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Original Article

Use of Music to Reduce Anxiety during Office Hysteroscopy: Prospective Randomized Trial

Roberto Angioli, MD*, Carlo De Cicco Nardone, MD, Francesco Plotti, MD, Ester Valentina Cafà, MD, Nella Dugo, MD, Patrizio Damiani, MD, Roberto Ricciardi, MD, Francesca Linciano, MD, and Corrado Terranova, MD

From the Department of Obstetrics and Gynaecology, University of Rome "Campus Bio-Medico," Rome, Italy (all authors).

ABSTRACT **Study Objective:** To investigate the effects of music on anxiety and perception of pain during office hysteroscopy.
Design: Prospective randomized trial (Canadian Task Force classification I).
Setting: Major university medical center.
Interventions: Three hundred fifty-six patients were enrolled between July 2012 and January 2013. Hysteroscopy was performed in a dedicated ambulatory room, using vaginoscopy and without any type of anesthesia. A Bettocchi hysteroscope 5 mm in diameter was used. All procedures were performed by the same surgeon, a gynecologist with special interest in hysteroscopy.
Measurements and Main Results: Data collected included age, body mass index, number of vaginal deliveries, educational achievement level, and history of endometrial surgery (curettage and/or hysteroscopy). For each patient, vital parameters such as blood pressure, heart rate, and respiratory rate were recorded 15 minutes before the procedure and during hysteroscopy after traversing the cervix. Wait time before surgery and the duration of the procedure were also recorded. A completed Italian version of the state anxiety questionnaire (State-Trait Anxiety Inventory) and a visual analog scale (VAS) were administered to each patient before and after the procedure. The *t* test and Mann-Whitney *U* test was used when appropriate to compare the 2 groups. Statistical significance was accepted at $p = .05$. During surgery, systolic blood pressure and heart rate were significantly lower in the music group compared with the no music group. Women in the music group experienced significantly lower anxiety after hysteroscopy and less pain during the procedure, and a significant decrease in both anxiety and pain scores after hysteroscopy. Postoperative State-Trait Anxiety Inventory form Y1 and VAS scores were significantly lower in the music group.
Conclusion: Music can be useful as a complementary method to control anxiety and reduce perception of pain. The patient is more relaxed and experiences less discomfort. Journal of Minimally Invasive Gynecology (2014) 21, 454–459 © 2014 Published by Elsevier Inc. on behalf of AAGL.

Keywords: Anxiety; Music; Office hysteroscopy; Pain; STAI; VAS

Hysteroscopy can be regarded as the criterion standard for evaluation of the uterine cavity and for detection and treatment of intrauterine disease [1]. Pain experienced during hysteroscopy is the most common reason for failure of the procedure [2,3] and is the main limiting factor to large-scale use of office hysteroscopy [4].

Over the years, to minimize patient discomfort and promote the chance of success of the procedure, hysteroscopy has endorsed new tools such as thinner and/or flexible instruments in an attempt to eliminate any kind of premedication, analgesia, or anesthesia [5,6]. Despite these innovative efforts, patient compliance is still not optimal

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Corresponding author: Roberto Angioli, MD, Department of Obstetrics and Gynaecology, University of Rome "Campus Bio-Medico," Via Álvaro del Portillo, 200-00128 Rome, Italy.
E-mail: r.angioli@unicampus.it

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because of the discomfort and pain associated with the procedure.

The literature includes an increasing number of studies that highlight how music could be a tool to support patient emotional and psychologic status by creating an environment that stimulates and maintains relaxation, well-being, and comfort. Music can be used as a self-management technique to reduce or control distress [7]. The commonly accepted theory explaining the effect of music in reducing pain, anxiety, and stress is that music is a distracter, focusing patient attention away from negative stimuli to something pleasant and encouraging [8–10].

Music has been documented to reduce patient perceived pain and anxiety in various clinical and surgical areas [11,12]. The present study is the first prospective randomized study to investigate the effects of music on perception of pain and anxiety during office hysteroscopy.

Material and Methods

From July 2012 to January 2013, a prospective randomized trial (No. NCT0170387; www.clinicaltrialgov.org) was performed in the Division of Gynecology of the University Campus Bio-Medico in Rome. All patients referred for office hysteroscopy were considered for inclusion in the study. The study was approved by the hospital institutional review board.

