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Contents

Anesthesia's role in reducing psychological trauma amongst women undergoing urgent or emergency Cesarean sections: a qualitative study of stressors and potential solutions

Submission ID

68

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INTRODUCTION

Emergency Cesarean section (CS) is an important predictor of psychological trauma and post-traumatic stress disorder (PTSD) in women.[1] While multiple risk factors including anesthesia-related complications increase this risk, the improved supportive care women receive during CS may alleviate their impact.[2,3] This qualitative study explored and described women's perceptions of stressful and helpful aspects of their interdisciplinary care *immediately before*, *during*, and *immediately after* urgent or emergency (UE) CS. Here we report findings of women's experiences of their anesthesia care. This study was a part of a larger research program aimed at developing an Interdisciplinary Patient Support Tool (IPST) to guide health care providers (HCP) caring for women during CS.

METHODS

Following research ethics board approval and written informed consent, women within 72 hr of UE CS participated in face-to-face, in-depth interviews at our tertiary care hospital. Sampling was purposeful using maximum variation producing a sample that represented the breadth and depth of women's anesthesia, as well as live childbirth experiences, during UE CS. Women were asked open-ended questions about stressful and helpful aspects of the interdisciplinary HCP care they received during their UE CS. Interviews were assisted by a semi-structured guide, member-checking and extensive field notes. Women were asked if they wanted to complete a secondary follow-up interview six weeks after the initial one. Verbatim interviews were analyzed in NVivo12Plus software (QSR International, Burlington, WA, USA) using thematic content analysis.

RESULTS

Thirty-six women were interviewed, 19 of whom also completed the follow-up interview. Participants were almost equally split across parity, term *vs* preterm gestations, and UE CS. We identified five major stressor themes relevant to all disciplines, including anesthesia:
1) *Unpreparedness for CS* (prenatal education did not inform them CS was a possibility, unaware of anesthesia options); 2) *Fear of the operating room* (OR, "the needle," "going to sleep," "being awake," intraoperative/postoperative pain); 3) *Uncertain trust in HCP* (anesthesiologist/resident skills/competency fears, limited prior anesthesia interactions); 4) *Loss of the expected birth experience* (grief over how CS changed birth experience); and, 5) *Inconsistent patient-centred care* (variability in supportive care, structural challenges in the ORs); see Table. Helpful aspects of anesthesia care included anticipatory guidance and continuous support, high-quality surgical anesthesia and efforts made to preserve the birth experience whenever possible.

DISCUSSION

Our findings share women's perspectives on aspects of their anesthesia care that they found stressful and helpful *immediately before*, *during*, and *after* their UE CS. Solutions identified by women will inform the development of an IPST for all HCP during CS. The IPST will be used in ORs within our institution and globally to reduce psychological trauma in women undergoing UE CS.

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Table Quotes for major stressor themes

Theme	Quotes
Unpreparedness for CS	• "*[The emergency CS] is already a stressful situation... then you're bombarded by all of these anesthesia risks on top of it"* (Participant 15) • "*There is a disconnect between [what is taught in] prenatal classes and what is actually [happening] during the birthing process*" (Participant 16)
Fear of the Operating Room	• *"It was a lot [being in the OR]. I just had to mentally protect myself because I was already so… overwhelmed. So I was just like 'you do what you gotta do to let me know if you need me to do anything'"* (Participant 6) • "*I heard from a patient… at another hospital… that the anesthesia didn't work and she felt pain during the CS"* (Participant 9)
Uncertain Trust in Health Care Providers	• "*I don't think any patient wants to know a student [resident] is doing stuff to them"* (Participant 4) • *"I think she was [saying] like, that I was gonna be okay, and then I asked, 'Am I gonna die?' because the resident made me sign something, but I didn't get to read it or anything. I just signed it. So… then it was like, signing, like, my life away or something"* (Participant 35)
Loss of the Expected Birth Experience	• "*It's kind of a sad moment when you're not there [under general anesthesia]… like your child is born… I always imagined skin-to-skin and being able to hold her and… being the first person that she saw so [now I'm] realizing I'm probably going to be the last person she sees today. No one really talked to me about it… I just didn't realize that it would be hours [before I would get to see her]… I wasn't expecting it and afterwards I felt really alone"* (Participant 2) • *"I was totally in the dark until they came through the Recovery Room and then when I heard them mention [how my baby was doing]. That was the first time I knew what was going on"* (Participant 25)
Inconsistent Patient-centred Care	• *"I think the only thing was just to having the information [about my medical records]… because of like them asking the same questions and not knowing who I am and what I have in my file or what happened in the history because I did have my [other] C-section here originally"* (Participant 10) • *"… They kind of just took my husband away from me, and… like that's my support person. Yeah, or [they should have talked] to us both and just say like, 'hey, you're going to stay here, we're going to take her down the hallway, you know, we are going to put you in a suit,' or whatever cause I think he came in later with like a, you know, full suit. But they left him like in the, the room for a few minutes and so I know he was panicked as well"* (Participant 29)

