



# Comparison of spinal versus general anesthesia on the perioperative blood glucose levels in patients undergoing lower abdominal and pelvic surgery: a prospective cohort study, Ethiopia

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**Introduction:** Surgery is linked with fear and stress that disrupt metabolic and neuroendocrine activities, which impair normal maintained glucose metabolism that leads to stress hyperglycaemia. This study aimed to compare the effect of general and spinal anaesthesia on perioperative blood glucose levels in patients undergoing lower abdominal and pelvic surgery.

**Methods:** This prospective observational cohort study recruits 70 adult patients who underwent lower abdominal and pelvic surgery under general and spinal anaesthesia; 35 in each group. A systematic random sampling technique was used to select study participants. Capillary blood glucose was measured at four perioperative times. An independent *t*-test, dependent *t*-test, and Mann–Whitney U test were used for statistical analysis, as appropriate. *P* values less than 0.05 were considered statistically significant.

**Results:** No statistically significant difference was observed in mean blood glucose levels at baseline and 5 min after induction of general anaesthesia and complete blocks of spinal anaesthesia. But at the end of surgery and 60 min after the end of surgery the mean blood glucose levels were statistically significantly higher in the general anaesthesia group compared with the spinal anaesthesia group ( $P < 0.05$ ). And the blood glucose level was significantly increased from baseline compared with the different time intervals in the general anaesthesia group.

**Conclusion:** The mean blood glucose levels were lower in patients undergoing surgery under spinal anaesthesia compared with general anaesthesia. The authors recommend spinal over general anaesthesia whenever possible for patients undergoing lower abdominal and pelvic surgery.

**keywords:** blood glucose level, general anaesthesia, lower abdominal surgery, pelvic surgery, spinal anaesthesia

## Introduction

Surgery is associated with increased stress response which results in sympathetic activations and the release of pituitary hormones that accelerate glycogenolysis and gluconeogenesis and result in stress hyperglycaemia<sup>[1]</sup>. Stress hyperglycaemia is defined as any blood glucose concentration  $> 7.8$  mmol/l (140 mg/dl) without evidence of previous diabetes by the American Diabetes

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## HIGHLIGHTS

- The mean blood glucose level was higher in general anaesthesia group compared with spinal anaesthesia group at the end of surgery.
- The proportion of raise in perioperative mean blood glucose level was higher in general anaesthesia group compared with Spinal anaesthesia group.
- Spinal anaesthesia maintains perioperative mean blood glucose level better than general anaesthesia

Association and American Association of Clinical Endocrinologists consensus<sup>[2]</sup>.

Stress-induced hyperglycaemia is common and more than 50% occurs in previously non-diabetic patients<sup>[3,4]</sup>. Perioperative stress-induced hyperglycaemia is reported in 20–40% of patients undergoing general surgical procedures<sup>[5–7]</sup>.

The magnitude of stress hyperglycaemia relates to the extent of surgical procedures, the technique of anaesthesia, the anatomic location of the surgery, and the types of intraoperative fluids<sup>[8,9]</sup>.

The associated factors for the incidence of stress hyperglycaemia include age, body mass index, duration of surgery, baseline blood glucose level, and intraoperative blood transfusion<sup>[3,10,11]</sup>.

Perioperative stress hyperglycaemia is associated with an increased risk of postoperative complications; including infection, and vascular and immune dysfunction both in diabetic and

non-diabetic patients<sup>[12,13]</sup>. Studies also show patients with stress-induced hyperglycaemia had a higher risk of developing postoperative complications than known diabetic patients with the same blood glucose level<sup>[14,15]</sup>. In patients undergoing abdominal surgery, it is associated with a higher incidence of anastomotic leak and intra-abdominal abscess<sup>[16]</sup>. All of these complications result in long hospital stays and poor surgical outcomes.

On the other hand, treating intraoperative hyperglycaemia may cause hypoglycemia and which has its consequence and complication. Hypoglycemia is the most common complication secondary to insulin administration and is associated with poor clinical outcomes<sup>[2]</sup>. This may indicate that preventing hyperglycaemia is more important than treating hyperglycaemia.