Inclusion criteria were indication for hysteroscopy (abnormal uterine bleeding, abnormal findings at ultrasound or hysterosalpingography, and infertility), signed informed consent, and ability to read and understand Italian. Exclusion criteria were mental impairment, surgical procedure not completed because of stenosis of the cervical canal, and excessive pain reported by patients. After consent was obtained, the patients were randomly assigned to either a music or no-music group by the research nurse, using a computer-generated random number series.

No premedication for cervical ripening was used. According to our protocol, 10 minutes before the procedure a detailed medical history was obtained for each patient, including age, body mass index, educational achievement level, number of vaginal deliveries, and history of endometrial surgery (curettage and/or hysteroscopy). For each patient, vital parameters including blood pressure, heart rate, and respiratory rate were recorded at 15 minutes before the procedure and during hysteroscopy, after traversing the cervix. Wait time before surgery and the duration of the procedure were also recorded. In addition, a completed Italian version of the state anxiety questionnaire (State-Trait Anxiety Inventory [STAI]) and a visual analog scale (VAS) were administered to each patient before and after the procedure. The STAI for adults was used to assess anxiety [13]. It consists of 40 self-reported items that measure state (STAI form Y-1) and trait (STAI form Y-2) anxiety. Scores range from 20 to 80, and the lower the score the lower the anxiety level. In particular, the STAI Y-1 is designed to assess momentary or situational anxiety. The STAI Y-2 is designed to assess trait anxiety, with questions that explore how the subject feels habitually. STAI Y-1 was administrated twice, before and at the end of the procedure, whereas STAI Y-2 was administered only before the procedure to assess homogeneity between trait anxiety of both groups.

Each subject also assessed anticipated pain and real pain experienced during the procedure using VAS. Scores ranged from 0 to 10, with 0 indicating "no pain" and 10 indicating "worst pain possible."

Before the start of the procedure, patients were asked to indicate their favorite music to be played during hysteroscopy; they could choose among selected pop, jazz, classical, or rock playlists. Music was administered through a stereo to a volume of 50 to 60 dB [14] during hysteroscopy for subjects in the music group, whereas patients in the no-music group were examined in the same setting without music.

Hysteroscopy was performed in a dedicated ambulatory room, using vaginoscopy and without any type of anesthesia, by the same surgeon, a gynecologist with special interest in hysteroscopy. A Bettocchi hysteroscope with a 5-mm diameter was used. Before the procedure, an extensive explanation of the intervention was given. However, during the procedure, the surgeon could provide the necessary information about the examination only if asked by the patient.

Operative time for all procedures was calculated from entry of the hysteroscope into the external uterine orifice to exit from the uterine cervix.

It was expected that VAS scores during hysteroscopy would be proportional to patient comfort and anxiety. The mean decrease in VAS score ranged from 4.5 to 3.5, as reported in the literature [15]. One hundred forty-one patients in each treatment group were required to detect such a difference, with a power of 80% and at significance of 50%. The Student *t* test and Mann-Whitney *U* tests were used when appropriate to compare the 2 groups. A values of $p = .05$ was considered statistically significant.

Results

Between July 2012 and January 2013, 383 eligible subjects were asked to join the study. Five women refused to fill in the questionnaires, and 6 indicated no interest in participating. Thus, 372 women were enrolled in the trial and randomized into 2 groups: 185 in the Music Group (MG) and 187 in the No Music Group (NMG). Fifteen patients (9 in MG and 7 in NMG) did not complete the surgical procedure because of stenosis of the cervical canal and/or excessive pain reported. Data for the remaining 356 patients (176 in MG and 180 in NMG) were considered for statistical analysis.

Patient characteristics including age, body mass index, number of vaginal deliveries, previous endometrial surgery (curettage and/or hysteroscopy), educational achievement level, STAI Y-2, types of procedure, and operative time were comparable between groups ($p > .05$) (Table 1).

Table 1

Patient characteristics[a]

Variable	Music Group	No Music Group	p value
Age, yr	57.03 (12.24)	55.11 (13.91)	NS
Body mass index	26.36 (4.52)	26.28 (3.42)	NS
No. of patients with at least 1 vaginal delivery	113 (0.48)	123 (0.46)	NS
STAI Y-2 score	35.80 (9.65)	35.90 (11.89)	NS
Educational achievement level, No. of patients (%)			
Primary	53/176 (30)	47/180 (26)	NS
Secondary	21/176 (12)	41/180 (23)	NS
High school	69/176 (39)	65/180 (36)	NS
University	33/176 (19)	27/180 (15)	NS
Previous endometrial surgery	73 (0.48)	80 (0.49)	NS
Type of procedure, %			
Diagnostic with multiple biopsies	63	67	NS
Operative	37	33	NS
Operative time, min	15.95 (3.48)	16.94 (5.05)	NS

NS = not significant; STAI Y-2 = State-Trait Anxiety Inventory form Y-2.
[a] Unless otherwise indicated, values are given as mean (SD).

