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Original contribution

# The impact of anesthesia on hemodynamic and volume changes in operative hysteroscopy: a bioimpedance randomized study☆,☆☆,★

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**Abstract**

**Background:** Operative hysteroscopy is accompanied by the use of distention medium. Its absorption can lead to volume overload and hemodynamic disturbances that can lead to serious complications. We investigated the impact of the type of anesthesia on decreasing these complications with the use of noninvasive thoracic bioimpedance.

**Design:** A prospective, randomized, blind study.

**Method:** Sixty women, with American Society of Anesthesiologists classifications I-III, undergoing operative hysteroscopy were randomly allocated into 2 groups. Spinal anesthesia group received intrathecal 0.5% hyperbaric bupivacaine 12.5 mg and 25 μg fentanyl; the other group received general anesthesia with intravenous analgesia, propofol, and rocuronium followed by endotracheal intubation. Total glycine absorption, cardiac output, systemic vascular resistance, thoracic fluid content (noninvasive thoracic bioimpedance), and serum sodium were measured.

**Results:** Women in the general anesthesia group showed more significant changes in the total glycine absorption, thoracic fluid content, and hemodynamic parameters. Serum sodium decreased significantly postoperatively in the general anesthesia group.

☆ Brief statement: We conducted this study to search for an appropriate anesthetic technique during operative hysteroscopy that could decrease complications associated with glycine absorption such as volume overload, and hemodynamic and electrolyte disturbance. This was detected by the use of noninvasive thoracic bioimpedance intraoperatively.

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[1] Conflict of interest: The conflict in beginning our study was to find an appropriate noninvasive method for measuring hemodynamic and volume changes intraoperatively in women undergoing operative hysteroscopy that was solved with the bioimpedance device that provided us with simple and accurate measurements. During the course of the study, no conflicts of interest were reported.

[2] Conflict of interest: Ahmed El Attar reported no conflict of interest.

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**Conclusion:** Spinal anesthesia is associated with less glycine absorption, less thoracic fluid load, better control of hemodynamics, and better patient satisfaction in operative hysteroscopy.


## 1. Introduction

Operative hysteroscopy is usually done under general anesthesia (GA). Chest problems, unstable hemodynamics, delayed recovery, and anaphylactic reactions may complicate GA and increase the operative risk [1].

Spinal anesthesia (SA) is often recommended as a safe choice over GA. The hemodynamic benefits of SA include a minimum decrease in myocardial contractility and only modest decreases in blood pressure and cardiac output (CO) [2].

The increased absorption of the irrigating electrolyte-free glycine solution can lead to volume overload, water intoxication, hyponatremia, brain or pulmonary edema, visual disturbances, and even death in severe cases. Good monitoring of fluid balance, control of irrigation pressure, and optimum preparation of the endometrium can decrease excessive glycine absorption [3-5].

Thoracic electrical bioimpedance (TEB) retains the significant capability of assessing severely hyperhydrated and dehydrated patients and detecting pulmonary fluid and pleural effusions [6].

TEB technology depends on detecting changes in impedance to small electrical currents. The change in thoracic blood volume causes changes in impedance between the 8 electrical patches placed on the neck and the thorax of the patient. It was considered as a simple and rapidly reproducible noninvasive technique that allows easy determination of CO, stroke volume (SV), systemic vascular resistance (SVR), acceleration index (ACI), and thoracic fluid content (TFC) [7,8]. TEB measurements of CO are comparable with those obtained with other techniques such as thermodilution, esophageal Doppler, and dye dilution [9,10]. The TFC parameter is the inverse of baseline impedance ($Z_0$) that is directly proportional to the amount of conductive material in the thorax [11].

Recently, the type of anesthesia has been considered as an important factor that could affect fluid absorption, and choosing the appropriate and safe anesthetic technique is the debate for many researchers [3]. In this study, we used TEB for hemodynamic and volume changes monitoring in patients undergoing operative hysteroscopy, comparing the impact of the anesthetic technique on circulatory glycine load and the incidence of adverse effects. The primary outcome was the effect of anesthesia type on the mean glycine absorption, and the secondary outcome was the effect of anesthesia on the hemodynamics, TFC, serum sodium, and patient satisfaction.

## 2. Methods

This prospective, randomized, single-blind study consisted of 60 women (20-70 years), with American Society of Anesthesiologists (ASA) classifications I-III, who underwent an operative hysteroscopy for abnormal uterine bleeding performed by the same surgeon at Alexandria University Hospital. Exclusion criteria included any contraindication to hysteroscopy, GA, or SA.

This study was initiated after approval of the ethical committee of Department of Anesthesia and Surgical Intensive Care, Medical Research Institute, Alexandria University. Written informed consent was obtained from all women before the start of surgery after explaining the procedure and the adverse effects of both GA and SA. The study was registered with the Pan African Clinical Trial Registry with registration number PACTR201408000833217. On the day of surgery, eligible patients were randomly allocated into 2 groups, GA group and SA group, each with 30 patients, using prenumbered sealed and opaque envelopes that were arranged by an assistant not involved in the study. Patients were stratified based on patient's menopausal age and preoperative use of endometrial thinning agents. Sequence and numbers of randomization were computer generated.

A physician blinded to the type of anesthesia carried out blood sampling, fluid estimation, and data measurements and recording.

The day before surgery, all patients were evaluated with a full medical history, clinical examination, routine investigations, and ECG.

Blood samples were obtained for serum sodium and hemoglobin upon arrival to the operation room and 2 hours postoperatively.

Patients in both groups received premedication with intravenous (IV) midazolam 0.05 mg/kg 1 hour before surgery. Normal saline bolus infusion of 6 mL/kg was given, and then maintenance fluid was infused until the end of surgery. TEB changes were measured with the noninvasive continuous CO monitor (Model NICCOMO; Medizinische Messtechnik GmbH, Germany). Four pairs of TEB electrodes were placed: 2 pairs opposite each other in the lower anterior cervical region and 2 pairs in the 8th to 11th thoracic interspace in the midaxillary line.

Hemodynamic parameters obtained included CO, SV, TFC, SVR, and ACI. Noninvasive mean arterial blood pressure (MABP), arterial oxygen saturation, heart rate, and axillary temperatures were measured by the same monitor.

Baseline hemodynamic measurements were obtained before induction of anesthesia, then every 5 minutes thereafter until the end of surgery, every 15 minutes postoperatively for the first 2 hours, and every hour until the end of 8 hours postoperatively.

In the GA group, IV induction was done using 1 μg/kg fentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium followed by endotracheal intubation. Anesthesia was