



# Minimally invasive anesthesia for laparoscopic hysterectomy: a case series

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## Abstract

**Purpose** Regional anesthesia (RA) is considered as a “minimally invasive technique” to achieve anesthesia. To assess the feasibility and the perioperative outcomes of laparoscopic hysterectomy in regional anesthesia from the point of view of the surgeon, anesthesiologist and patient.

**Methods** A retrospective search was performed to identify patients who underwent laparoscopic hysterectomy under RA from April 2020 to September 2021. Five patients affected by benign gynecological disease (atypical endometrial hyperplasia or uterine leiomyomas) were included.

**Results** The postoperative pain, nausea, and vomiting (PONV) and the antiemetic/analgesic intake were evaluated. Postoperative surgical and anesthesiological variables were recorded.

Duration of surgery was  $84 \pm 4.18$  and no conversion to GA was required. According to VAS score, the postoperative pain during the whole observation time was less than 4 (median). A faster resumption of bowel motility ( $\leq 9$  h) and patient’s mobilization ( $\leq 4$  h) were observed as well as a low incidence of post-operative nausea and vomit. Early discharge and greater patient’s satisfaction were recorded. Intraoperatively pain score was assessed on Likert scale during all the stages of laparoscopy in RA, with only 2 patients complaining scarce pain (=2) at pneumoperitoneum.

**Conclusion** RA showed to have a great impact on surgical stress and to guarantee a quicker recovery without compromising surgical results. RA technique could be a viable option for patients undergoing laparoscopic hysterectomy.

**Keywords** Gynecological surgery · Regional anesthesia · Postoperative pain · PONV · Patient satisfaction

## What does this study add to the clinical work

Regional anesthesia has a positive impact on surgical stress and guarantees a quicker recovery without compromising surgical results. Laparoscopic hysterectomy could be performed under regional anesthesia without compromising the surgical technique.

## Introduction

General anesthesia (GA) is the most common and used technique for laparoscopic hysterectomy, because it controls surgical pain and improves patient comfort [1]; however, it is responsible for different adverse effects in the postoperative period including the need for rescue analgesics and antiemetics [2, 3]. The surgery, performed under regional anesthesia (RA), allows patient being admitted and discharged on the same day or within 24 h, lowering the risk of nosocomial infection, providing cost-effectiveness and earlier mobilization [4, 5].

In addition, in no negligible cases, the expectation of undergoing GA may trigger preoperative anxiety attributable to fear of the unconscious state and to not waking up that can even exceed the anxiety about surgery [6, 7].

Regional anesthesia (RA) from an anesthesiology perspective is considered as a “minimally invasive technique” to achieve anesthesia. SA for the operative laparoscopic

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procedure has been largely applied for cholecystectomy procedures and only few reports are described for appendectomy and gynecological surgery [8, 9]. It is responsible for less surgical stress response, postoperative pain, lower incidence of postoperative nausea and vomiting, and rapid bowel canalization [10]. To date, only few cases on total laparoscopic hysterectomy are described in the literature [1]. The use of Trendelenburg position, worsening pulmonary compliance and generating discomfort for the patient, does not allow to easily apply the data of laparoscopic cholecystectomy on hysterectomy.

The aim of this case series was to report the feasibility and the intraoperative and postoperative outcomes of laparoscopic hysterectomy under RA from the point of view of the surgeon, anesthesiologist and patient.

## Materials and methods

This is a retrospective case series performed in a tertiary level referral center for minimally invasive gynecologic surgery. All medical records of women who were referred to our center and met the inclusion criteria between April 2020 and September 2021 were analyzed.

Women undergone laparoscopic hysterectomy for non-malignant gynecologic conditions such as atypical endometrial hyperplasia and uterine fibromatosis and aged more than 18 years old were included. All patients had received detailed instructions about the pre-operative diet (total daily fiber intake inferior to 10 g, for 7 days prior to the surgery). All patients accepted to undergo SA after an extensive interview with both anesthesiologist and surgeon. No patients suffered from severe coagulopathies or severe cardiovascular diseases, allergy to local anesthetics,  $BMI \geq 35$ , a history of abdominal surgery or psychiatric disorders.