Association between intraoperative fluid balance and vasopressors doses with postoperative complications in liver transplantation: preliminary results from a multicentre cohort study

Submission ID

88

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INTRODUCTION

Liver transplantation (LT) is associated with a high incidence of postoperative complications, including graft dysfunction, acute kidney injury (AKI) and severe complications.[1] The optimal intraoperative hemodynamic management strategy to mitigate these complications remains controversial in LT.[2] A recent systematic review suggested that a restrictive fluid management strategy may improve postoperative outcomes based on low to very low quality of evidence.[3] Few studies reported the effect of intraoperative fluid management strategy on important postoperative outcomes, such as early allograft dysfunction (EAD), AKI, or severe complications. If we are to determine the best intraoperative hemodynamic management strategy, more data

based on pertinent patient-centred outcomes is required. The objective of this study was to measure the association between intraoperative hemodynamic management (fluid balance and vasopressor doses) and postoperative complications following LT such as EAD, AKI, and severe complications. These results would help estimate potential benefits from different intraoperative hemodynamic strategies.

METHODS

We conducted a multicentre cohort study across 6 Canadian and 2 French centres. Each centre included consecutive LT patients over at least 1 year between January 2021 and May 2023. We excluded subsequent LT performed on the same patients during the recruitment period. Our primary outcome was EAD or primary graft non-function up to 7 days after LT. Secondary outcomes included 7-day AKI and severe complications up to hospital discharge (Dindo–Clavien grade III or higher). The exposures of interest were intraoperative fluid balance (intraoperative fluid volume (crystalloids/1.5 + colloids + blood products + transfused cell saver) minus estimated blood loss, expressed in liters) and intraoperative dose of vasopressors (converted in norepinephrine equivalent, expressed in increments of 25 $\mu g \cdot kg^{-1}$). We fitted multivariable mixed models, adjusted for the following confounders: hypotension (area under the curve below a mean arterial pressure of 65 mm Hg), ascites volume, recipient age, sex, body mass index (BMI), model for end-stage liver disease (MELD) score, glomerular filtration rate, hemoglobin level, indication for LT, preoperative organ support, type of donation, donor age, sex, BMI, static cold ischemia time, intraoperative use of phlebotomy, piggyback anastomosis, vasopressin, or blood products and duration of surgery. We reported marginal adjusted risk ratios (aRR) with 95% confidence intervals (CI).

RESULTS

We included 852 patients, of whom 836 had complete data. Participants had a mean age of 54 yr (standard deviation, 12), with 559 (67%) being male. The median MELD was 19 [quartiles = 11, 28]. The incidence of our primary outcome, EAD, was 28%, while the incidence of 7-day AKI and severe complications were respectively 50% and 59%. Neither fluid balance nor vasopressor doses were significantly associated with an increased risk of EAD (aRR, 1.01 [95% CI, 0.97 to 1.06] and aRR, 1.03 [95% CI, 0.99 to 1.06], respectively) or AKI (aRR, 1.01 [95% CI, 0.98 to 1.05] and aRR, 1.01 [95% CI, 0.99 to 1.03], respectively). However, both fluid balance and vasopressors doses were associated with an increased risk of severe complications, with a non-linear relationship observed for fluid balance (P = 0.026; see Figure) and an aRR of 1.03 (95% CI, 1.01 to 1.06) for vasopressor doses.