The stress response can be reduced by adequate suppression of the pain pathways that arise from the site of injury<sup>[17]</sup>. Both general anaesthesia and spinal anaesthesia blocks stress responses to surgery and hyperglycemic responses through different mechanisms. General anaesthesia blocks the brain's signal at the hypothalamic pituitary adrenal Axis (HPA axis) whereas regional anaesthesia blocks the afferent neuronal pathway that transmits the impulse from the spinal cord to the brain<sup>[8]</sup>. Lower abdominal and pelvic surgeries can be performed by both techniques.

There are contradicting studies on the effect of types of anaesthesia on blood glucose levels. In studies conducted on elective surgical patients, they observed a significant reduction of perioperative blood glucose levels in spinal anaesthesia (SA) than general anaesthesia (GA)<sup>[18–20]</sup>. On the other hand, a significant reduction of blood sugar levels was observed in GA than in SA right after surgeries in patients undergoing caesarean section<sup>[21]</sup>. Another study found an absence of significant differences in blood glucose levels between the two groups<sup>[22]</sup>.

In addition to contradictory findings on the effect of spinal and general anaesthesia on blood glucose levels, as far as the author's knowledge there is no published previous literature that compares blood glucose levels between the two groups in Africa and also in Ethiopia as ethnicity, race, and genetic affect pain threshold, insulin sensitivity, and hypothalamic pituitary adrenal axis response to stress<sup>[23–26]</sup>. Doing this study in our setup is important because it helps the clinician in decision-making and it contributes to the baseline for the future researcher. Therefore, this study aimed to compare perioperative blood glucose levels among patients undergoing lower abdominal and pelvic surgeries under spinal versus general anaesthesia.

## Materials and methods

### Research registration

Unique Identifying number or registration ID: Research registry 8345 'retrospectively registered' <https://www.researchregistry.com/browse-the-registry#home/>

### Ethical approval

Ethical approval was obtained from the Institutional Review Board (IRB) of the Addis Ababa University, College of Health Sciences with a reference number: Anes07/2020/2021.

### Study design, period, and setting

An institutional-based prospective cohort study was conducted from 30 January 2021, to 20 May 2021. This Hospital is among the main Teaching and Referral Hospitals found in Ethiopia.

### Population and eligibility criteria

The source population was all adult patients who underwent elective lower abdominal and pelvic surgery under general or spinal anaesthesia at Tikur Anbessa Specialized Hospital during the study period. The study population was all eligible adult patients, who fulfilled the inclusion criteria and were selected for the study, during the study period.

Non-diabetic adult patients with American Society of Anesthesiologists grading of I or II without difficult airway undergoing elective lower abdominal and pelvic procedures were included in the study. Patients with failed SA changed to GA, patients with cardiovascular, respiratory, endocrine, renal disease and patients taking beta-blockers, statins, or steroids, patients undergoing caesarean section, chronic alcohol consumers or drug abusers, anaemic patients, nil per os (NPO) time greater than 12 h, patient receive perioperative nerve block and vasoactive drugs, intraoperative blood transfusion, patients with fasting blood glucose level >126; intraoperative administration of insulin or glucose were excluded from the study.

### Study variables

The primary outcome variable was blood glucose levels in the perioperative periods, the explanatory variables were socio-demographic factors, clinical characteristics, types of Anaesthesia, types of surgery, and duration of surgery.

### Operational definitions

#### Surgical stress

This is a systemic response to surgical injury<sup>[27]</sup>.

#### Stress-induced hyperglycaemia (SIH)

Any blood glucose concentration >7.8 mmol/l (140 mg/dl) without evidence of previous diabetes<sup>[2]</sup>.

#### Incidence of stress hyperglycaemia

At least one measurement of intraoperative and postoperative stress hyperglycaemia.

#### Capillary blood glucose levels

The concentration of glucose found in the blood.

#### Difficult airway

Difficult to facemask ventilation or tracheal intubation which requires multiple attempts<sup>[28]</sup>.

