Russian Journal of Anesthesiology and Reanimatology
2026, No. 3, pp. 50–55
https://doi.org/10.17116/anaesthesiology202603150

Effectiveness of virtual reality technology in gynecological surgeries

© O.V. Ryazanova[1, 2], S.M. Makishev[1], N.Yu. Pylaeva[2], D.S. Makisheva[3], A.M. Ioskovich[4, 5]

[1]Saint-Petersburg City Perinatal Center No. 1, Saint-Petersburg, Russia;
[2]Vernadsky Crimean Federal University, Simferopol, Russia;
[3]Medical Technical College of the Federal Medical Biological Agency, Saint-Petersburg Russia;
[4]Shaare Zedek Medical Center, Jerusalem, Israel;
[5]Hebrew University of Jerusalem, Jerusalem, Israel

ABSTRACT

Introduction. Despite minimally invasive nature, hysteroscopic resection is associated with anxiety and pain. Pharmacological agents pose the risk of adverse effects that highlights the relevance of non-pharmacological approaches to reducing perioperative stress.

Objective. To evaluate the effect of virtual reality (VR) technology on anxiety and pain perception in patients undergoing hysteroscopic resection.

Material and methods. A prospective randomized controlled trial included 62 patients (ASA grade I–II) who underwent hysteroscopic resection under spinal anesthesia. Patients were allocated to the control group (n=33) and the VR group (n=29). Anxiety was assessed using the STAI-8 scale. We also analyzed pain intensity, perioperative systolic and diastolic blood pressure, as well as heart rate. Patient satisfaction with anesthesia was evaluated.

Results. The VR group demonstrated significantly lower systolic and diastolic blood pressure and heart rate (p<0.01), as well as lower pain intensity (p<0.05) at the most traumatic stage of the procedure. Six hours postoperatively, anxiety was significantly lower in the VR group (24.1±2.96 vs 35.4±4.1; p<0.05). Patient satisfaction with anesthesia was higher in the VR group (p=0.033).

Conclusion. VR technology in hysteroscopic resection reduces anxiety, pain perception, and severity of hemodynamic response to surgical stress. This approach also improves patient satisfaction with anesthetic management.

Keywords: *hysteroscopic resection, virtual reality, pain, stress, anxiety.*

INFORMATION ABOUT THE AUTHORS:
Ryazanova O.V. — https://orcid.org/0000-0003-2354-8565
Makishev S.M. — https://orcid.org/0009-0009-0291-3149
Pylaeva N.Yu. — https://orcid.org/0009-0007-3004-0088
Makisheva D.S. — https://orcid.org/0009-0003-6006-1403
Ioskovich A.M. — https://orcid.org/0000-0001-6449-0254
Corresponding author: Makishev S.M. — e-mail: dr_mak@bk.ru

TO CITE THIS ARTICLE:

Ryazanova OV, Makishev SM, Pylaeva NYu, Makisheva DS, Ioskovich AM. Effectiveness of virtual reality technology in gynecological surgeries. *Russian Journal of Anesthesiology and Reanimatology*. 2026;3:50–55. (In Russ.). https://doi.org/10.17116/anaesthesiology202603150

Introduction

Hysteroresectoscopy is a leading method in minimally invasive gynecological surgery, enabling not only diagnosis but also effective treatment of various intrauterine lesions [1]. High precision and minimal invasiveness make this technique preferable for surgical interventions. Despite low invasiveness, hysteroresectoscopy is associated with significant anxiety and increased pain perception in patients [2].

Various medicines, including narcotic analgesics and sedatives, are used to relieve intraoperative pain and reduce anxiety. This is associated with potential complications such as allergic reactions, respiratory depression, nausea, vomiting, and others. These drugs may be unadvisable in patients with comorbidities. In short-term surgical procedures, sedatives may be undesirable due to potential risk of side effects outweighing the expected benefit [2, 3].

In this regard, non-pharmacological methods aimed at improving psychoemotional state of patients without increased medication burden is of particular interest. One such approach is virtual reality (VR) technology that may be a complement to neuraxial anesthesia. VR technology can reduce anxiety and diminish subjective pain sensations through cognitive distraction and creation of a relaxing environment.

The purpose of the study was to evaluate the impact of VR technology on anxiety and pain perception in patients undergoing hysteroresectoscopy.