DISCUSSION

Intraoperative fluid balance and vasopressor doses were not significantly associated with an increased risk of EAD and AKI. However, both were associated with an increased risk of severe complications. Since a restrictive fluid management strategy increases the requirement for vasopressors, and vice versa, it is clinically unlikely that both interventions, aimed at stabilizing hemodynamics, causally increase complications.[4] Despite adjusting for multiple confounders,

including hypotension, our estimates are likely affected by residual confounding, potentially reflecting the clinical complexity of the underlying cases. A clinical trial is needed to disentangle these associations and determine the best intraoperative hemodynamic management strategy for LT.

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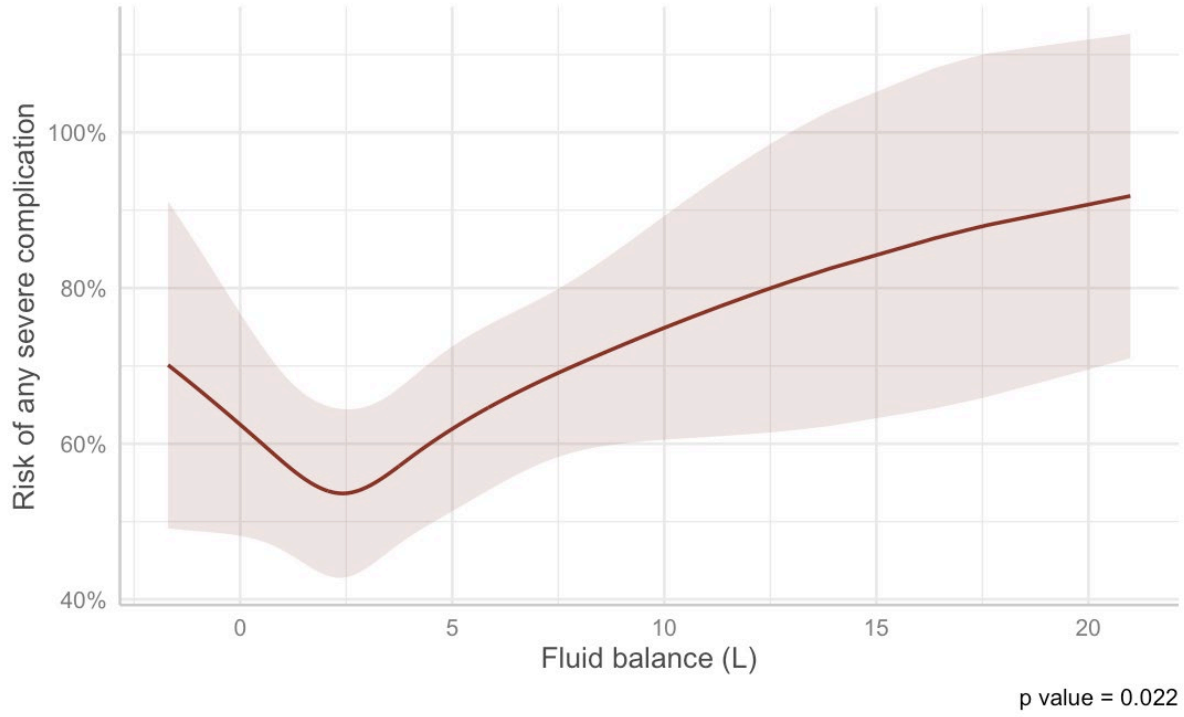
Figure Dose-response curve between fluid balance and the risk of severe complications



Expert consensus on minimum anesthesia requirements for Cesarean (MARC) delivery: a Delphi study

Submission ID

48

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INTRODUCTION

The World Health Organization–World Federation of Societies of Anaesthesiologists (WHO-WFSA) outlined minimal expected standards for safe anesthesia practice, but they lack specificity to obstetric anesthesia.[1] Cesarean delivery (CD) is the most common surgical procedure globally, accounting for 30% of all operations, but lacks minimal expected standards.[2] We aim to achieve expert consensus on the minimal requirements for provision of safe anesthesia for CD in WHO Level 2 facilities in low-middle income countries (LMICs).