#### Sample size and sampling technique

The sample size was calculated using a comparison of two means in the formula for continuous outcomes with equal sample size; based on a previous study done in Nepal<sup>[19]</sup> which showed, the mean and standard deviation of the mean blood glucose level in the GA group is (86.32 ± 12.3 mg/dL) and in SA group is

(95.36 ± 14.15 mg/dL), with  $\mu_1 = 86.32$ ,  $\sigma_1 = 12.3$  and  $\mu_2 = 95.36$ ,  $\sigma_2 = 14.1$ , and with an alpha error of 0.05 at a power of 80%.

$$n_1 = n_2 = \frac{(\sigma_1^2 + \sigma_2^2)(Z_1 + Z_2)^2}{(\mu_1 - \mu_2)^2}$$

By substituting the formula;

$$n_1 = n_2 = \frac{(12.3^2 + 14.15^2)(1.96 + 0.84)^2}{(95.36 - 86.32)^2} = 34$$

By adding 10% contingency, the final total sample size was 76; with 38 patients in each group.

Study participants were selected by using a systematic random sampling technique by calculating the sampling interval which was 3. After the random selection of the first study participant by lottery method, data were collected in every third case from the daily schedule list of elective lower abdominal and pelvic surgery until the required sample size was fulfilled in each group.

**Data collection procedures and data quality control**

Before the study, ethical approval was obtained from the Institutional Review Board (IRB) of the funding institution. The importance of the study was explained and written informed consent was obtained from each participant by the data collectors.

Patients scheduled for elective lower abdominal and pelvic surgery during the study period and, who met inclusive criteria were included in the study by using a systematic random sampling technique after taking their informed consent. Patients were grouped into GA or SA, based on the types of anaesthesia they were given by the responsible anaesthesia provider.

In the GA group; following pre-oxygenation with oxygen, patients were induced with 5 mg/kg of thiopentone, 0.1 mg/kg of morphine, and 2 mg/kg suxamethonium for tracheal intubation. Anaesthesia was maintained with oxygen, isoflurane, and vecuronium. At the end of the surgery, patients were reversed with atropine and neostigmine followed by endotracheal extubation.

In the SA group, 0.5% heavy bupivacaine was used after infiltrating the skin with lidocaine. Needle puncture was performed at L2–3 or L3–4 or L4–5 interspace and the sensory block was below the T6 dermatome level.

Capillary blood glucose (CBG) was measured four times throughout the perioperative period. Time 1 (T1); preoperatively 5 min before induction in GA group and 5 min before giving spinal anaesthesia as a baseline value, time 2 (T2); intraoperatively after 5 min of induction in GA and after 5 min of complete block in SA, time 3 (T3); immediately at the end of surgery in both groups and time 4 (T4); postoperatively 60 min after the end of the surgery in the recovery room or ward in both groups. During each time sample taking, the tips of the fingers of the non-dominant hand were disinfected with an alcohol swap before pricking with a lancet tip to measure the blood glucose levels. The work described has been carried out under The Code of Ethics of the World Medical Association.

To ensure the quality of data, a pretest was done on 5% of the total sample size at a hospital other than the study hospital. The data collectors and supervisors were trained on the study objective and how to review the document, and collected data were checked for completeness, accuracy, and clarity on daily basis.

**Data processing, analysis, and report**

Data were manually checked for completeness, coded, and entered into Epi-Info version 7.0. Then, the data were transported to SPSS version 24 for analysis. The normality distribution was checked using a histogram and the Shapiro–Wilk test. Continuous variables were presented in mean and SD or median and interquartile range. Normally distributed data were analyzed using an independent *t*-test, and the Mann–Whitney U test was used for non-normally distributed data. Categorical variables were presented as a number and percentage and compared using  $\chi^2$  or Fisher’s exact test. A *P* value less than 0.05 was considered statistically significant.

This work was reported in line with STROCSS 2021 guideline checklist<sup>[29]</sup>.

**Results**

**Demographic characteristics**

From a sample of 76 patients, 70 were included in this study for final analysis, with a response rate of 92%. Six patients were excluded from the analysis: three patients from the GA group due to perioperative nerve block and three patients from the SA group, one patient due to intraoperative blood transfusion, and two patients due to intraoperative vasoactive use. The demographic characteristics of the study participants were comparable between the groups (Table 1).

**Clinical characteristics**

Perioperative characteristics: NPO time, types of surgery, duration of surgery, types of fluid, estimated blood loss, and postoperative analgesia were comparable between the groups (*P* > 0.05) (Table 2).

**Comparison of blood glucose level within the GA group**

A comparison of blood glucose levels at different time intervals to the baseline value (T1) in the general anaesthesia group is presented as shown in (Table 3).

