Original Research

Video Colposcopy for Reducing Patient Anxiety During Colposcopy

A Randomized Controlled Trial

Ziad Hilal, MD, Ferizan Alici, MD, Clemens B. Tempfer, MD, Veronika Seebacher, MD, and Günther A. Rezniczek, PhD

OBJECTIVE: To test whether video colposcopy reduces anxiety among patients undergoing colposcopy.

METHODS: In a prospective, randomized multicenter trial, we compared video colposcopy and no video colposcopy in a one-to-one ratio. Situation-specific anxiety was measured before (S1) and after (S2) colposcopy using the State-Trait Anxiety Inventory. The primary endpoint was the reduction of the situation-specific anxiety scores (ΔS=S2–S1). Secondary endpoints were pain during and 10 minutes after colposcopy, general unpleasantness, anxiety during colposcopy, satisfaction with the information about the procedure, and overall satisfaction (11-item visual analog scales). Analysis was by intention to treat. A sample size of 104 per group (n=208) was planned to achieve 80% power to detect a difference of 4.8 with a SD of 12.3 in the primary outcome.

RESULTS: Between August 2016 and March 2017, 225 women were randomized. The mean ΔS was −10.3±11.3 SD in 111 women in the video colposcopy group and −10.3±11.0 SD in 105 women without video colposcopy (*P*=.50). The secondary endpoints pain during examination (median 2 [interquartile range 1–3] compared with 2 [1–4]; *P*=.91), pain 10 minutes after examination (1 [0–3] compared with 1 [0–2.5]; *P*=.24), general unpleasantness (3 [1–5] compared with 3 [1–5]; *P*=.90), anxiety during examination (3 [1–5] compared with 3 [1–5]; *P*=.61), satisfaction with the information about the procedure (10 [9–10] compared with 10 [9–10]; *P*=.88), and overall satisfaction (10 [9–10] compared with 10 [9–10]; *P*=.54) were also not different between the two study groups. In a multivariate linear regression analysis, study center (*P*=.028), body mass index (*P*=.033), and smoking status (*P*=.025) independently affected the reduction of anxiety.

CONCLUSION: Video colposcopy does not reduce anxiety in women undergoing colposcopy.

CLINICAL TRIAL REGISTRATION: ClinicalTrials.gov, NCT02697175.

(Obstet Gynecol 2017;0:1–9)

DOI: 10.1097/AOG.0000000000002127

Colposcopy is a standard technique in the diagnostic algorithm of women with suspected cervical dysplasia. Like any other medical intervention, colposcopy causes anxiety and discomfort in patients undergoing this procedure.[1–3] In addition, colposcopy may be specifically troublesome for some patients because cervical dysplasia is a cancer precursor and therefore they may be particularly anxious as a result of a potential cancer diagnosis.[4–6] In light of this, any intervention sufficient to reduce the anxiety of patients before and during colposcopy is useful. A small number of controlled trials assessed interventions such as music, information leaflets, or educational videos in patients undergoing colposcopy with the aim of reducing the patients' anxiety levels.[3,7–11] Only two randomized trials assessed the effect of live video demonstration: Walsh et al[12] performed consecutive colposcopy and randomly assigned women to either video colposcopy or a control group. A significant decrease in state anxiety was observed from one visit to the next in all patients. This decrease in anxiety was significantly greater in the video colposcopy group. In another

From the Department of Obstetrics and Gynecology, Ruhr-Universität Bochum, Bochum, Germany; and the Department of Gynecology and Gynecologic Oncology, Gynecologic Cancer Unit, Comprehensive Cancer Centre, Medical University of Vienna, Vienna, Austria.

Each author has indicated that he or she has met the journal's requirements for authorship.

Corresponding author: Günther A. Rezniczek, PhD, Department of Obstetrics and Gynecology, Ruhr-Universität Bochum, Marien Hospital Herne, Hölkeskampring 40, 44625 Herne, Germany; email: guenther.rezniczek@rub.de

Financial Disclosure

The authors did not report any potential conflicts of interest.

ISSN: 0029-7844/17

study, Kola et al[13] showed that video colposcopy reduced blood pressure (as a proxy of distress), but only in a subgroup of women with a coping style that is characterized by scanning for threatening cues and information-seeking and typically results in better psychological outcomes when detailed sensory and procedural information is presented.

Based on these data in the literature, video colposcopy may be an appropriate intervention to alleviate the level of anxiety among patients undergoing this procedure. To test this hypothesis, we performed a randomized trial to test whether video colposcopy reduces the level of anxiety among patients undergoing colposcopy.

MATERIALS AND METHODS

This is a prospective randomized multicenter trial, which was carried out at the Department of Obstetrics and Gynecology, Ruhr-Universität Bochum, Bochum, Germany, and the Institute of Cytology and Immune Cytochemistry ZYDOLAB, Dortmund, Germany, in a population of women referred to these institutions for colposcopy as a result of cervical abnormalities obtained by cytologic screening. The Department of Obstetrics and Gynecology represents a hospital setting, and the Institute of Cytology and Immune Cytochemistry represents a doctor's office. Approval for this study was obtained by the Ruhr-Universität Bochum medical faculty's ethical review board (registration number 5609-16; date of approval April 6, 2016). The trial was registered with ClinicalTrials.gov (NCT02697175). All participating women gave written informed consent before study inclusion.