METHODS

With ethics approval an international consensus study was conducted via a modified Delphi process. A panel of 27 experts with geographic representation from all 6 WHO regions developed a preliminary list of requirements extracted from existing international guidelines. Preliminary requirements were grouped as 1) anesthesia personnel, 2) drugs, 3) airway management, 4) patient monitoring, and 5) institutional requirements. Experts completed each Delphi questionnaire and attended round-table meetings where data were reviewed and interpreted. Participants rated requirements, using a 5-point Likert scale, ranging from “extremely important” to “not at all important” for the provision of safe anesthesia for a CD. Any requirement rated as highly recommended (≥ 75% rated as “extremely important” or “very important”) or rated by ≥ 75% of participants as “slightly important” or “not important at all” reached consensus agreement for inclusion or exclusion.

RESULTS

All experts participated in each Delphi round. Table 1 lists all requirements that were considered over 5 rounds of voting and round-table discussions. Thirteen medications or class of medications, 10 airway tools, 4 patient monitors, and 7 institutional needs were considered

minimal requirements for safe anesthesia for CD. Regarding anesthesia personnel, the panel consensus was that a subspecialized obstetric anesthesiologist does not need to be responsible for anesthesia care, spinal anesthesia should only be provided by anesthesia providers with competency in general anesthesia, and any anesthesia provider (physician, nonspecialist physician, or nonphysician) who has completed training recognized in their own country and is deemed competent in providing neuraxial and general anesthesia with endotracheal intubation can be solely responsible for anesthesia care for CD.

DISCUSSION

International expert consensus on the minimum requirements for provision of anesthesia for CD at Level 2 health care facilities in LMICs includes a list of essential medications, airway management equipment, safe monitoring, and institutional requirements for neuraxial and general anesthesia. There was also consensus that any anesthesia provider who has completed training recognized in their jurisdiction and deemed competent in providing both neuraxial and general anesthesia can be solely responsible for anesthesia care for CD.

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Table Results of Delphi rounds for drugs, airway management, patient monitoring, and institutional requirements

Table 1

Consensus to include | Consensus to exclude | Advance to the next round | Non-consensus

	Delphi 1	RT1	Delphi 2	RT2	Delphi 3	RT3	Delphi 4	RT4	Delphi 5	FINAL
Drugs										
Induction Agents (e.g. Propofol, Thiopentone, Ketamine, or Etomidate)										
Vasopressor Agents (e.g. Ephedrine, phenylephrine, or equivalents)										
Vasopressor Agents – specifically Epinephrine										
Anticholinergics (e.g. Atropine or Glycopyrolate)										
Muscle Relaxants (e.g. Succinylcholine or Rocuronium)										
Local anesthetic solutions suitable for epidural anesthesia										
Local anesthetic solutions suitable for spinal anesthesia										
Uterotonics (e.g. Oxytocin, Methergine, and Misoprostol)										
Uterine Relaxation medications (e.g. Nitroglycerine)										
Antihypertensives (e.g. Labetolol or Esmolol)										
Muscle Relaxant Reversal Agents (e.g. Neostigmine or Sugammadex)										
Co-induction agents (e.g. Midazolam)										
Lipid emulsion										
Malignant Hyperthermia Treatment (e.g. dantrolene)										
Tranexamic Acid										
Magnesium Sulfate										
Volatile Anesthetic Agents										
Opioids										
Calcium Gluconate										
Sodium Bicarbonate										
Airway Management										
Functional laryngoscope handles with working blades										
Appropriately sized endotracheal tubes size										
Appropriately sized supraglottic airway device										
Appropriately sized supraglottic airway device with gastric drain										
Oropharyngeal airways										
Secure oxygen supply										
Suction source available										
Appropriately sized facemask										
Equipment suitable for surgical airway										
Bougie										
Video-laryngoscope										
Nasogastric Tube										
Patient Monitoring										
Continuous pulse oximetry										
Apparatus to measure blood pressure										
Electrocardiography										
ETCO2 monitoring (Capnography)										
Apparatus to measure temperature										
Agent-specific anesthetic gas monitor when inhalational agents are used										
Peripheral nerve Stimulator										
Intra-arterial blood pressure monitor										
Institutional Requirements										
O negative blood (whole blood or packed cells) available										
Spinal needle										
Pencil-point spinal needles										
Epidural needles and catheters										
Monitored PACU bed										
Monitored ICU bed										
Manual ventilation bag / Ambu bag										
Active or passive scavenging of anesthetic gases										
Ultrasound										
Warming device										
Infusion pumps										
Anesthetic Gas Machine										
Arterial gas analysis equipment										
Fluid warmer										
Rapid infusion device										