During the preoperative workup, all patients have undergone gynecological examination and a detailed pelvic ultrasound scan by an expert sonographer.

Five patients were included in the analysis.

All the procedures were performed by a single operator (PG) with expertise in laparoscopic gynecological surgery who performed more than 75 procedures per year. The entire procedure was performed so that the patient could be invited to follow it: a high-resolution color video screen was provided to show the intraoperative images. Patients have been informed about every single step of the intervention by both the surgeon and anesthesiologist. During each phase, patients have been asked to score the pain using a Likert scale from 1 to 5.

Baseline demographic and clinical data of the patients included in the study as well as the intra-operative surgical and anesthesiologic variables have been analyzed.

As for a previous study, the following primary outcomes were evaluated:

- postoperative pain through VAS scale;
- postoperative nausea and vomiting (PONV);
- antiemetic/analgesic drugs usage.

As secondary outcomes, we evaluated anesthesia and surgical complications, resumption of bowel motility, time to mobilization, global surgeon and patient satisfaction, intraoperative pain in SA group through Likert scale.

In the operating room, venous access and antibiotic prophylaxis was administered (30 min before skin incision) together with dexamethasone 4 mg iv and midazolam 1 mg. Vital signs as  $SpO_2$ , heart rate and blood pressure were monitored every 5 min.

In the sitting position, SA was performed at the T9–T10 level. The level of puncture was confirmed by ultrasound counting the vertebrae from the sacrum, in a caudo-cranial sense. In the subarachnoid space after the vision of clear cerebrospinal fluid (CSF) in the spinal needle 27 Gauge, without letting out the CSF, Ropivacaine 0.375% 18 mg, Sufentanil 7 mcg, and Clonidine 20 mcg were injected. Intraoperative sedation was carried out with midazolam 0.05 mg/kg and fentanyl 1 mcg/kg when pneumoperitoneum was performed. The anesthetic plane, suitable to the surgical procedure (T1-S4), was tested with the Pinprick and Ice test.

The internal anesthetic protocol for the management of postoperative pain involves the administration of Paracetamol 1000 mg in the case of  $VAS < 5$  and the administration of Ketorolac 30 mg in the case of  $VAS \geq 5$ . In case of inadequate analgesia, after 60 min of the Ketorolac administration, Tramadol 100 mg i.v. is administered. Ondansetron 4 mg i.v. was administered in case of manifestation of PONV. If after 60 min PONV still occurs, dexamethasone 4 mg i.v. is administered. Pneumoperitoneum induction was achieved by open laparoscopy (Hasson technique) in order to avoid the high intraperitoneal pressure, otherwise necessary for the blind insertion of the first trocar, when performing the closed technique (Verres technique). Thus, the procedure was started with a low pressure of 8 mmHg and slowly increased to high flow, and pressure not higher than 11 mmHg was maintained throughout the entire surgery. Patients were placed into a minimal Trendelenburg position (maximum  $16^\circ$ ) able to provide adequate visualization and bowel retraction [9]. Ultrasound energy to cut and coagulate instead of monopolar/bipolar energy was used to perform salpingectomy or adnexectomy allowing to save time and reduce tissue trauma.

## Statistical analysis

Sample characteristics were reported using standard descriptive statistics. Mean  $\pm$  standard deviation (min to max) in case of numerical variables and absolute frequencies and percentages in case of categorical factors. Numerical variables showing highly skewed distribution were described using median with interquartile range (25<sup>th</sup>–75<sup>th</sup> percentile).

## Results

All selected patients underwent surgical laparoscopy under RA.

Baseline demographic and clinical data of the are illustrated in Table 1.

Among the gynecological diseases, 3/5 (60%) had a histological diagnosis of atypical endometrial hyperplasia obtained by hysteroscopic biopsy [11–13] and 2/5 (40%) had uterine fibromatosis.