Women could participate only if this was the first colposcopy they had undergone and if they were between 18 and 80 years old. Further reasons for exclusion were pregnancy, presence of a language barrier, a previous oncologic disease, human immunodeficiency virus infection, or a known anxiety disorder or depression.

Sample size calculations were based on the expectation of a similar effect as observed by Chan et al[7] who investigated the effect of music on anxiety during colposcopy. They found mean situational State-Trait Anxiety Inventory scores of 39.4 ± 10.9 and 44.2 ± 12.3 in the study and control groups, respectively. Based on a difference of 4.8 and a SD of 12.3, an α of 0.05, and power of 0.8, we calculated that 104 women per group were required (120 assuming a 15% dropout rate). Separate allocation lists were prepared for both sites by use of a computerized randomization tool. The random allocation sequence (block size four, randomization ratio one to one) was performed by a member of staff not involved in the study who inserted the allocation slips into consecutively numbered, opaque envelopes.

Two senior gynecologists (both male) with extensive experience in colposcopy and a very similar style of patient interaction performed the examinations, one in each center. The number of colposcopists was limited to minimize potential bias. The standardized procedure was as follows: before any contact with the senior gynecologists, another gynecologist who did not perform the examinations and did not take part in the analysis of this study informed women of the study. The women, who agreed to participate in the study and provided written consent, completed the German version of the State-Trait Anxiety Inventory.[14] The State-Trait Anxiety Inventory originates from Spielberger et al[15] and consists of 40 items, each with four answers, which are grouped into two scales that measure baseline (trait) and situational (state) anxiety. The processing time takes approximately 4–6 minutes for each questionnaire. A higher score indicates higher anxiety, and a State-Trait Anxiety Inventory state cutpoint of 39–40 is usually set to detect clinically significant symptoms.[16] The scores from the questionnaires completed before the colposcopy are denoted T (trait) and S1 (state).

To ensure a standardized level of medical information, all women then received an information leaflet providing details about cervical cancer and its precursors, the biology of the human papillomavirus, and information concerning the subsequent colposcopic examination. If questions remained, women could ask the senior gynecologist before the onset of the examination. Randomization envelopes were opened by the assisting nurse just before the start of the examination. Patients were not blinded to their group assignment as a result of the study design. Each woman assigned to the experimental group (group 1, "video colposcopy") could observe her colposcopic examination from the moment the speculum was placed to visualize the cervix. The examination was presented in real time on a high-end light-emitting diode television with a 45-inch screen size fixed to the wall at a distance of approximate 6 feet from the head of the study participant. The sequence of the examination was standardized: first, samples for Pap test and human papillomavirus testing were collected using a cervical brush device. Then, the cervix was examined in its native condition for 1 minute and for at least 3 minutes after applying a 3% acetic acid solution with a cotton swab. Three levels of magnification were used ($\times 7.5$, $\times 15$, and $\times 30$). The colposcopic findings were discussed with the patients watching

the video feed. The television screen was switched off before any cervical biopsies of potentially dysplastic lesions were performed. The number of biopsies was at the discretion of the colposcopist. Endocervical curettage was performed after biopsy in case of a type 3 transformation zone or in cases of apparent or suspected endocervical abnormalities. Lugol's solution was not routinely applied. The colposcopic examination was assessed according to the 2011 colposcopic terminology of the International Federation for Cervical Pathology and Colposcopy.[17] We did not use any hemostatic agents after colposcopy and immediately removed the specula after the examination. Women assigned to the control group (group 2, "no video colposcopy") did not watch their examinations on the television screen, and any findings were discussed with them only after the procedure was completed. The other procedural steps were identical.

After the examination, all women filled out the State-Trait Anxiety Inventory state questionnaire once more to reevaluate their situational anxiety (score S2). In a further questionnaire, all women were asked to score on 11-item visual analog scales: their pain levels during (Q1) and after (Q2) colposcopy (both: 0, "no pain" to 10, "worst imaginable pain"), how unpleasant the examination was for them (Q3; 0, "not at all unpleasant" to 10, extremely unpleasant"), the level of their anxiety during the examination (Q4; 0, "no anxiety at all" to 10, "worst imaginable anxiety"), their satisfaction concerning the medical consultation (Q5), and their overall satisfaction (Q6; both: 0, "maximally unsatisfied" to 10, "maximally satisfied"). Women in the study group (group 1) additionally were asked to answer the following questions (11-item visual analog scale): level of discomfort as a result of the live video feed (Q7; 0, "not uncomfortable at all" to 10, "maximally uncomfortable"), level of anxiety caused by watching the live video feed (Q8; 0, "no anxiety" to 10, "very considerable anxiety"), and how they judged the importance of watching the video feed for understanding their disease (Q9; 0, "not important" to 10, "very important").