Measurement of extubation forces generated by inflated *versus* deflated tracheal tube cuffs in a porcine larynx model

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15

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INTRODUCTION

Conflicting strategies for tracheal tube cuff management during extubation have been reported in the literature. Extubation with the cuff inflated has been proposed to carry secretions away from the glottis[1,2] and reduces aspirate volume in dogs.[3] However, excessive extubation forces from inflated cuffs may confer the risk of laryngeal trauma including arytenoid dislocation, vocal cord damage or long term sequellae such as laryngotracheal stenosis. Limited data is reported regarding the magnitude of glottic forces generated with airway management. One clinical study of stylet use found that forces exceeding 10 N during stylet removal are associated with post-operative sore throat.[4] A prior study on a plastic manikin model demonstrated that extubation with the cuff fully inflated resulted in significantly higher forces than both partial or full cuff deflation.[5] The purpose of this study was to quantify the extubation forces generated by differing cuff deflation techniques using an *in vitro* animal larynx model.

METHODS

This *in vitro* animal model study was approved by the Dalhousie University Committee on Laboratory Animals (protocol #I23-29). Two larynx specimens from food grade pigs, weighing 60–68 kg, were obtained from a local abattoir and frozen until testing. After thawing, each larynx was sutured to a low friction roller base plate on a custom test fixture with an inline load cell (BTE 50N digital force gauge). The mid-trachea diameter for each porcine larynx was measured using digital calipers (Mastercraft, 58-6800-4). Testing was performed using standard 7.0 mm ID Shiley Hi-Lo cuffed endotracheal tubes (Covidien). Extubation forces were measured for three different cuff conditions; fully deflated, fully inflated (cuff pressure set to 30 cm H_2O using a manometer), and with the pilot tubing broken by snapping the tubing immediately before extubation. The peak extubation force was recorded during manual tracheal tube extraction which was performed at a clinically relevant rate by an experienced staff anesthesiologist. A total of 36 tracheal extubation tests were performed. Peak extubation force data was analysed using a two-way analysis of variance with the Holm–Sidak correction. The level of significance was set to $P < 0.05$.

RESULTS

The mid-trachea diameters of the two porcine specimens used for testing were 15.8 and 15.5 mm. There was no significant difference in peak extubation forces between the two pig larynx specimens ($P = 0.24$). The peak extubation force (mean ± SD) generated with the cuff fully inflated (4.8 ± 0.7 N) was significantly higher than the cuff partially deflated (3.3 ± 0.5 N; $P < 0.001$) and fully deflated condition (3.4 ± 0.6 N; $P < 0.001$). We were unable to detect a difference in peak extubation forces between partial and fully deflated cuffs ($P = 0.92$). No gross structural damage was observed by visual inspection in either larynx specimen after the completion of testing.

DISCUSSION

Laryngeal forces generated by full and partial cuff deflation during extubation were equivalent and significantly lower than extubation with fully inflated cuffs. The forces generated by partial cuff deflation (min-max range 2.6 to 4.3 N) were below the clinical 10 N threshold for a sore throat after stylet extraction.[4] This *in vitro* study is limited due to the lack of vocal cord adduction forces which may be present in a patient emerging from anesthesia. These results in an animal model provide further evidence towards the safety of using a partial cuff deflation technique during extubation,[1–3,5] allowing for future human clinical trials of this technique.