Mean (SD) wait time before surgery was 23.65 (7.91) minutes (95% confidence interval [CI], 22.45–24.79) in the MG and 22.41 (6.40) minutes (95% CI, 21.48–23.35) in the NMG. In the MG, 63% of all procedures were diagnostic with multiple biopsies and 37% were operative (adhesiolysis in 15, removal of polyps <1 cm in 46, removal of grade 0 submucous myomas in 4), and in the NMG, 67% of procedures were diagnostic with multiple biopsies and 33% were operative (adhesiolysis in 6, removal of polyps <1 cm in 51, and removal of grade 0 submucous myomas in 2). Operative time was 15.95 (3.48) minutes (95% CI, 15.44–16.46) in the MG, and 16.94 (5.05) minutes (95% CI, 16.20–17.68) in the NMG. There were no statistically significant differences between the 2 groups insofar as wait time, type of surgery, or duration of the procedure ($p > .05$).

Vital parameters before and during surgery are given in Table 2. There were no statistically significant differences between the 2 groups ($p > .05$) for all parameters recorded before and during the procedure except for systolic blood pressure (129.55 [10.57] mm Hg in MG vs 135.53 [11.75] mm Hg in NMG) and heart rate (81.41 [10.98] bpm in MG vs 86.16 [10.88] bpm in NMG) during surgery, which was statistically significant.

Before hysteroscopy, the STAI Y-1 anxiety score was 39.75 (8.94) (95% CI, 38.06–40.25) in the MG, and 39.15 (7.42) (95% CI, 38.44–41.06) in the NMG, with no statistically significant differences between the groups ($p > .05$).

Patients evaluation of expected pain using the VAS before hysteroscopy was not statistically significant between the groups ($p > .05$). The VAS score was 6.22 (2.47) (95% CI, 5.86–6.59) in MG and 5.94 (2.30) (95% CI, 5.60–6.28) in NMG.

Women in MG experienced significantly lower anxiety after hysteroscopy: STAI Y-1, 27.59 (6.30) (95% CI, 26.66–28.52) in MG vs 32.66 (11.63) (95% CI, 30.96–34.36) in NMG. They also experienced less pain during the procedure: VAS score, 2.95 (3.16) (95% CI, 2.48–3.42) in MG vs 4.83 (2.67) (95% CI, 4.44–5.22) in NMG. Women in MG experienced a significant decrease in both anxiety and pain scores after hysteroscopy. Results of STAI Y-1 and VAS are given in Table 3.

There was no statistically significant difference between diagnostic and operative procedures in terms of preoperative and postoperative STAI Y1 and VAS scores (expected preoperative and postoperative VAS) for NMG and MG (Table 4).

Table 2

Vital parameters at baseline and during procedure[a]

Variable	Music Group	No Music Group	p value
Systolic BP, mm Hg			
Before hysteroscopy	129.95 (8.87)	131.94 (11.47)	NS
During hysteroscopy	129.54 (10.57)	135.52 (11.75)	<.001
Diastolic BP			
Before hysteroscopy	78.86 (6.93)	79.8 (5.67)	NS
During hysteroscopy	77.5 (1.99)	78.05 (5.58)	NS
Heart rate, bpm			
Before hysteroscopy	77.18 (8.20)	75.66 (13.30)	NS
During hysteroscopy	81.40 (10.98)	86.15 (10.88)	<.001
Respiratory rate, breaths/min			
Before hysteroscopy	13.93 (1.99)	14.33 (2.31)	NS
During hysteroscopy	15.95 (2.88)	15.88 (3.27)	NS

BP = blood pressure; NS = not significant.
[a] Values are given as mean (SD).

Table 3

Baseline pain and anxiety scores before and after hysteroscopy[a]

Variable	Music Group	No Music Group	p value
STAI Y-1 score			
Before hysteroscopy	39.75 (8.94)	39.15 (7.42)	NS
After hysteroscopy	27.59 (6.30)	32.66 (11.63)	<.001
Change in anxiety score	7.09 (14.59)	11.57 (6.79)	<.001
VAS score			
Expected before hysteroscopy	6.22 (2.47)	5.94 (2.30)	NS
After hysteroscopy	2.95 (3.16)	4.83 (2.67)	<.001
Change in pain score	3.27 (3.81)	1.11 (2.97)	<.001

NS = not significant; STAI Y-1 = State-Trait Anxiety Inventory; VAS = visual analog scale.
[a] Values are given as mean (SD).