The primary endpoint was the change in situational anxiety (ΔS; calculated as the difference S2–S1 between the anxiety scores before [S1] and after [S2] the colposcopy). Secondary endpoints were anxiety after colposcopy, pain during colposcopy, pain 10 minutes after colposcopy, general unpleasantness, anxiety during colposcopy, satisfaction with the information about the procedure, and overall satisfaction. Analysis was by intention to treat.

Descriptive statistics are reported using means and SD for normally distributed data and median and interquartile range for data not meeting this assumption. Accordingly, statistical analysis was performed using parametric (t test) or nonparametric tests (Mann–Whitney U test). To compare rates and proportions, the χ^2 test was used. All P values are two-tailed and $P<.05$ was considered statistically significant. Multiple linear and logistic regression analyses were performed with the difference in State-Trait Anxiety Inventory state scores before and after the examination (ΔS) as the dependent variable and study group, study center, age, body mass index (BMI, calculated as weight (kg)/[height (m)]^2), parity, presence of allergies, smoking behavior, and level of education as the independent variables. This selection of potential confounders was based on the hypotheses that age, parity, and educational level may be good proxies for a more experienced and relaxed approach to medical investigations such as colposcopy and may thus potentially influence an investigation of procedure-associated anxiety. We chose BMI because women with an elevated BMI may be prone to be more ashamed during an investigation involving nudity and thus have different anxiety levels. Regarding smoking, it is well known that depression is more prevalent in smokers and therefore smoking was regarded as a potential confounder. Finally, we have chosen a history of allergies to be included in the list of potential confounders based on the assumption that allergies are chronic conditions involving frequent medical encounters. Thus, allergy patients may be more relaxed during colposcopy. We used the statistics software package SigmaPlot 12.5 for statistical analysis.

RESULTS

Between August 2016 and March 2017, 275 patients were screened for this study. Forty-six patients did not meet the inclusion criteria and four patients declined to participate before randomization. Therefore, 225 patients were randomized and participated in the study. One hundred fourteen patients were randomized in group 1 (video colposcopy) and 111 patients were randomized in group 2 (no video colposcopy). Nine protocol violations occurred (technical failure of the video camera [n=1], patients did not fill out the questionnaire [n=6], patient declined participation during colposcopy [n=1], colposcopy not performed [n=1]). These patients were not included in the final analysis. Thus, 216 patients were included in the analysis. A flow diagram depicting the patents' flow through the study is shown in Figure 1. Patient characteristics according to study allocation are shown in Table 1 and were comparable between the two treatment groups.

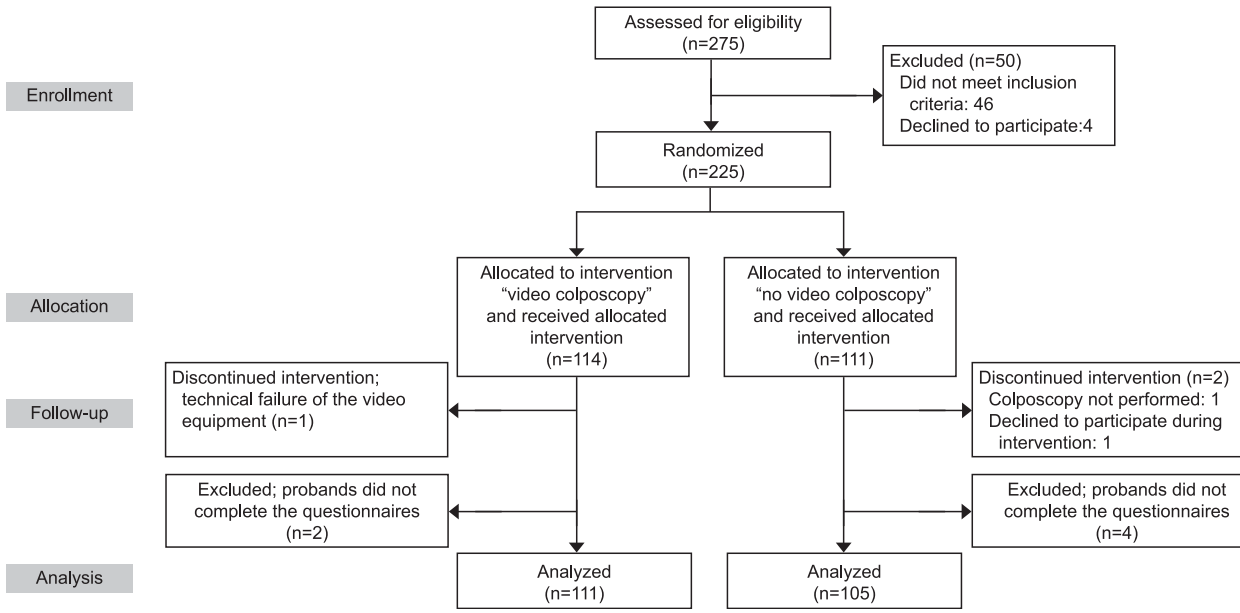

Fig. 1. Study flow diagram.
Hilal. Video Colposcopy and Anxiety. Obstet Gynecol 2017.

