group, Gender, and Chosen Versus Assigned Cognitive-Behavioral Intervention (N = 248)

Treatment group	Chosen intervention (n = 122) Men (n = 41) M	SD	Women (n = 81) M	SD	Assigned intervention (n = 126) Men (n = 41) M	SD	Women (n = 85) M	SD
Music	3.4	0.78	3.6	0.6	3.5	0.62	3.6	0.76
Kaleidoscope	3.0	0.63	3.6	0.81	2.6	0.94	3.1	1.0
Guided imagery	2.8	1.1	3.5	0.74	2.7	1.2	3.3	0.7
Total	**3.2**	**0.87**	**3.5**	**0.7**	**3.0**	**0.97**	**3.3**	**0.84**

** Acceptability of the intervention was assessed on a five-point numeric rating scale that posed the question "How well did you like receiving the intervention?" with values ranging from 0 (ie, "not at all") to 4 (ie, "extremely well").*

relationship between nurses' self-rated skill at IV insertion and insertion difficulty (r = -.088, P = .117), pain intensity (r = 0.065, P = .242), and pain distress (r = 0.078, P = .166) of IV insertion. All relationships were weak and statistically nonsignificant.

The effects of IV catheter gauge and site of IV insertion on the dependent variables of pain intensity and pain distress were examined using MANCOVA (Table 7). Both catheter gauge (Pillai's Trace = 0.124, $F_{4,628}$ = 10.35, P < .001, multivariate η^2 = 0.062) and insertion site (Pillai's Trace = 0.063, $F_{6,622}$ = 3.36, P = .003, multivariate η^2 = 0.031) demonstrated significant main effects on the combined dependent variable. Univariate ANOVA results indicated that only the dependent variable of pain intensity was significantly affected by catheter gauge ($F_{2,314}$ = 18.98, P < .001, partial η^2 = 0.108) and insertion site ($F_{3,311}$ = 6.42, P < .001, partial η^2 = 0.058). Bonferroni adjustments demonstrated that insertions with 18-gauge catheters were significantly more painful than those with 20- or 22-gauge catheters, and that antecubital insertions were significantly lower in pain intensity than insertions in the hand, wrist, or forearm.

Fourteen percent (n = 45) of the IV insertion attempts were unsuccessful. Seventeen percent of attempts on women and 9% of attempts on men were unsuccessful, a difference that was not statistically significant (χ^2 [1, N = 324] = 3.24, P = .072). Insertion attempts were significantly more difficult in women (M = 2.1, SD = 2.6, n = 206) than in men (M = 1.3, SD = 2.2, n = 117) (t_{321} = -2.933, P = .006).

Discussion

Results of the study did not support the research hypotheses that CBIs and the ability to choose an intervention would reduce pain intensity and pain distress of IV catheter insertion. Patient participants who received a CBI (ie, listening to music, viewing a kaleidoscope, performing guided imagery) during IV insertion, whether the intervention was assigned or chosen, did not report less pain intensity or pain distress than patients who received usual care (ie, no extra intervention). Thus, the model of CBI for IV insertion pain was not supported. These findings parallel those in other controlled studies that failed to demonstrate an effect of music[1,10,53] or guided imagery[54] on procedural pain. They conflict, however, with studies that demonstrated significantly reduced procedural pain with music,[55] a kaleidoscope,[6] and self-hypnosis with relaxation and imagery.[7] A recent meta-analysis of 51 studies showed small but significant effects of music on clinical pain.[56] More research with rigorous designs[57] focusing on the content and dosing of the interventions[26] that account for individual

Table 5
Choice of Cognitive-Behavioral Intervention Among Men and Women (N = 158)

Treatment choice	Men n	Men (%)	Women n	Women (%)
Music	24	(37.5)	38	(40.4)
Kaleidoscope	6	(9.4)	21	(22.3)
Guided imagery	11	(17.2)	23	(24.5)
Usual care	23	(35.9)	12	(12.8)
Total	**64**	**(100)**	**94**	**(100)**

Table 6
Mean and Standard Deviation (SD) of Age for Cognitive-Behavioral Intervention Choice (N = 156)*

Treatment choice	Mean age	SD
Music (n = 62)	58.3	15.6
Kaleidoscope (n = 25)	49.5	16.1
Guided imagery (n = 34)	58.4	12.8
Usual care (n = 35)	53.8	18.6

** Sample does not equal 158 as a result of missing data.*

TABLE 7
Mean (M) and Standard Deviation (SD) of Pain Intensity and Pain Distress by IV Catheter Gauge (n = 318)* and Insertion Site (n = 316)*

	Pain intensity** M	Pain intensity** SD	Pain distress** M	Pain distress** SD
IV gauge				
18 (n = 98)	3.0	2.4	1.9	2.2
20 (n = 58)	2.7	2.2	2.1	2.4
22 (n = 162)	1.5	2.1	1.6	2.2
IV site				
Hand (n = 173)	2.3	2.2	1.8	2.3
Wrist (n = 28)	2.9	2.2	2.3	2.2
Forearm (n = 25)	2.8	3.1	2.2	2.6
Antecubital (n = 90)	1.3	1.9	1.5	2.0

** Sample sizes do not equal 324 as a result of missing data.*
*** Pain intensity and pain distress are measured on 11-point numeric rating scales in which 0 = no intensity/distress and 10 = most intense/distressing pain imaginable.*

variations in psychological factors such as susceptibility and expectancy[58] can better determine the effectiveness of CBIs under various conditions.