Concerning the comparison between the diagnostic procedures of NMG and MG (Table 5), postoperative STAI Y1 and VAS were significantly lower in MG. Moreover, concerning the comparison between the operative procedures of NMG and MG, the postoperative VAS score was significantly lower in MG. Furthermore, after operative procedures, even STAI Y1 was lower in MG than in NMG; however, this difference was not statistically significant.

During our survey, 50% of patients preferred listening to classical music, 45% preferred pop music, 5% preferred jazz, and none preferred rock music.

We stratified the results of STAI Y-1 and VAS on the basis of music preference, comparing classical vs pop music. Because only a small number of patients chose jazz, the data were not analyzed. Results showed no statistically significant difference between the 2 playlists in terms of postoperative VAS score, but a significant difference in terms of postoperative STAI Y1 score ($p < .001$). Data are summarized in Table 6.

Table 4

Comparison between diagnostic and operative procedures according to pain and anxiety scores[a]

Variable	Diagnostic	Operative	p value
No Music Group			
STAI Y-1			
Before hysteroscopy	39.4 (8.5)	40.4 (9.8)	NS
After hysteroscopy	32.9 (10.4)	32.1 (14.0)	NS
VAS			
Expected before hysteroscopy	5.8 (2.5)	6.1 (1.9)	NS
After hysteroscopy	4.8 (2.8)	4.9 (2.4)	NS
Music Group			
STAI Y-1			
Before hysteroscopy	37.0 (11.3)	38.4 (8.1)	NS
After hysteroscopy	27.5 (6.8)	27.8 (5.4)	NS
VAS			
Expected before hysteroscopy	6.0 (2.4)	6.5 (2.6)	NS
After hysteroscopy	2.9 (2.8)	3.1 (3.4)	NS

NS = not significant; STAI Y-1 = State-Trait Anxiety Inventory form Y-1; VAS = visual analog scale.
[a] Values are given as mean (SD).

Table 5

Between-group comparison of pain and anxiety scores in diagnostic and operative procedures[a]

Variable	No Music Group	Music Group	p value
Diagnostic procedures			
STAI Y-1			
Before hysteroscopy	39.4 (8.5)	39.6 (7.0)	NS
After hysteroscopy	32.9 (10.4)	27.5 (6.8)	<.001
VAS			
Expected before hysteroscopy	5.8 (2.5)	6.0 (2.4)	NS
After hysteroscopy	4.8 (2.8)	2.9 (2.8)	<.001
Operative procedures			
STAI Y1			
Before hysteroscopy	40.4 (9.8)	38.4 (8.1)	NS
After hysteroscopy	32.1 (13.9)	27.8 (5.4)	NS
VAS			
Expected before hysteroscopy	6.1 (1.9)	6.5 (2.6)	NS
After hysteroscopy	4.9 (2.4)	3.1 (3.4)	<.005

NS = not significant; STAI Y-1 = State-Trait Anxiety Inventory form Y-1; VAS = visual analog scale.
[a] Values are given as mean (SD).

Discussion

It has been well documented that surgery is associated with increased anxiety and that this emotional state can lead to both psychologic and physiologic responses [16].

In the sixth century, Pythagoras, who is considered the founder of music therapy, believed that music greatly contributed to health and prescribed music and a specific diet to restore and maintain harmony of the body and soul.

The beneficial role of music is well documented, both in patients undergoing surgery and in those submitted to chronic treatments [17–19]. Various theories have been

Table 6

Results of STAI Y-1 and VAS stratified for music choice[a]

Variable	Pop Music	Classical Music	p value
STAI Y1			
After hysteroscopy	26.20 (5.98)	29.54 (6.04)	<.001
VAS			
After hysteroscopy	3.00 (2.54)	3.18 (3.65)	NS

NS = not significant; STAI Y-1 = State-Trait Anxiety Inventory form Y-1; VAS = visual analog scale.
[a] Values are given as mean (SD).

described to explain the mechanism by which music acts in health care. In 1990, Unkefer and Thaut [20] proposed that music could stimulate the brain, acting on specific areas involved in processes of memory, learning, and multiple motivational and emotional states. Moreover, music reduces the activity of the sympathetic nervous system and causes a relaxation response and a feeling of well-being [18,21]. In the field of endoscopy, Palakanis et al [11] and Bampton and Draper [12] presented evidence that music relieved anxiety and improved tolerance for endoscopic examination in patients undergoing colonoscopy.