Table 2 shows a comparison of the primary and secondary endpoints between the two study groups. Specifically, the primary endpoint of this study (the mean reduction of the anxiety scores [ΔS]) was not different between the two study groups (−10.3±11.3 SD in 111 women in the video colposcopy group and −10.3±11.0 SD in 105 women without video colposcopy; *P*=.50). The anxiety scores before (S1; median 51 [interquartile range 42–62] compared with 50 [interquartile range 41–61]; *P*=.73) and after the intervention (S2; 39 [33–50] compared with 40 [33–48]; *P*=.80) were also not different between the groups. The secondary endpoints baseline anxiety (T; 38 [33–46] compared with 37 [31–44]; *P*=.42), pain during examination (2 [1–3] compared with 2 [1–4]; *P*=.91), pain 10 minutes after examination (1 [0–3] compared with 1 [0–2.5]; *P*=.24), general unpleasantness (3 [1–5] compared with 3 [1–5]; *P*=.90), anxiety during examination (3 [1–5] compared with 3 [1–5]; *P*=.61), satisfaction with the information about the procedure (10 [9–10] compared with 10 [9–10]; *P*=.88), and overall satisfaction (10 [9–10] compared with 10 [9–10]; *P*=.54) were also not different between the two study groups. Figure 2 shows box plots of S1, S2, and T anxiety scores in the two study groups.

In a multiple linear regression analysis with ΔS as the dependent variable and study group, study center, age, BMI, parity, level of education, presence of allergies, and smoking behavior as independent variables, study center (*P*=.028), BMI (*P*=.033), and smoking status (*P*=.025) independently affected the level of anxiety after colposcopy (Table 3). In a multiple logistic regression analysis using the same variables, only smoking status (odds ratio [OR] 1.94, 95% CI 1.07–3.51; *P*=.029), but not study group assignment (OR 0.94, 95% CI 0.53–1.67; *P*=.84), study center (OR 1.44, 95% CI 0.81–2.55; *P*=.22), BMI (OR 0.96, 95% CI 0.90–1.03; *P*=.24), age (OR 0.98, 95% CI 0.95–1.02; *P*=.28), parity (OR 1.03, 95% CI 0.76–1.41; *P*=.85), or education level (OR 1.00, 95% CI 0.85–1.19; *P*=.96) affected the primary endpoint, that is, anxiety level reduction (Table 3).

In addition, we looked at the most anxious and the least anxious patients separately to find out whether these subgroups would selectively benefit from video colposcopy. For this purpose, we compared anxiety levels and the amount of anxiety level reduction in the quartiles with the highest S1 anxiety scores and the lowest S1 anxiety scores. Results are depicted in Table 4. Among the group of the most anxious patients, we found significantly more smokers (*P*=.007; Fisher exact test), whereas other patient characteristics such as age, BMI, parity, and education level were similar. Anxious patients had significantly higher anxiety scores both before and after colposcopy. Also, the amount of anxiety reduction (ΔS) was significant in both groups, but relatively higher in the group of anxious patients. The study intervention, live video colposcopy, however, did not affect

Table 1. Group-Specific Characteristics of Study Participants in Groups 1 and 2

Patient Characteristic	Group 1, Video Colposcopy	Group 2, No Video Colposcopy
No. of patients	111	105
Age (y)	36.1±9.5	35.5±10.8
BMI (kg/m^2)	23.5±4.0	24.2±4.3
Educational level*	4 (3–5) [4]	3 (2–6) [2]
Insurance status (private/regular)	8 (7.2)/103	9 (8.7)/95 [1]
Parity	0.94±1.01	1.00±1.08
Allergy (yes/no)	42 (37.8)/69	46 (44.2)/58 [1]
Smoking (yes/no)	51 (45.9)/60	59 (56.7)/45 [1]
Drug abuse (yes/no)	0 (0)/111	2 (1.9)/102 [1]
Prescription drug use (yes/no)	38 (34.2)/73	38 (36.5)/66 [1]
Concomitant disease (yes/no)	48 (43.2)/63	38 (36.5)/66 [1]
Complications	1 (0.9)	1 (1.0)
Type of transformation zone		
1	85 (76.6)	81 (77.1)
2	16 (14.4)	12 (11.4)
3	10 (9.0)	12 (11.4)
Referring cytology		
ASC-US	2 (1.8)	6 (5.7)
AGC, endocervical	1 (0.9)	0
ASC-H	4 (3.6)	3 (2.9)
AGC "favor neoplastic," endocervical	7 (6.3)	4 (3.8)
LSIL	36 (32.4)	33 (31.4)
HSIL	60 (54.1)	57 (54.3)
Other	1 (0.9)	2 (1.9)
Colposcopic findings		[1]
Normal	16 (14.4)	17 (16.3)
Minor changes	35 (31.5)	29 (27.9)
Major changes	54 (48.6)	56 (53.8)
Suspicious for invasion	5 (4.5)	0
Nonspecific	0	0
Miscellaneous findings	1 (0.9)	2 (1.9)
Histologic results		
Negative for dysplasia	24 (21.6)	28 (26.7)
CIN I	24 (21.6)	21 (20.0)
CIN II	13 (11.7)	12 (11.4)
CIN III	48 (43.2)	40 (38.1)
ACIS	0	2 (1.9)
Invasive squamous cancer	2 (1.8)	1 (1.0)
No biopsy	0	1 (1.0)

BMI, body mass index; ASC-US, atypical squamous cells of undetermined significance; AGC, atypical glandular cells; ASC-H, atypical squamous cells cannot exclude high-grade squamous intraepithelial lesions; LSIL, low-grade squamous intraepithelial lesions; HSIL, high-grade squamous intraepithelial lesions; CIN, cervical intraepithelial lesion; ACIS, adenocarcinoma in situ.