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Single shot thoracic paravertebral block in video-assisted thoracic surgery lung resection: a single-centre retrospective before-and-after study

Submission ID

47

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INTRODUCTION

Thoracotomies are known to cause significant postoperative pain, but this may also be true for video-assisted thoracic surgery (VATS).[1] Moderate-to-severe pain after thoracic surgery negatively impacts recovery and may lead to persistent postoperative pain.[2] The 2019 Enhanced Recovery After Surgery (ERAS®) Society Guidelines suggested that thoracic paravertebral blockade (TPVB) provides equivalent analgesia and less side effects versus thoracic epidural analgesia.[3] Recent PROSPECT guidelines strongly recommend the use of regional anesthesia for VATS, specifically TPVB.[4]

The historical analgesic practice for VATS procedures at our institution was surgeon-performed intercostal nerve blocks (ICNB). In October 2023, ICNB needles became unavailable due to failed validation testing, leading to a transition toward TPVB for VATS analgesia. The aim of this study was to measure analgesic outcomes for VATS after implementation of TPVB and to compare them to ICNB. We postulate that TPVB will provide better analgesia and a longer duration of action when compared to ICNB.

METHODS

The recall of ICNB needles led to a well-defined transition for a single-centre retrospective cohort study comparing ICNB and TPVB. Following Research Ethics Board approval (Foothills Medical Centre, Calgary, AB, Canada), chart review of adult VATS lung resection patients between August 2023 and February 2024 was conducted. We excluded patients with chronic pain, conversion to thoracotomy, pleurectomy and patients who received both analgesic blocks.

Thoracic paravertebral blockades were performed preoperatively by anesthesiologists using an ultrasound-guided single-shot approach with 20 mL of bupivacaine at the T5–6 or T6–7 paravertebral space. Intercostal nerve blocks were done by surgeons at the end of the surgery under VATS visualization. Postoperative follow-up was conducted by the thoracic surgery team with identical ERAS order sets including scheduled acetaminophen and ketorolac with as needed hydromorphone. All patients received intraoperative dexmedetomidine infusions. The

primary outcome was pain scores during the first 24 hr. Recovery and pain related secondary outcomes were obtained from intraoperative, postanesthesia care unit (PACU), and postoperative records.

Sample size calculation was based on VATS pain scores reported by Turhan *et al*.[5] As such, we included 30 patients charts in each group. Predicted visual analog scale (VAS) pain scores from linear mixed models are presented as mean. Surgical characteristics and opioid consumption are presented as median [IQR] morphine milligram equivalent (MME).

RESULTS

Patient and surgical characteristics were similar between groups. Linear mixed model predicted pain scores were 4.0, 3.1, 2.8, 3.6, 2.9 and 3.9, 3.0, 3.7, 4.3, 3.4 at 0, 6, 12, 18, and 24 hr for TPVB and ICNB groups, respectively. Pain was significantly reduced at 12-hr in TPVB patients compared to ICNB as noted by a significant interaction between TPVB and postoperative time ($P = 0.027$).

Postoperative day 1 opioid consumption was 27.5 [19.4–59.4] and 45.0 [23.8–93.8] MME in TPVB and ICNB patients, respectively ($P = 0.131$). Seventy-three-point-three percent of TPVB patients were discharged postoperative day 1 compared to 50.0% of ICNB patients ($P = 0.063$). No difference between groups was found in PACU outcomes of peak VAS, opioid consumption, PACU duration, or postoperative nausea and vomiting. Intraoperative fentanyl use was greater in ICNB (200 μg [150–250]) patients compared to TPVB (150 μg [88–200]) patients ($P = 0.029$).

DISCUSSION

The key finding of our study is that TPVB, even if done before surgery, appeared to have a prolonged analgesic effect compared to ICNB in the setting of ERAS and multi-modal analgesia. The anatomical difference and higher local anesthetic absorption seen with ICNB could explain the identical initial analgesia but shorter duration of action. Further prospective studies are needed to explore the trends of reduced opioid consumption and length of stay. Patient-centred outcomes such as Quality of Recovery-15 score or incidence of persistent postoperative pain, often underestimated in VATS, would also be helpful to assess differences between the two blocks.