Material and methods

A prospective randomized controlled trial included 62 patients scheduled for hysteroresectoscopy. All surgeries were performed at the St. Petersburg City Perinatal Center No. 1. The study was approved by the local ethics committee (protocol No. 13 dated December 10, 2025).

Inclusion criteria: women with ASA grade I—II, age 25—45 years, normal vision and hearing. Patients with risk of sei-

zures were excluded (previous epilepsy or severe neurological diseases) (n=2). We also excluded patients with claustrophobia (n=2) and those who refused to participate (n=2). At baseline, 68 patients were eligible. However, 6 ones were excluded in accordance with exclusion criteria. As a result, 62 patients were included in final analysis.

All women were fully informed about objectives, methods, and conditions. All ones signed an informed consent.

Preoperative management included laboratory and instrumental examinations, anesthetic assessment with analysis of functional status and anesthetic risk, premedication, prophylaxis of infectious and thromboembolic complications. Patients were randomized into the control (n=33) and the main groups (n=29).

The main group additionally underwent VR course with Pico 4 goggles **(Fig. 1)**. A video clip demonstrated natural scenes such as sound of sea waves, tropical beaches, and picturesque landscapes. To ensure sanitation, disposable hygienic masks were placed under the headset, and headset itself was disinfected with disposable alcohol wipes.

Spinal anesthesia was administered at the L2—L3 or L3—L4 level with injection of 2% lidocaine solution 2—3 ml (40—60 mg) according to patient height and instructions [5].

In the main group, VR course was initiated one hour before surgery and lasted 15 min. After that, patients delivered to the operating theater. After spinal anesthesia, VR goggles were put back on, and VR course was continued throughout surgery. Postoperatively, women were proposed to continue VR procedures if they desired. In the control group, patients were conscious and adequately anesthetized. Surgery was performed without virtual reality.

We controlled blood pressure (BP), heart rate (HR) and VAS scores of pain at the beginning of surgery, during uterine curettage (the most traumatic moment), at the end of surgery, after 6 and 24 postoperative hours [6].

To assess perioperative anxiety, we used an express version of the State-Trait Anxiety Inventory-8 (STAI-8) scale. The last one was based on the Russian version of the Spielberger-Khanin questionnaire and designed to assess state anxiety in clinical practice [4, 7]. This scale includes 8 questions and allows for quick quantitative assessment of anxiety [4].

Anxiety was assessed at baseline (the day before surgery) and 6 hours after surgery. Patients filled a standardized electronic questionnaire [8]. The total score was converted to equivalent of full-version STAI (range 20—80) using a linear transformation.

We analyzed patient satisfaction with quality of anesthesia using the scale by Sinbukhova E.V. The last one is valuable to assess subjective effectiveness of pain relief, intraoperative emotional state and comfort [9].

Statistical analysis was performed using Jamovi software (version 2.6.25). Distribution normality was assessed using the Shapiro—Wilk test. In case of normal distribution, we applied parametric methods (Student's t-test). Non-parametric distributions required non-parametric methods (Mann—Whitney test). Pearson's χ^2 test was used for categorical data analysis. Differences were significant at p<0.05.

Results

Characteristics of women are presented in **Table 1**.

Analysis of sociodemographic characteristics revealed no significant **differences (Table 2).**



Fig. 1. **PICO 4 virtual reality goggles.**

Table 1. **Characteristics of patients**

Variable	Main group (n=29)	Control group (n=33)
Age, years	32.5±7.4	33.9±4.8
Height, cm	166.2±4.3	168.3±5.9
Body mass, kg	66.4±8.3	68.2±6.8
BMI, kg/m^2	23.1±2.2	23.7±1.6

Note. There were no significant between-group differences (p>0.05).

Table 2. **Socio-demographic characteristics of patients, *n* (%)**

Variable	Main group (n=29)	Control group (n=33)
Marital status (registered marriage)	22 (75.9)	24 (72.7)
Higher education	24 (82.8)	22 (66.7)
Employment	27 (93.1)	28 (84.8)
Children	19 (67.9)	21 (70)
Smoking	13 (46.4)	14 (46.7)
Duration of sleep, h	7.82±1.19	8.33±1.0

Both groups were comparable in key sociodemographic variables, such as marital status, education, employment, number of children, smoking and sleep duration (p>0.05).

Surgery time did not differ significantly (14.3±1.6 and 14.6±1.7 min in both groups, respectively, p=0.64) **Table 3**. There were also no significant differences in previous surgical interventions.

Intraoperative BP and HR are presented in **Table 4**.