The median degree of Trendelenburg's position was of 14.2 (range 13–16).

Also, operative time was not significantly different between the five cases and always  $<90$  min ( $84 \pm 4.18$ ). Uterine size was always inferior to a 14-week pregnant uterus with a median weight of 189.6 gr [range 70–400] (Table 2). The hospital length stay was  $<24$  h in all cases (Table 3). Regarding the postoperative pain (Table 4), the patients did not complain noteworthy pain, indeed VAS score was  $<2$  up to 12 h [1.8 (0–3) at 12 h], showing a slight increase at 18 h [3.4 (2–5)], reducing again at 24 h [2.4 (0–7)]. Analyzing the intake of analgesics after surgery, the most requested drug was paracetamol (4 cases), and only 1 patients asked for ketorolac at 12 h. Table 2 also reports the secondary outcomes: only one case of intraoperative hypotension and no surgical complications were evidenced. The resumption of bowel motility was always  $<9$  h ( $7.6 \pm 1.14$ ) while the patient's mobilization occurred quickly ( $3.6 \pm 1.34$ ). The surgeon global satisfaction, described in term of pelvic organ exposure and ability to perform the procedure in relation to the anesthesia used, and the patient satisfaction (patients were asked to answer a closed-ended question upon

**Table 1** Patients' characteristics [BMI: Body Mass Index; ASA: American Society of Anesthesiologists]

Cases	1	2	3	4	5
Age (years)	55	49	50	47	42
BMI	21.7	19	24.6	21.8	25.8
Comorbidity	Thyroid disease	None	None	Thyroid disease	Thyroid disease
ASA	I	II	II	II	I
Gynecological disease	Atypical endometrial hyperplasia	Atypical endometrial hyperplasia	Atypical endometrial hyperplasia	Fibromatosis	Fibromatosis

**Table 2** Surgical outcome and intra operative data

Cases	1	2	3	4	5
Trendelenburg's position (°)	13	13	16	14	15
Operative time (min)	90	80	80	85	85
O <sub>2</sub> saturation (%)	>95	>95	>95	>95	>95
Estimated blood loss (mL)	100	150	100	200	250
Uterus weight (g)	70	83	75	320	400
Anesthesia complications	Hypotension	None	None	None	None
Surgical complications	None	None	None	None	None

**Table 3** Postoperative data and global surgeon/patients satisfaction

Cases	1	2	3	4	5
Resumption of bowel motility (h)	8	6	7	9	8
Mobilization (h)	3	2	3	5	5
Hospital length stay (h)	24	19	22	20	21
Global surgeon satisfaction	Very Good	Very Good	Excellent	Good	Good
General patient satisfaction (would you do the same anesthesia again?)	Yes	Yes	Yes	Yes	Yes

**Table 4** Primary outcomes [VAS: visual analogue scale; PONV: post-operative nausea and vomiting]

	All Cases
VAS score	
0 h	0.2 (0–1)
6 h	1.2 (0–3)
12 h	1.8 (0–3)
18 h	3.4 (2–5)
24 h	2.4 (0–7)
PONV ( <i>n</i> ° (%))	3 (60)
-No	1 (40)
-Yes	
Antiemetic drugs ( <i>N</i> ° patients)	None
Analgesics intake	
Paracetamol 1 gr	
0 h	0 (0)
6 h	2 (40)
12 h	0 (0)
18 h	1 (20)
24 h	1 (20)
Ketorolac 30 mg	
0 h	0 (0)
6 h	0 (0)
12 h	1 (20)
18 h	0 (0)
24 h	0 (0)
Tramadol 100 mg	None

discharge: would you do the same anesthesia again?), were also reported.

Finally, we reported the pain score obtained with the Likert scale, classically divided into 5 points (0: no pain, 5: maximum pain) during the various stages of surgery: introduction of uterine manipulator, introduction Hasson trocar and induction of pneumoperitoneum; introduction of ancillary trocars; exploration of pelvic organs; actual surgical procedure; skin suture. All patients showed a pain score of 1, except for 2 patients with a score of 2 during the induction of pneumoperitoneum.