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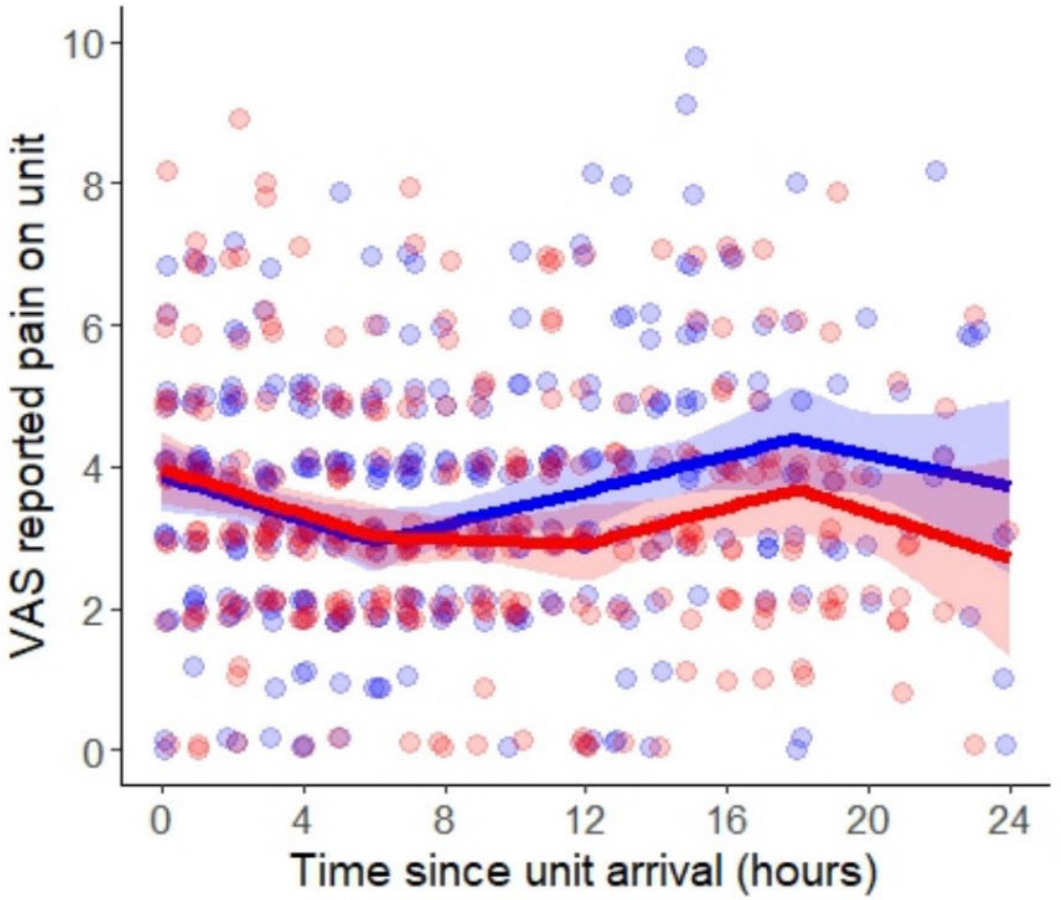
Figure Visual analog scale reported pain up to 24 hr post-unit arrival in intercostal nerve block (blue) and paravertebral block (red) patients



VAS = visual analog scale

The impact of virtual reality on patient satisfaction during ambulatory hysteroscopy: a prospective, randomized controlled trial

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INTRODUCTION

Virtual reality (VR) is a computer-generated 3D simulation delivered via a head-mounted display, shown to reduce pain and anxiety during various medical procedures. However, robust evidence supporting VR as an adjunct to standard care is lacking, particularly regarding its impact on patient satisfaction.[1,2] We hypothesized that using immersive VR during ambulatory hysteroscopy under sedation would improve patient satisfaction, as measured by the Iowa Satisfaction with Anesthesia Scale (ISAS), by at least 20% (mean difference, 0.6).

METHODS

Following ethics committee approval (The University of British Columbia, Vancouver, BC, Canada) and clinical trial registration, patients undergoing ambulatory hysteroscopy under monitored anesthetic care were randomized 1:1 to VR or control group. The VR group received usual care plus an intraoperative immersive VR experience. Virtual reality (Oculus Rift®, Oculus VR, Menlo Park, CA, USA) was administered by a head-mounted device displaying a kaleidoscope effect of colours and shapes teamed with meditation music (Cosmic Flow, Dmitri Medvedev, Raleigh, NC, USA). The primary outcome was mean difference in ISAS scores between groups analyzed by unpaired *t* test. Secondary outcomes included mean difference in patient self-rated anxiety scores, total intraoperative fentanyl and midazolam dose required, intraoperative changes in hemodynamics, proportion of patients wishing to use the technology again and their self-rated immersion perception score (0 = not immersed, 10 = completely immersed).