To our knowledge, the present study is the first prospective randomized study to investigate the effects of music on pain perception during office hysteroscopy. Our results show that women in the MG experienced significantly lower anxiety after hysteroscopy (mean [SD] STAI Y-1 27.59 [6.30] vs 32.66 [11.63] for MG and NMG, respectively) and less pain during the procedure (VAS score 2.95 [3.16] vs 4.83 [2.67] in MG and NMG, respectively). Therefore, patients who listened to music reported intraoperatively a lower perception of pain and had a lower anxiety score correlated with the procedure.

In addition, concerning the comparison between the diagnostic procedures of NMG and MG, postoperative STAI Y1 and VAS scores were significantly lower in MG. Moreover, concerning the comparison between the operative procedures of NMG and MG, postoperative VAS scores were significantly lower in MG. Furthermore, after operative procedures, even STAI Y1 was lower in MG than in NMG; however, this difference was not statistically significant. It probably would reach significance with a greater number of patients.

We also demonstrated that music reduces sympathetic nervous system activity and determines a relaxation response that correlates with a sense of well-being, as demonstrated by the significantly lower systolic blood pressure (129.55 [10.57] mm Hg vs 135.53 [11.75] mm Hg in MG and NMG, respectively) and heart rate (81.41 [10.98] bpm vs 86.16 [10.88] bpm in MG and NMG, respectively) recorded during the procedure and by the lower scores on STAI Y-1.

Our findings also confirm that anxiety state and pain perception are highly correlated. Indeed, it is important to know that pain is not an emotionally neutral experience but is almost always accompanied by emotional disturbance and distress. It is also evident that anxiety can enhance painful sensations at all levels of the nervous system from the peripheral receptors to the cortical level [22,23].

Music may promote relaxation and decrease anxiety, resulting in a higher threshold for pain [24,25]. Alternatively, music may distract from painful sensation and thereby reduce anxiety responses. The distraction may also work at the cognitive level; patients are distracted from their worries and anxiety-provoking thoughts and instead focus on more pleasant stimuli, thereby reducing their level of tension, which in turn could predictably have a beneficial effect on reducing pain and distress [26,27].

Our playlists for classical, pop, jazz, and rock music have been structured to include music as relaxing as possible. It is important to note that no patient chose the rock playlist, indicating a natural tendency to associate smooth music with a relaxing effect. Indeed, the type of music most often used in health care settings was smooth music with a sustained melodic quality and a general absence of strong rhythms, percussion, and lyrics [28,29].

In addition, the present study shows, as reported previously [30], that within the smooth musical tones there is no a genre of music that is more associated with relaxation: beauty is in the eye [ear] of the beholder [listener]. Although universal psychologic principles and innate processes seem to govern musical experience across cultures [31,32], listeners undeniably perceive, remember, and respond emotionally to music in culture-specific ways [33]. A comprehensive understanding of the cognitive architecture of music therefore depends on disentangling culture-general from culture-specific processes. As demonstrated by Hannon et al [34] in a trial performed using 6- and 12-month-old infants, the difficulties in perceiving and producing complex ratio rhythms may arise not from universal, innate constraints but from learned expectations about meter and rhythm that are acquired during infancy.

This cultural influence may be why we found some difference between patients who chose classical and pop music. Indeed, postoperative STAI Y1 was statistically significant lower in patients who preferred to listen to pop music (Table 4). Inasmuch as the mean age of patients in the study was 57 and 55 years for MG and NMG, respectively, most patients were born between 1950 and 1960, and their cultural background probably was influenced more by pop music than by classical music.

In addition, classical music is usually considered more relaxing, which may be why so many patients chose this playlist. However, this could be a bias; although these patients preferred a different kind of music, they chose the classical playlist because it is associated with the (wrong) cultural belief of greater relaxation. This is another possible reason for the lower postoperative STAI Y1 scores in patients who preferred to listen to pop music, which is probably the type of music more familiar to these patients, whereas patients who chose classical music most likely were accustomed to a musical background different from the classical one. However, this is an important aspect that should be investigated in future studies and which may be resolved by asking patients to bring their own favorite CD compilation.

In conclusion, music can be useful as a complementary method to control anxiety and reduce pain perception. Patients are more relaxed and experience less discomfort.

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