At baseline, there were no significant between-group differences in preoperative BP and HR (p>0.05). At the beginning of surgery, systolic BP was significantly lower in the main

group (102.6±8.4 vs. 110.7±6.6 mm Hg, p=0.03). At the most traumatic moment of surgery (curettage), these differences increased even more (96.1±7.4 vs. 108.3±6.4 mm Hg, p=0.0024). A similar trend was observed for diastolic BP.

We observed significant differences in HR. This parameter was significantly lower at the beginning of surgery in the main group (71.3±8.7 vs. 85.4±9.4 bpm, p=0.0018). This difference persisted during curettage (71.1±9.1 vs. 89.2±7.4 bpm, p=0.0021).

There were higher VAS scores in the control group (3.27±1.3 at the beginning of surgery and 3.36±0.9 during curettage) **(Fig. 2)**. In the main group, mean VAS scores were significantly lower (1.45±0.7 and 1.72±0.7, respectively, p<0.05). No significant between-group differences were found at the end of surgery, after 6 and 24 hours (p>0.05).

Table 3. **Characteristics of surgery**

Variable	Main group (n=29)	Control group (n=33)	p
Surgery time, min	14.3±1.6	14.6±1.7	0.64
Previous surgeries, n (%)	19 (63.3%)	18 (60%)	0.45

Dynamics of pain syndrome is presented in **Fig. 2**.

At baseline, STAI-8 scores of anxiety **(Fig. 3)** did not show significant between-group differences (37.2±10.4 and 38.9±8.1 points; p>0.05). However, anxiety was lower in 6 hours after surgery in the main group (24.1±2.96 vs. 35.4±4.1 points, p<0.05) **(Fig. 3)**.

Furthermore, satisfaction was higher in the VR group (10.0 vs. 9.17±1.26 points, p=0.033). This indicates a more comfortable perception of procedure in the main group.

Discussion

VR technology significantly reduces anxiety following hysteroresectoscopy under regional anesthesia. An important result is significantly lower anxiety (STAI-8 scale) in postoperative period (24.1±2.96 vs. 35.4±4.1 points in the control group).

In addition to lower anxiety, VR technology significantly impacted perception of pain. At the beginning of surgery, VAS scores were 1.45±0.7 and 3.27±1.3 points, respectively (p<0.05). During curettage, these differences were stable (1.72±0.7 vs. 3.36±0.9 points, respectively, p<0.05). However, there were no between-group differences in 6 hours after surgery (p>0.05).

Table 4. **Blood pressure and heart rate**

Stage of surgery	Main group (n=29)	Control group (n=33)	p
Systolic BP before surgery, mm Hg	116.4±8.6	119.2±9.3	0.22
Systolic BP at the beginning of surgery, mm Hg	102.6±8.4	110.7±6.6	0.03
Systolic BP during curettage, mm Hg	96.1±7.4	108.3±6.4	0.0024
Systolic BP at the end of surgery, mm Hg	113.3±6.1	115.2±5.9	0.44
Diastolic BP before surgery, mm Hg	72.4±6.6	74.3±5.4	0.48
Diastolic BP at the beginning of surgery, mm Hg	63.3±5.2	71.3±6.2	0.0027
Diastolic BP during curettage, mm Hg	65.4±6.6	72.4±5.8	0.0032
Diastolic BP at the end of surgery, mm Hg	62.7±4.5	65.2±5.2	0.332
HR before surgery, bpm	78.5±8.1	83.2±10.3	0.356
HR at the beginning of surgery, bpm	71.3±8.7	85.4±9.4	0.0018
HR during curettage, bpm	71.1±9.1	89.2±7.4	0.0021
HR at the end of surgery, bpm	75.2±7.2	76.1±7.6	0.328

Note. Significant differences are highlighted in bold.