## Discussion

Given the raising interest on this topic, in literature there are already different published reports proving the suitability of RA for gynecological laparoscopic surgery. However, the analysis is limited principally to cases requiring diagnostic laparoscopy, salpingectomy, adnexectomy, and only in rare occasion myomectomy [14–16].

We report five cases of total laparoscopic hysterectomy using RA. To date, similar case histories are not available in the literature. To the best of our knowledge, laparoscopic

hysterectomy is reported exclusively in one case report [17] and in a case series using the combination of spinal and epidural anesthesia for eight patients [8]. This latter lack of some important data such as intraoperative assessment of pain, surgical technique, uterine weight or length of hospitalization [8].

In our series, four out of five were procedure carried to term without significant issues and only one patient complained PONV.

Therefore, from an anesthesiology point of view, our results have to be considered undoubtedly satisfactory: in four patients SpO<sub>2</sub>, ETCO<sub>2</sub> and respiratory rate remained within normal limit through the entire operative procedure, suggesting that, although the Trendelenburg position (in no cases greater than 16 degrees), thanks to the fact of being awake, patients could adjust their minute ventilation ensuring adequate parameters. Only an intraoperative hypotension (Patient 1) was recorded and was promptly managed with intravenous saline infusion. The stability of the hemodynamic parameter is of outstanding importance in order to ensure the absence of the inhibitory effect of mechanical ventilation and preserve the tone of the diaphragm.

A complete arousal of the patient must be ensured and sedation should thus be reduced as much as possible. For this reason, we consider essential to inform the patient and, peculiarity of our study, to assess procedure's tolerability and the evaluation of the pain during each step of the surgery.

For all the case, the procedure was well accepted: in all steps a maximum of 1 point on the Likert scale (considered a minimal pain) was recorded: only 2 patients reported a score of 2 during the induction of pneumoperitoneum. It must be highlighted that shoulder tip pain is a very common and quite troublesome problem during laparoscopic surgery under RA. This is a referred pain due to the stretching of diaphragm by insufflating CO<sub>2</sub>, as diaphragm is supplied by cervical roots which are spared during regional anesthesia. The use of low-pressure pneumoperitoneum (< 10 mmHg) decreases shoulder pain incidence and severity [18]: thanks to surgeon experience, we worked at low pressure, reaching just in few occasions and for limited seconds higher pressure (never > 12 mmHg).

At the beginning of the surgery, according to Moawad et al. [17], we performed an open (Hasson) entry technique to enter the abdomen, instead of the Veress needle technique, which require a pneumoperitoneum pressure of 25 to 30 mmHg for trocars insertion.

Another important advantage of RA is the long-term analgesic effect, that is crucial to enhance recovery [19]. No woman required intravenous opioid administration and only one required the use of Ketorolac in addition to Paracetamol. Better postoperative pain control can be partly linked the persistent neuraxial blockade. To enhance this

effect, in our study clonidine, an  $\alpha_2$  adrenergic agonist used like an adjuvant in anesthesia, was administered. According to some researchers, the action of  $\alpha_2$ -agonism of clonidine induces vasoconstriction and potentiates the spinal block via synergistic interaction between  $\alpha_2$  receptors and sodium channels, contributing to a prolonged and more effective the analgesia [20, 21]. Furthermore, accordingly to the literature [22], in the postoperative period only one case of PONV was registered, suggesting that RA could reduce this remarkable adverse effect of GA, and no women experienced postoperative urinary retention. At the end of the surgery, the surgical team was questioned about global satisfaction of surgery and giving positive feedback. Although the minimal Trendelenburg grade position, surgeons did not complain about intra-abdominal organs view. In gynecological surgery, the surgical view and the access to the surgical field has always been perceived as a major problem: for these reasons, in the last year, great attention on preoperative bowel preparation has been given [23].