Data are n, mean±standard deviation, median (interquartile range), or n (%). Numbers in square brackets indicate the number of missing values.

* Educational level, range 1–8 (1=minimum education required by law, 8=postgraduate education).

the amount of anxiety score reduction in both groups (ΔS of −19.0±11.3 compared with −21.2±10.4, P=.47 in the group of the most anxious patients and 0.0±6.8 compared with −2.7±7.3, P=.15 in the group of least anxious patients). This means that anxious patients have high levels of anxiety both before and after colposcopy, but also lose a high amount of anxiety during the course of colposcopy. They do not, however, benefit from watching the colposcopy live feed. The group of the least anxious patients, interestingly, also lost a significant amount of anxiety during the course of colposcopy, although their absolute anxiety levels both before and after colposcopy were low. They also did not benefit from live video colposcopy. Figure 3 shows box plots of S1 and S2 anxiety scores in the most and least anxious quartiles of patients broken down by study group.

Because patients in the two study centers differed in regard to their anxiety levels before colposcopy, we analyzed the two study centers separately. As shown

Table 2. Primary and Secondary Outcomes

Variable	Group 1, Video Colposcopy	Group 2, No Video Colposcopy	P*
No. of patients	111	105	
STAI-S1 score	51 (42–62)	50 (41–61)	.73
STAI-S2 score	39 (33–50)	40 (33–48.5)	.80
ΔS	−10.3±11.3	−10.3±11.0	.50†
STAI-T score	38 (33–46)	37 (31–44)	.42
Q1: pain during procedure	2 (1–3) [2]	2 (1–4)	.91
Q2: pain 10 min after procedure	1 (0–3) [2]	1 (0–2.5)	.24
Q3: general unpleasantness	3 (1–5) [2]	3 (1–5)	.90
Q4: anxiety during procedure	3 (1–5) [3]	3 (1–5) [3]	.61
Q5: satisfaction with information about procedure	10 (9–10) [2]	10 (9–10) [1]	.88
Q6: overall satisfaction with treatment	10 (9–10) [2]	10 (9–10) [1]	.54
Q7: level of discomfort as a result of live video feed	0 (0–2.75) [3]	NA	
Q8: level of anxiety caused by watching the live video feed	0 (0–2) [4]	NA	
Q9: importance of video colposcopy for understanding cervical disease	9 (8–10) [7]	NA	

STAI, State-Trait Anxiety Inventory; STAI-S1, STAI-S2, situational STAI scores before (S1) and after (S2) colposcopy, respectively; ΔS, difference S2–S1; STAI-T, baseline (trait) STAI score; Q1–9, 11-item visual analog scales (see Materials and Methods section); NA, not applicable.

Data are n, median (interquartile range), or mean±standard deviation. Numbers in square brackets indicate the number of missing values.

* Mann–Whitney *U* test, unless specified otherwise.

† Student *t* test (one-tailed *P* value).

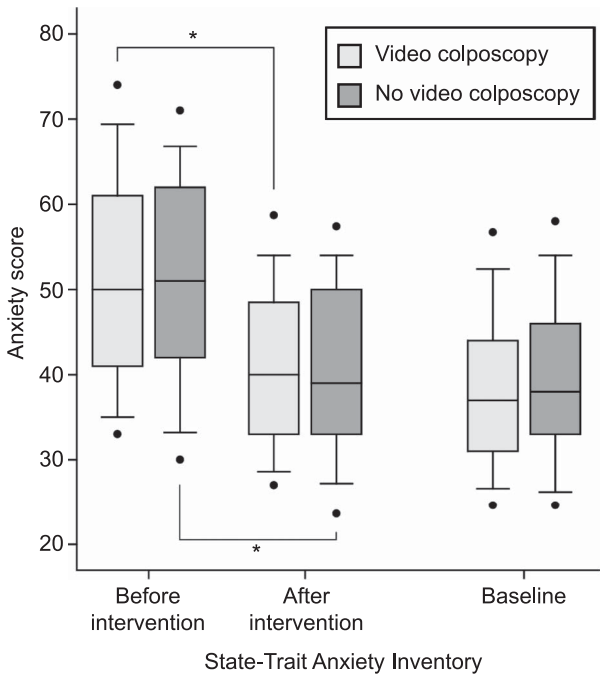

Fig. 2. Box plots showing State-Trait Anxiety Inventory scores for situational anxiety before and after the intervention and scores for baseline anxiety before the intervention in both study groups. *Boundaries* of the boxes indicate the 25th and 75th percentiles; *black lines* within the boxes mark the medians. *Whiskers* and *filled circles* indicate the 10th and 90th and the fifth and 95th percentiles, respectively. Statistically significant differences are indicated. **P*<.001.