Although IV insertion is ubiquitous in clinical arenas, it may not be a highly painful procedure to many. Thus, the failure of the interventions to demonstrate a reduction in pain may have been due to a floor effect (ie, the pain stimulus was so low that interventions to reduce pain had only a minimal effect). Further study of these types of interventions on painful procedures other than IV insertion (eg, nasogastric or chest tube insertion, suturing) is warranted.

Another factor that may have influenced the effectiveness of the experimental interventions was the artificiality of the standardized, nonindividualized approach to participants necessitated by the study design. Patient participants may have perceived this as a poorly integrated "add on" and not participated fully in the intervention, which would reduce its distraction potential. Use of CBIs more fully integrated within a care delivery system and offered by clinical staff members might demonstrate more effective outcomes.

Although the CBIs used in this study did not reduce IV insertion pain, they were well-accepted by participants. Other studies have demonstrated similar positive attitudes toward CBIs such as music.[53,55] Providing CBIs to patients undergoing painful or invasive procedures may address their emotional needs and promote satisfaction with care. Data compiled from annual large-scale surveys of hospitalized patients consistently reflect that patients identify emotional and spiritual needs as a high priority.[59]

Findings related to how participants accepted (ie, "liked") receiving the interventions confirm the popularity of complementary and alternative therapies. Although participant age did not influence acceptability of CBIs in this study, women rated the interventions higher than men, and in participants offered a choice of intervention, men chose not to receive an intervention (ie, they chose usual care) more frequently than women. These findings are consistent with previous studies demonstrating higher usage rates of nonpharmacologic or complementary and alternative therapies by women.[60,61] The intervention of music was more liked than kaleidoscope, with no difference in acceptability of guided imagery, which suggests that having a variety of interventions for patients or providers to choose from would be beneficial.

Insertion difficulty was weakly but significantly correlated with pain intensity and pain distress, as suggested by the theoretical model for the study. Reducing insertion difficulty may result in less pain of IV insertion. Patients' perception of IV insertion pain and their belief in nurses'

Although the cognitive-behavioral interventions in this study did not reduce IV insertion pain intensity or distress, their use may increase patient satisfaction with care.

skill at insertion are strong predictors of patient satisfaction with care.[62] In this study, nurses' self-rated skill at IV insertion was not related to their ratings of IV insertion difficulty. Although insertion attempts were significantly more difficult in women, insertion failure rates did not differ by gender, mirroring findings in previous research studies.[63] More research is needed to identify and modify factors that contribute to insertion difficulty and failure.

In this study, pain intensity was related to the insertion site (ie, antecubital was less painful than hand, wrist, or arm) and the IV catheter gauge (ie, 18-gauge catheters were more painful than 20- or 22-gauge catheters). Previous studies also have found higher pain ratings with larger gauge IV catheters.[64,65] These findings may be due to differences in nociceptor distribution as reflected in the study model.

Limitations

Several limitations are associated with this study. Although the sample size was sufficient according to a power analysis, use of a convenience sample from two institutions limits the ability to generalize the findings. The use of single-item measures for IV insertion difficulty, pain, and intervention acceptability prevents reliability testing of the instruments by the usual means (ie, test-retest, split-half, interrater) because of their subjective nature and the unique nature of each IV insertion. As a result of the nature of CBIs, neither participants nor data collectors could be blinded to the interventions.[57]

Although the research protocol called for a standardized approach to patient participants in explaining and delivering the interventions,[66] this approach may have reduced effectiveness of the interventions by not encouraging full patient participation, which when present would enhance absorption (ie, degree of involvement in the intervention) and increase distraction. Random assignment of participants to treatment groups was assumed to control for individual differences in susceptibility to CBIs; however, this assumption may not have been met and therefore may have influenced the study's outcomes. Finally, participants in the usual care group may have generated their own cognitive pain management strategies during the IV insertion, resulting in "treatment in the no-treatment control group."[67]

Implications for Practice

In this study, CBIs did not reduce the pain intensity or pain distress of IV insertion. Nevertheless, they are well-accepted by patients, particularly women and may increase patient satisfaction with care. They are low-cost, low-tech, and easy to implement, and thus they should be available and offered to patients undergoing procedures in perioperative and other health care settings.

Findings of this study support previous research that demonstrated an association between IV insertion pain and insertion difficulty, IV catheter gauge, and IV insertion site. These factors should be considered by nurses who insert IVs, with choices based on promoting the most effective delivery of IV therapy with the least amount of patient pain. ❖

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SamplePower is a registered trademark of SPSS, Chicago.

NOTES

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Cola Drinks Linked to Osteoporosis Risk in Women

Women who drink cola beverages on a regular basis are at an increased risk for osteoporosis, according to an Oct 6, 2006, article from HealthDay News. In a study of more than 2,500 participants whose average age was just less than 60 years, researchers found an association between the consumption of cola and lower bone mineral density in women. Cola intake, however, was not found to lower bone density in men.

Approximately 55% of Americans, most of whom are women, are at risk for developing osteoporosis. Researchers speculate that cola intake affects bone calcium because of either

- the caffeine in cola, which interferes with calcium absorption, or
- the phosphoric acid in cola, which may cause calcium to be depleted from bones as the body responds to neutralize the acid.

The calcium reduction in bones also was noted in women who drink diet cola, but it was weaker in participants who consumed decaffeinated cola. The researchers recommended a limited intake of cola not only later in life but also for younger women during the years when their bone density is forming.

S Reinberg, "Cola raises women's osteoporosis risk," HealthDay News, *(Oct 6, 2006)* http://www.healthday.com/view.cfm?id=535373 *(accessed 19 Oct 2006).*