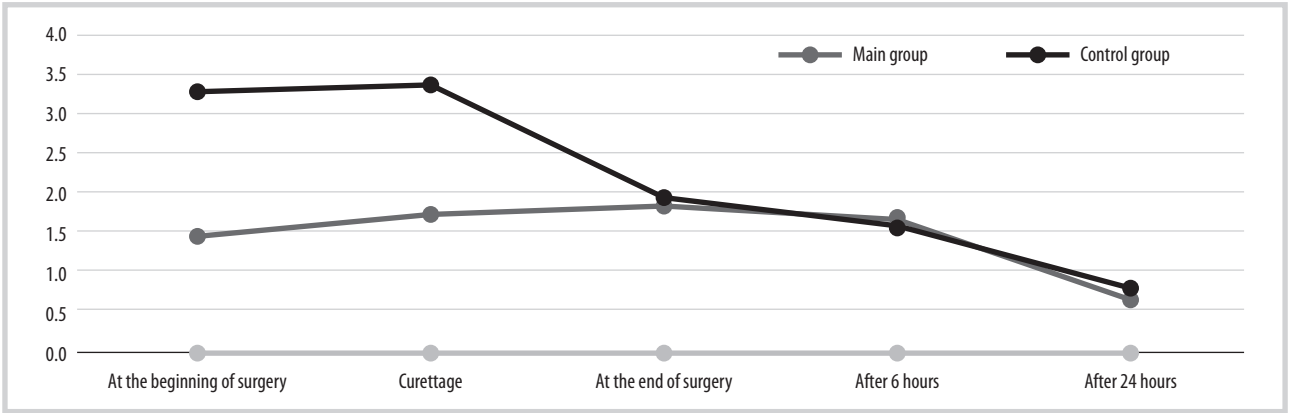

Fig. 2. **Perioperative pain syndrome.**

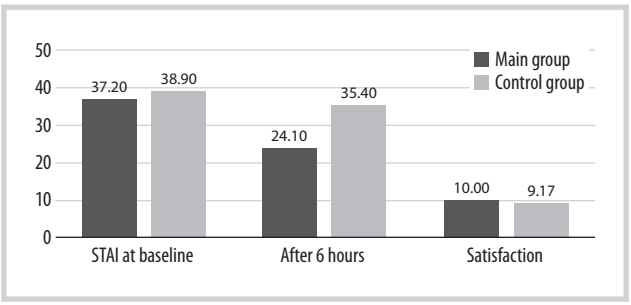

Fig. 3. **Satisfaction with anesthesia and anxiety (STAI-8).**

Pelazas-Hernández et al. [10] described similar results. They examined the effect of VR technology on pain in women undergoing outpatient diagnostic hysteroscopy. Unlike hysteroresectoscopy, diagnostic hysteroscopy is a less invasive and painful procedure. However, the authors found significantly lower pain perception in case of VR technology. Mean VAS scores were 2.45±1.17 and 3.97±0.52, respectively (p=0.006). After 15 min, these values were 1.77±0.49 and 3.30±1.05 (p=0.004), after 30 min — 1.62±0.38 and 2.72±1.15, respectively (p=0.044). Both studies demonstrated a similar trend (lower subjective pain perception following VR technology).

In our study, patient satisfaction with anesthesia (Sinbukhova's scale) in the main group was 10 points (maximum value on this scale). In the control group, this indicator was lower (9.17±1.26, p=0.033). This is consistent with data of a randomized controlled trial conducted by Moon J.Y. et al. [11]. The authors assessed the effectiveness of VR as a non-pharmacological alternative to sedation in patients undergoing endoscopic urological surgery under spinal anesthesia. The authors assessed satisfaction using a five-point rating scale, where 5 points corresponded to the highest satisfaction with anesthesia. About 94.4% of patients gave the maximum score in the VR group, while the group of pharmacological sedation with midazolam demonstrated lower value (63.2%, p=0.042). The same trend was observed in assessments by anesthesiologists (maximum satisfaction with anesthesia in 94.4% of cases in the VR group vs. 42.1% in the sedation group, p=0.001).

Our results and previous studies [12] indicate that VR technology allows patients to subjectively experience more effective pain relief and comfort. Perioperative VR courses in surgery under regional anesthesia can significantly improve subjective perception of anesthetic care. Higher satisfaction among patients and anesthesiologists demonstrates improvement of not only emotional state of patients, but also overall quality of anesthetic care. These data support the feasibility of VR technology in outpatient and minimally invasive surgery as a component of multimodal strategy for patient comfort and safety.

Conclusion

VR technology in hysteroresectoscopy significantly reduces anxiety, pain perception and stress-associated physiological responses. VR is an effective non-pharmacological method improving patient comfort and satisfaction. Further research should be aimed at exploring the optimal parameters of VR and assessing long-term postoperative effects.

Author contribution:
Concept and design of the study — Ryazanova O.V., Makishev S.M.
Collection and analysis of data — Makishev S.M., Makisheva D.S.
Statistical analysis — Ioskovich A.M., Makishev S.M.
Writing the text — Ryazanova O.V., Makishev S.M., Pylaeva N.Yu.
Editing — Ryazanova O.V., Makishev S.M.