Hilal. Video Colposcopy and Anxiety. Obstet Gynecol 2017.

in Table 5, S1 was higher in center 2 compared with center 1 (median 52 [interquartile range 42–63] compared with 48 [41–57]; *P*=.057) as was the amount of anxiety reduction ΔS (mean −11.7±11.5 SD compared with −8.3±10.3 SD; *P*=.025). This effect appears to be triggered by the setting (doctor's practice [center 1] compared with hospital [center 2]) and in part by the higher rate and higher S1 scores of smokers in center 2. However, in both centers, video colposcopy did not reduce ΔS.

Lastly, we asked patients in the live video colposcopy group about their experience with watching the live video feed (Table 2, bottom, questions 7–9). They reported that their level of discomfort resulting from watching the live video feed was negligible (median anxiety level 0; interquartile range 0–2.75) as was their level of anxiety caused by watching the live video feed (median anxiety level 0; interquartile range 0–2). On the other hand, somewhat surprisingly, they rated the importance of the live video feed for understanding the disease very high (median 9; interquartile range 8–10). A corresponding question was not asked of the control (no video colposcopy) group.

DISCUSSION

Women undergoing colposcopy are anxious and interventions aimed at reducing the level of anxiety before and during colposcopy are useful. We performed a prospective, randomized trial comparing video colposcopy and no video colposcopy as

Table 3. Multivariate Analyses

Independent Variable	Multiple Linear (Dependent: ΔS)	Multiple Logistics (Dependent: ΔS, ≤ vs. > Median=−9.5)
Study group	.69	0.94 (0.53–1.67); .84
Study center	**.028**	1.44 (0.81–2.55); .22
Age	.51	0.98 (0.95–1.02); .28
BMI	**.033**	0.96 (0.90–1.03); .24
Parity	.85	1.03 (0.76–1.41); .85
Allergies	.31	0.95 (0.55–1.63); .84
Smoking	**.025**	1.94 (1.07–3.51); **.029**
Education level*	.78	1.00 (0.85–1.19); .96

OR, odds ratio; BMI, body mass index.
Data are *P* or odds ratio (5–95% CI); *P*.
ΔS was the primary outcome measure (ie, difference between the situational State-Trait Anxiety Inventory scores measured before and after colposcopy).
Bold indicates statistical significance ($P<.05$). The same variables were retained for both the multiple linear and multiple logistics models.
* Educational level, range 1–8 (1=minimal education required by law, 8=postgraduate education).

Table 4. Benefit of Video Colposcopy in Most and Least Anxious Patients

Variable	Most Anxious Patients*	Least Anxious Patients†
No. of patients	55	56
Age (y)	36.4±9.9	37.7±11.3
BMI (kg/m²)	23.53±4.53	24.63±4.16
Parity	1 (0–2)	1 (0–2)
Allergies (yes/no)	26 (47.3)/29	22 (40.0)/33 [1]
Smoking (yes/no)	35 (63.6)/20	20 (36.4)/35 [1]
Education level‡	4 (2–5) [2]	4 (3–6) [1]
STAI-T score	43 (35–54)	30 (26.25–36)
STAI-S1 score	67 (64–71)	35 (32.25–39)
STAI-S2 score	49 (40–54)	32 (28–38)
P (STAI-S1 vs STAI-S2)§	**<.001**	**.016**
ΔS	−20.0±10.8	−1.4±7.1
Video colposcopy	−19.0±11.3 (n=26)	0.0±6.8 (n=27)
No video colposcopy	−21.2±10.4 (n=29)	−2.7±7.3 (n=29)
P (video vs no video)‖	.47	.15

BMI, body mass index; STAI, State-Trait Anxiety Inventory; STAI-T, baseline (trait) STAI scores; STAI-S, situational STAI measured before (S1) and after (S2) colposcopy; ΔS, difference S2–S1.
Data are n, mean±standard deviation, median (interquartile range), or n (%). Numbers in square brackets indicate the number of missing values.
Bold indicates statistical significance ($P<.05$).
* Most anxious patients are those with S1 scores in the top quartile.
† Least anxious patients had S1 scores in the lowest quartile.
‡ Educational level, range 1–8 (1=minimal education required by law, 8=postgraduate education).
§ Mann–Whitney *U* test.
‖ Student *t* test (two-tailed *P* values).

a measure to reduce anxiety associated with this common gynecologic procedure. We found that this is not the case. Video colposcopy is not a meaningful intervention to reduce the level of anxiety among women undergoing colposcopy. In addition, other measures of discomfort such as pain during and 10 minutes after colposcopy, general unpleasantness, anxiety during examination, satisfaction with the information about the procedure, and overall satisfaction were also not positively affected by video colposcopy. Despite the lack of an anxiety-reducing effect, the importance of the live video feed for understanding the disease was rated very highly by the patients. Based on the results of this study, we conclude that video colposcopy should not be regarded as an effective measure to reduce anxiety during colposcopy, but also does not harm patients and is rated highly as an adjunct for patients to better understand cervical dysplasia.