Several authors have failed to identify a benefit of mechanical bowel preparation, moreover it was associated with poor patient' satisfaction and compliance [24]. In our opinion, these results could be called into question in our condition where only a minimal Trendelenburg is consented, raising the risk that bowel could be an important setback for the accomplishment of surgery. According with most surgical scientific organizations [25, 26], our patients did not undergo mechanical bowel preparation before the surgery, however, a minimal residue intake 7 days prior to the surgery was strictly followed by patients on the fact that high residue intake could lead to delay of gastric emptying [27] and may therefore interfere with fecal mass formation by production of gases that in turn could cause bowel distension [28]. We suggest to follow this practice in accordance with Lijoi et al. [29] that showed with this diet the same efficacy of mechanical bowel preparation allowing in the same time a greater compliance and better perioperative patient comfort.

Raimondo et al. reported one case requiring the conversion from SA to GA because of anxiety and agitation; in our case series, no patient required conversion to GA [14]. We highlight the importance to counsel extensively by the surgeon as well as by anesthesiologists on the benefits and risks of undergoing RA. Patient anxiety must be addressed before the surgery with an appropriate counseling. The patients had been accurately selected excluding women with psychiatric comorbidities and, based on our experience, in addition to an accurate anamnesis, a more objective evaluation of the actual status of the patients, through the administration of questionnaire (e.g., *State Trait Anxiety Inventory (STAI)*) prior to the surgery, could be advisable [30].

The results of this case series provide the indication that RA could be considered a valid alternative to GA, not only

for minimally invasive and short-term gynecological procedures [31], but even for longer and more complex gynecological surgery such as hysterectomy procedure. This represents a convincing result, especially if it is considered that a recent review with meta-analysis has demonstrated no significant advantages to using SA over GA for laparoscopic treatment of benign gynecological diseases [32]. On the other hand, a prospective study published by the same Group has reported how RA could be a viable option for well-selected patients affected by benign gynecological diseases [33]. In addition, the use of regional anesthesia is gaining more and more importance also in the field of obstetrics [34, 35].

This technique has several advantages: the quick recovery, the better postoperative pain control and the reduced incidence of nausea and vomiting are key factors to avoid a longer bed stay, which can cause the appearance of paralytic ileus, muscular pain and fatigue. From an economical perspective, parameters such as duration of hospital stay are also decreased [36]. Moreover, it should not be neglected that the thought of undergoing GA frightens many patients, bothering them, in some cases, more than the thought of the actual surgical experience [37]. In addition, in COVID pandemic, in absence of contraindication RA should be preferred to GA [38]: acute respiratory infection during tracheal intubation to medicine personnel are proved to be 6.6 times compared to anesthesia without intubation [39] and these maneuvers could thus increase the risk of COVID-19 dissemination.

## Conclusions

It must be emphasized that our patients were accurately selected and they did not reflect the "general population": none of them had previous surgery, BMI was within normal limit, and the maximum uterus size estimated at preoperative analysis did not exceed 14 weeks of gestation. Our success is ascribable to adequate preoperative counseling, patient motivation and intense collaboration between an experienced surgeon and the anesthesia team.

In our experience, RA for laparoscopic hysterectomy has proven to be an acceptable and feasible technique.

To date, the choice of anesthesia for laparoscopic surgery remains a debated topic and is concerned by the experience and specific expertise. In case of oncological patients, SA could be a great alternative to GA in case of diagnostic laparoscopy for ovarian cancer when the suspicion of inoperability is raised at the preoperative imaging and a histological diagnosis is needed. Further studies are required to evaluate and confirm the suitability of more complex and longer surgical procedures.

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**Data availability** Data are available upon request by the Corresponding Author.

## Declarations

**Conflict of interest** Dr. Della Corte, Dr. Mercurio, Dr. Viciglione, Dr. Palumbo, Dr. Cafasso, Dr. Candice, Dr. Bifulco and Dr. Giampaolino have no conflicts of interest or financial conflicts to disclose.

**Ethical approval** All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Consent to participate** Informed consent was obtained from all individual participants included in the study.

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