**Comparison of blood glucose level within the SA group**

A comparison of blood glucose levels at different time intervals to the baseline value(T1) within the spinal anaesthesia group is presented as shown in (Table 4).

**Table 1**  
**Demographic characteristics of the study participants.**

Variable	GA	SA	<i>P</i> value
Age (years)	38.6 ± 9.67	42.74 ± 12.46	0.125*
BMI (Kg/m <sup>2</sup> )	21.7 ± 1.7	22.1 ± 1.52	0.294*
ASA, <i>n</i> (%)			
I	16 (45.7)	17 (48.6)	0.811**
II	19 (54.3)	18 (51.4)	
Sex, <i>n</i> (%)			
M	20 (57)	15 (45)	0.810**
F	15 (43)	16 (46)	

*P* value is taken from the unpaired *t*-test and  $\chi^2$  test; *n* (%) = number (percentage). ASA, American Society of Anesthesiologists; BMI, body mass index; F, female; GA, general anaesthesia; M, male; SA, spinal anaesthesia.  
\**P* value taken from the unpaired *t*-test.  
\*\**P* value taken from  $\chi^2$  test.

**Table 2**  
Clinical characteristics of the study participants.

Variables	Category	GA group (n = 35)	SA group (n = 35)	P value
NPO, M (IQR)	Fasting time (h)	9 (2)	10 (2)	0.588*
Types of surgery, (n, %)	General/pelvic	9 (25.7)	7 (20)	0.487**
	Gynaecological			
	Urological	11 (31.4)15 (42.9)	8 (22.9)20 (57)	
Types of fluid, (n, %)	Normal saline	21 (60)		0.741**
	Ringer lactate	3 (8.7)	24 (68.6)	
	Both	11 (31.4)	2 (5.7)9 (25.7)	
Estimated blood loss, M (IQR)	EBL in ml	600 (200)	550 (200)	0.307*
Duration of surgery, M (IQR)	min	110 (35)	110 (25)	0.621*
	NO	8 (22.9)	14 (40)	0.154**
Postoperative analgesia, (n, %)	Tramadol	5 (14.3)	7 (20)	
	NSAIDS	22 (62.9)	14 (40)	

M (IQR) = median (interquartile range); n (%) = number (percentage). F, female; GA, general anaesthesia; IQR, interquartile range; M, male; M (IQR), median (interquartile range); NPO, nil per os; NSAIDs, Nonsteroidal anti-inflammatory drugs; SA, spinal anaesthesia. \*P value was taken from Mann-Whitney U test. \*\*P value taken from  $\chi^2$  test.

**Comparison of mean blood glucose level between the GA and SA groups**

A comparison of mean blood glucose levels between the GA and SA groups at different time intervals is presented in Table 5 as shown below (Table 5).

**The incidence of stress-induced hyperglycaemia in GA and SA**

The incidence of SIH in 70 patients who underwent lower abdominal and pelvic surgery under both SA and GA was 21.4%. The proportion of patients who develop SIH under GA was 34.3% compared with 8.6% under SA (Fig. 1), which was statistically significant with a P value of 0.009.

**Discussion**

This study compared GA with SA on a mean blood glucose level in patients undergoing lower abdominal and pelvic surgery. The mean blood glucose level measurement at different time intervals within the group was higher than the baseline value in both groups, with a statistically significant difference observed in GA groups.

**Table 3**  
Comparison of mean blood glucose level within the general anaesthesia group.

Baseline measurement (T1) (mean ± SD)	Measurement at a different time interval (mean ± SD)	P value
107.06 ± 11.81 mg/dl	109.97 ± 13.46 mg/dL (T2)	0.001
107.06 ± 11.81 mg/dl	115.57 ± 16.6 mg/dL (T3)	0.001
107.06 ± 11.81 mg/dl	117.34 ± 16.79 mg/dL (T4)	0.001

P value is taken from paired t-test.

**Table 4**  
Comparison of mean blood glucose level within the spinal anaesthesia group.

Baseline measurement (T1) (mean ± SD)	Measurement at different time intervals (mean ± SD)	P value
103.00 ± 11.48 mg/dL	105.23 ± 12.66 mg/dL (T2)	0.046
103.00 ± 11.48 mg/dL	104.83 ± 14.06 mg/dL (T3)	0.281
103.00 ± 11.48 mg/dL	106.26 ± 14.57 mg/dL (T4)	0.058

P value is taken from paired t-test.