The results of our study are in line with previous data in the literature suggesting that interventions such as sensory focusing and active distraction do not influence pain perception, state anxiety, and affect during colposcopy.[18] Also, the results of our study are in line with those of Kola et al[13] who assessed the effect of video colposcopy on blood pressure as a surrogate of distress during colposcopy. They demonstrated that video colposcopy has varying influences on blood pressure depending on the individual patient's coping style. Obviously, live video colposcopy cannot be used as a one-fits-all intervention to reduce anxiety. However, many patients are interested in the colposcopic image and the postintervention ratings regarding video colposcopy as a measure to better understand the disease were very high in our study. Thus, it seems reasonable to offer video colposcopy to women as a potential tool to underscore transparency and as an attempt to make cervical dysplasia easier to understand for affected women. Also, our study is reassuring in that video colposcopy was not harmful and did not increase anxiety both among very anxious as well as less anxious women.

Because our study had a negative result, we want to emphasize that the study may not have had enough power to detect subtle effects or effects in specific subgroups not identified in this study. However, we can rule out that video colposcopy has a major effect on procedure-associated anxiety.

Freeman-Wang et al[3] performed an observational trial and found that women attending a colposcopy clinic for either diagnosis or treatment experienced

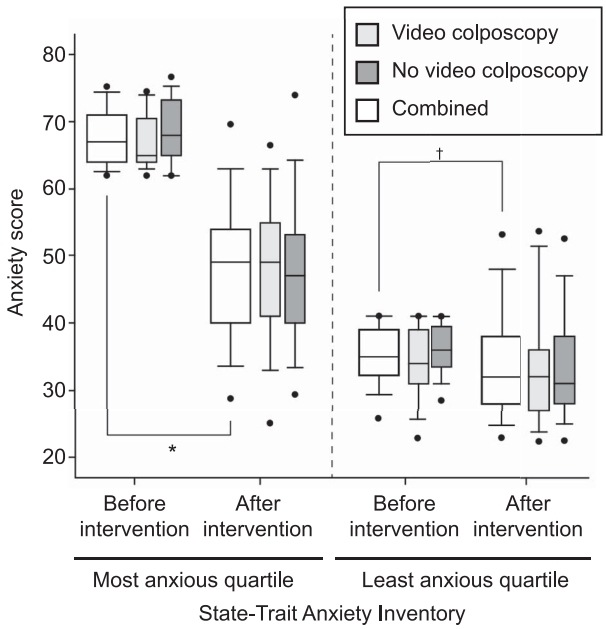

Fig. 3. Box plots showing State-Trait Anxiety Inventory scores for situational anxiety before and after the intervention for the most and least anxious quartiles of patients. *Boundaries* of the boxes indicate the 25th and 75th percentiles; *black lines* within the boxes mark the medians. *Whiskers* and *filled circles* indicate the 10th and 90th and the fifth and 95th percentiles, respectively. Statistically significant differences between before intervention and after intervention for the combined groups are indicated. Note that there were no statistically significant differences between the video group and the no video group before intervention and after intervention in either the most anxious quartile or the least anxious quartile. *$P<.001$; †$P<.05$.

Hilal. Video Colposcopy and Anxiety. Obstet Gynecol 2017.

a high level of anxiety. The highest levels occurred in women attending a one-stop see-and-treat clinic. The introduction of visual information in the form of an explanatory video before attendance significantly reduced anxiety in this study. Based on this observation, it was reasonable for us to hypothesize that letting patients watch a live feed during video colposcopy may also be a way to reduce anxiety during the procedure. However, this was not the case suggesting that visual information is useful to prepare patients for colposcopy but is not beneficial during the examination itself. This lack of an anxiety-reducing effect of video colposcopy was independent of baseline anxiety in our study. Specifically, we found that both the most anxious quartile of patients as well as the least anxious quartile of patients did not benefit from video colposcopy. The most anxious patients had high levels of anxiety both before and after colposcopy, but also lost a high amount of anxiety during the course of colposcopy. They did not, however, benefit from watching the colposcopy live feed. The group of the least anxious patients also lost a significant amount of anxiety during the course of colposcopy, although their absolute anxiety levels both before and after colposcopy were low. They also did not benefit from video colposcopy. In addition, another subgroup of patients with markedly elevated anxiety levels (smokers) also did not benefit from video colposcopy. These subgroup analyses of our study population confirm the lack of an anxiety-reducing effect of video colposcopy across different subsets of patients. Clearly, on the other hand, there is no indication based on our data that it increases