The authors declare no conflicts of interest.

REFERENCES

1. Grosheva MN, Stepanyancz SV. *Gisteroskopiya i gisterorezektoskopiya: razvitie, vozmozhnosti i ogranicheniya*. Luchshaya issledovatel'skaya rabota 2022: Sbornik statej II Mezhdunarodnogo nauchno-issledovatel'skogo konkursa. Petrozavodsk, 15 avgusta 2022 goda. Petrozavodsk: Mezhdunarodnyj tsentr nauchnogo partnerstva «Novaya Nauka»; 2022:208-218. (In Russ.).
2. Vitale SG, Caruso S, Ciebiera M, Török P, Tesarik J, Vilos GA, Cholkeri-Singh A, Gulino FA, Kamath MS, Cianci A. Management of anxiety and pain perception in women undergoing office hysteroscopy: a systematic review. *Arch Gynecol Obstet*. 2020 Apr;301(4):885-894. Epub 2020 Mar 05. PMID: 32140807. https://doi.org/10.1007/s00404-020-05460-2
3. Aydarkhanova DS, Kidralieva AN, Grigoryan NS, Saydazimova FZ. *Profilaktika oslozhnenij pri malykh ginekologicheskih vmeshatel'stvakh*. Sovremennye tendentsii razvitiya nauki i mirovogo soobshchestva v epokhu tsifrovizatsii: sbornik materialov XXII Mezhdunarodnoj nauchno-prakticheskoj konferentsii, Moskva, 29 marta 2024 goda. M.: ANO DPO CRON; 2024:243-248. (In Russ.).
4. Bragin DB, Astakhov AA, Turchaninov AYu, Lebedeva YuV. Express test of situational anxiety in choosing premedication. *Russian Journal of Anesthesiology and Reanimatology*. 2023;(2):65-70. (In Russ.). https://doi.org/10.17116/anaesthesiology202302165
5. Lidokain. Instruktsiya po meditsinskomu primeneniyu. Registr lekarstvennyh sredstv Rossii. (In Russ.). Accessed February 16, 2025. https://www.rlsnet.ru/drugs/lidokain-356
6. Karelov AE, Ryazankina AA, Semkichev VA, Karelov DA, Zabolotskii DV, Kuleva SA. Assessment of pain intensity: tools and their clinical using. Medical Council. 2023;17(11):108-116. (In Russ.)
7. Bragin D, Astakhov AA, Turchaninov AYu. State Anxiety Assessment in Clinical Practice. *Annals of Critical Care*. 2017;(4):47-52. https://doi.org/10.21320/1818-474X-2017-4-47-52
8. Ekspress-test situatsionnoj trevozhnosti (STAI-8). (In Russ.). Accessed December 13, 2025. https://psytests.org/anxiety/stai8-run.html
9. Sinbukhova EV, Lubnin AYu, Danilov GV, Strunina YuV. Patient's satisfaction with anesthesia. *Russian Journal of Anesthesiology and Reanimatology*. 2019;(1):50-56. (In Russ.). https://doi.org/10.17116/anaesthesiology201901150
10. Pelazas-Hernández JA, Varillas-Delgado D, González-Casado T, Cristóbal-Quevedo I, Alonso-Bermejo A, Ronchas-Martínez M, Cristóbal-García I. The effect of virtual reality on the reduction of pain in women with an indication for outpatient diagnostic hysteroscopy: a randomized controlled trial. *J Clin Med*. 2023;12(11):3645. https://doi.org/10.3390/jcm12113645
11. Moon JY, Shin J, Chung J, Ji SH, Ro S, Kim WH. Virtual Reality Distraction during Endoscopic Urologic Surgery under Spinal Anesthesia: A Randomized Controlled Trial. *J Clin Med*. 2018;8(1):2. https://doi.org/10.3390/jcm8010002
12. Ryazanova OV, Makishev SM, Grinenko GV, Pylaeva NYu, Korolev KI, Kolominchuk SA, Nagulmanova MD, Ryazanova AA. The effect of the use of virtual reality technology on the course of the perioperative period during cesarean section. *Messenger of anesthesiology and resuscitation*. 2025; 22(3):38-46. https://doi.org/10.24884/2078-5658-2025-22-3-38-46

Received 19.04.2025
Accepted 12.01.2026