In our study, the mean blood glucose level during GA was significantly increased at different time intervals compared to the baseline level (T1) with P less than 0.001. The result of our study is in line with a study conducted by Geisser *et al.*<sup>[30]</sup> found that patients who underwent GA for lower abdominal surgery showed a significant increase in blood glucose level at different time intervals compared with the baseline with P less than 0.001. The reason for the similarity could be due to the same anaesthetic agent used in both studies; like in our study, they used thio-pentone and isoflurane for induction and maintenance anaesthesia, respectively. And again, the types of surgery are almost similar. A similar pattern of the result was obtained in a study conducted by Behdad *et al.*<sup>[31]</sup> in 30 diabetic patients undergoing abdominal hysterectomy under GA, the blood glucose level was significantly increased from a baseline value at different time intervals including the postoperative period (P < 0.05).

In contrast to our study, a study conducted in 2014 in Serbia, by Milosavljevic *et al.*<sup>[20]</sup> found the blood glucose level was significantly higher at 30 min of induction (P < 0.01); but unlike our study, the changes were not persisted and they started to decrease below baseline value without significant difference (P > 0.05). The difference between this study and our result could be due to the difference in the types of anaesthetic agents used for the maintenance of anaesthesia. Unlike our study and the previous studies in which isoflurane was a maintenance agent, they used propofol as it may have less effect on glucose metabolism than inhalational anaesthetics<sup>[31]</sup>.

In our study, the mean blood glucose level in patients undergoing surgery under SA was increased from baseline value at a different time interval with a significant difference observed at T2 (5 min of complete sensory anaesthesia) P = 0.046. A similar pattern of the result was obtained in a study conducted in 2018 by Kouzegaran *et al.*<sup>[21]</sup>.

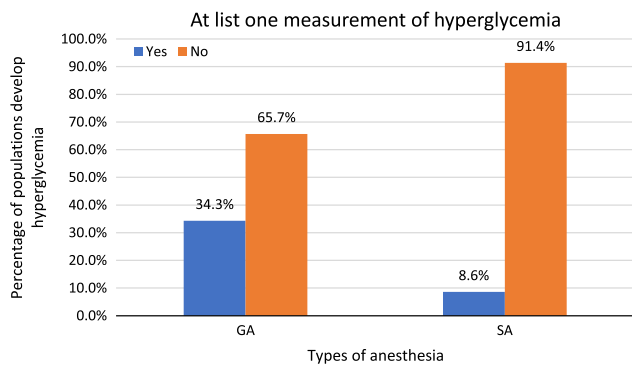
In contrast to our study, a study conducted by Bajracharya *et al.*<sup>[19]</sup> found in patients who underwent elective surgery under SA, each measurement of intraoperative blood glucose levels at different time intervals was slightly decreased from baseline value

**Table 5**  
Comparison of mean blood glucose level between the groups.

Different time interval	Mean blood glucose level in the GA group (Mean ± SD)	The mean blood glucose level in the SA group (Mean ± SD)	P value
T1	107.6 ± 11.81 mg/dl	103 ± 11.48 mg/dl	0.150
T2	109.97 ± 13.46 mg/dl	105.23 ± 18.66 mg/dl	0.113
T3	115.57 ± 16.6 mg/dl	104.83 ± 14.06 mg/dl	0.005
T4	117.34 ± 16.79 mg/dl	106.26 ± 14.57 mg/dl	0.004

P value is taken from unpaired t-test.

GA, general anaesthesia; SA, spinal anaesthesia.



**Figure 1.** Incidence of stress hyperglycemia between GA and SA groups of the study participants. GA general anaesthesia; SA spinal anaesthesia.

without significant difference ( $P > 0.05$ ). Another study also found that there is no significant change in blood glucose levels from a baseline value throughout a procedure in both diabetic mellitus and Non-diabetic mellitus patients undergoing hip surgery under SA<sup>[32]</sup>. The possible explanation for the difference between the above-mentioned studies and our study could be due to the psychological stress response a patient can experience from fear of surgery and spinal needle prick that is pronounced in African American ethnic groups<sup>[24,33]</sup>.