RESULTS

Data from a total of 185/192 patients (mean age, 39.9 yr) were analyzed. There was no significant difference between the mean ISAS scores between the VR group (3.75) and the

control (3.77) group (mean difference, 0.02; 95% confidence interval, −0.10 to 0.14; *P* = 0.15) (Figure). We also found no significant difference in all other secondary outcomes. The median [IQR] immersion perception score of the VR system was 7 [5–8], indicating most of the patients felt immersed in a virtual environment, with 96.2% of all VR patients indicate they would use the technology again in future procedures.

DISCUSSION

In patients undergoing ambulatory hysteroscopy with monitored anesthetic care, immersive VR did not improve patient satisfaction or significantly affect sedation requirements or hemodynamic changes. The passive nature of the VR program used may have influenced these outcomes,[3] highlighting the need for future research to explore the potential impact of interactive VR experiences.

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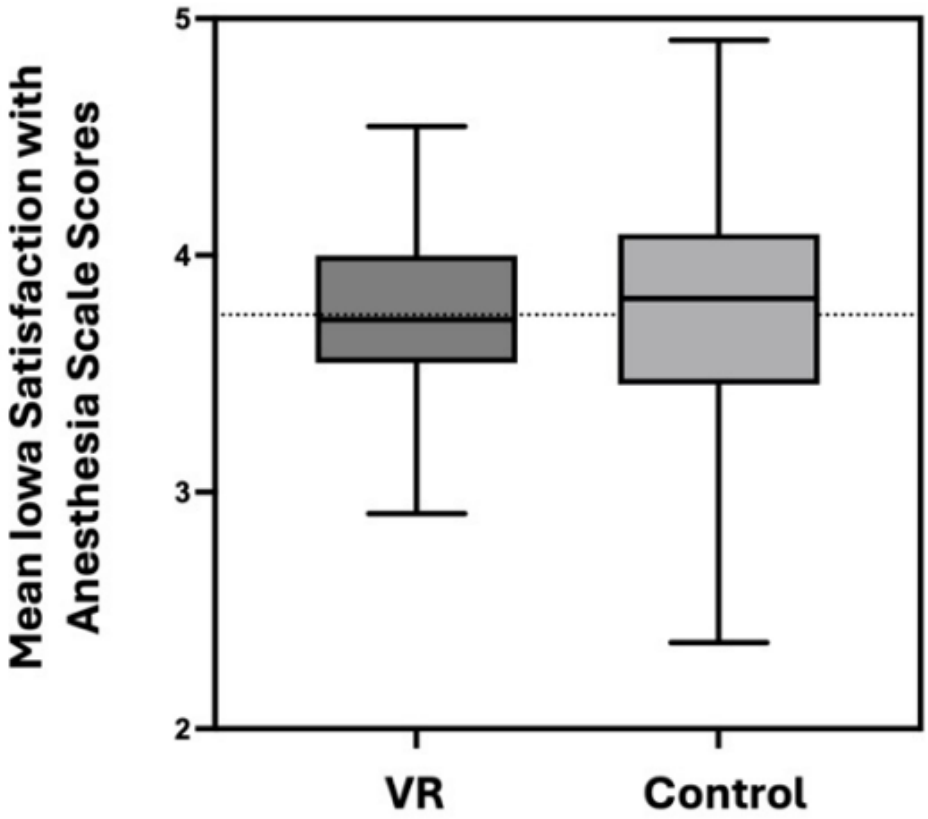
Figure The mean Iowa Satisfaction with Anesthesia Scale score is calculated by taking the mean of the patient's responses to each of the 11 statements



The box-and-whisker plot illustrates the distribution of average ISAS scores across virtual reality and control groups. The box represents the interquartile range [IQR], with the lower and upper edges indicating the 25th and 75th percentiles, respectively. The horizontal line within the box denotes the median. The whiskers extend to the smallest and largest values within 1.5 times the IQR from the box edges.

IQR = interquartile range; ISAS = Iowa Satisfaction with Anesthesia Scale; VR = virtual reality