Table 5. Influence of Study Center and Smoking Behavior

	Study Center			Smoking Behavior		
Variable	Center 1 (n=91)	Center 2 (n=125)	*P*	Nonsmokers (n=105)	Smokers (n=110)	*P*
STAI-T	36 (31–44)	39 (33–45)	.23*	37 (29–43)	39 (34–45.25)	**.025***
STAI-S1	48 (41–57)	52 (42.5–63.5)	.057*	49 (40–57.5)	53.5 (45–64)	**.002***
STAI-S2	39 (33–50)	40 (33–49)	.97*	38 (32.5–46)	41 (34–51)	.11*
ΔS	−8.3±10.3	−11.7±11.5	**.025†**	−8.7±11.0	−11.9±11.2	**.037†**
Video colposcopy	−7.4±10.6 (n=46)	−12.3±11.4 (n=65)	**.025†**	−9.3±12.0 (n=60)	−11.4±10.5 (n=51)	.34†
No video colposcopy	−9.2±10.1 (n=45)	−11.1±11.7 (n=60)	**.38†**	−7.8±9.4 (n=45)	−12.3±11.9 (n=59)	**.043†**
P (video vs no video)	.21†	.29†		.49†	.68†	
Smoking (yes/no)	44 (48.4)/47	66 (53.2)/58 [1]	.57‡	NA	NA	

STAI, State-Trait Anxiety Inventory; STAI-T, baseline (trait) STAI scores; STAI-S, situational STAI measured before (S1) and after (S2) colposcopy; ΔS, difference S2–S1; NA, not applicable.

Data are median (interquartile range), mean ± standard deviation, or n (%). Numbers in square brackets indicate the number of missing values.

Bold indicates statistical significance ($P<.05$).

* Mann–Whitney *U* test.

† Student *t* test (two-tailed *P* values).

‡ χ^2 test.

anxiety during or after colposcopy. Therefore, video colposcopy may be used in clinical practice and may be useful and appreciated by patients for demonstration and educational purposes.

REFERENCES

1. Bosgraaf RP, de Jager WC, Servaes P, Prins JB, Massuger LF, Bekkers RL. Qualitative insights into the psychological stress before and during colposcopy: a focus group study. J Psychosom Obstet Gynaecol 2013;34:150–6.
2. Hellsten C, Sjöström K, Lindqvist PG. A prospective Swedish cohort study on psychosocial factors influencing anxiety in women referred for colposcopy. BJOG 2007;114:32–8.
3. Freeman-Wang T, Walker P, Linehan J, Coffey C, Glasser B, Sherr L. Anxiety levels in women attending colposcopy clinics for treatment for cervical intraepithelial neoplasia: a randomised trial of written and video information. BJOG 2001;108:482–4.
4. Kola S, Walsh JC. Determinants of pre-procedural state anxiety and negative affect in first-time colposcopy patients: implications for intervention. Eur J Cancer Care (Engl) 2012;21:469–76.
5. Rogstad KE. The psychological impact of abnormal cytology and colposcopy. BJOG 2002;109:364–8.
6. Bertram CC, Magnussen L. Informational needs and the experiences of women with abnormal Papanicolaou smears. J Am Acad Nurse Pract 2008;20:455–62.
7. Chan YM, Lee PW, Ng TY, Ngan HY, Wong LC. The use of music to reduce anxiety for patients undergoing colposcopy: a randomized trial. Gynecol Oncol 2003;91:213–7.
8. Marteau TM, Kidd J, Cuddeford L, Walker P. Reducing anxiety in women referred for colposcopy using an information booklet. Br J Health Psychol 1996;1:181–9.
9. Howells RE, Dunn PD, Isasi T, Chenoy R, Calvert E, Jones PW, et al. Is the provision of information leaflets before colposcopy beneficial? A prospective randomised study. Br J Obstet Gynaecol 1999;106:528–34.
10. Byrom J, Clarke T, Neale J, Dunn PD, Hughes GM, Redman CW, et al. Can pre-colposcopy sessions reduce anxiety at the time of colposcopy? A prospective randomised study. J Obstet Gynaecol 2002;22:415–20.
11. Chan YM, Lee PW, Ng TY, Ngan HY. Could precolposcopy information and counseling reduce women's anxiety and improve knowledge and compliance to follow-up? Gynecol Oncol 2004;95:341–6.
12. Walsh JC, Curtis R, Mylotte M. Anxiety levels in women attending a colposcopy clinic: a randomised trial of an educational intervention using video colposcopy. Patient Educ Couns 2004;55:247–51.
13. Kola S, Walsh JC, Hughes BM, Howard S. Matching intraprocedural information with coping style reduces psychophysiological arousal in women undergoing colposcopy. J Behav Med 2013;36:401–12.
14. Laux L, Glanzmann P, Schaffner P, Spielberger CD. Das State-Trait-Angstinventar (STAI). Theoretische grundlagen und handlungsanweisungen. Weinheim (Germany): Beltz; 1981.
15. Spielberger CD, Gorsuch RC, Lushene RE. Manual for the state-trait anxiety inventory. Palo Alto (CA): Consulting Psychologists Press; 1970.
16. Knight RG, Waal-Manning HJ, Spears GF. Some norms and reliability data for the State–Trait Anxiety Inventory and the Zung Self-Rating Depression scale. Br J Clin Psychol 1983;22:245–9.
17. Bornstein J, Bentley J, Bösze P, Girardi F, Haefner H, Menton M, et al. 2011 colposcopic terminology of the international federation for cervical pathology and colposcopy. Obstet Gynecol 2012;120:166–72.
18. Kola S, Walsh JC, Hughes BM, Howard S. Attention focus, trait anxiety and pain perception in patients undergoing colposcopy. Eur J Pain 2012;16:890–900.