Our study demonstrated that blood glucose level in patients undergoing surgery under GA was statically significantly higher than in patients undergoing surgery under SA at T3 and T4 with  $P$  less than 0.05. Our result is in line with a previous finding in 2014 by Gottschalk *et al.*<sup>[32]</sup> observed a significant increase in intraoperative and postoperative blood glucose level in patients randomized to GA compared with SA; in this randomized control, they observed a statically significant difference at the immediate end of surgery and after 1 h. of surgery. Our findings are also directly in line with a recent comparative prospective study conducted by El-Radaideh *et al.*<sup>[18]</sup> (in 2019) in elective caesarean section patients, as they observed a significant change in a perioperative mean blood glucose concentration between the GA and SA groups. The time interval used for measurement was also similar except for T4. The blood glucose level at T1 and T2 was comparable, but there was a statistically significant higher mean blood glucose level in GA compared with SA at T3 and T4 (after 30 min of end of surgery) ( $P < 0.001$ ).

In contrast to our study, a study conducted in Iran, in 2014, by Amiri *et al.*<sup>[22]</sup> found the absence of a significant change in the mean blood glucose level between GA and SA with  $P$  greater than 0.05; in this randomized clinical trial on 50 patients that undergo curettage surgeries, even though it was insignificant, they observed a decrease in blood glucose level in the GA group when compared with the SA group. The possible reason for this discrepancy in our result could be, in their study the patients were not intubated so the laryngoscopic stimulation was absent since one cause of stress responses is laryngoscopic stimulation and endotracheal intubation<sup>[34]</sup>. The other reason could be the level of spinal sensory block was limited to T10 dermatomes that could not completely abolish the neurohormonal stress response to surgery<sup>[8]</sup>.

Our study revealed that the proportion of patients who develop stress hyperglycaemia under GA was 34.3% compared with 8.6% under SA which was statically significant (with a

$P$  value of 0.009). The relative risk of developing hyperglycaemia under GA compared with SA was 4 (95% CI, 1.235–12.955). The result of our study is higher than the study conducted in 2013 by Maitra *et al.*<sup>[6]</sup> found in patients undergoing major abdominal surgery under GA, the incidence of intraoperative stress-induced hyperglycaemia was 29% (capillary blood glucose  $\geq 150$  mg/dL) during surgery. Another study also found that in patients undergoing elective surgery under GA, none of the patients had intraoperative hyperglycaemia ( $> 180$  mg/dl)<sup>[9]</sup>. The differences could be due to the definition used for hyperglycaemia (cutoff point of hyperglycaemia).

In 2009, Pili-Floury *et al.*<sup>[35]</sup> found in a patient undergoing knee and hip surgery under general anaesthesia the incidence of postoperative stress hyperglycaemia was found to be 75% ( $> 126$  mg/dL). In 2015, in the same study population under spinal anaesthesia, even though they include diabetic patients only 40% of them developed postoperative stress hyperglycaemia<sup>[11]</sup>. The difference between the two results was thought to be due to the types of anaesthesia used which also confirms the difference we found between the SA and GA. In contrast to our results, the incidence of stress hyperglycaemia was highly increased in both groups as their study only focused on the postoperative period.

### Strength

Study groups were homogenous (elective patients undergoing lower abdominal and pelvic surgery under spinal or general anaesthesia). We used exclusion criteria to prevent confounding and groups are comparable in terms of sociodemographic distribution and perioperative factors; the difference observed might be secondary to the exposure factor.

### Limitation

The study has certain limitations including the inability to distinguish patients with impaired glucose tolerance and stress hyperglycaemia due to a lack of tests and equipment. The other limitation of this study was the hemodynamic changes were not measured simultaneously with blood glucose levels as surgical stress responses. The small sample size might be another limitation of this study.

### Relevance and implications

It is clinically relevant, particularly in the settings like ours, where resources are limited and postoperative hyperglycaemia-induced Diabetes is challenging. It gives implications for further research.

### Conclusion and recommendation

Based on our results in patients undergoing lower abdominal and pelvic surgery, spinal anaesthesia has a better effect on maintaining perioperative mean blood glucose level when compared with general anaesthesia. From our observation, it is reasonable to recommend spinal anaesthesia over general anaesthesia whenever possible for patients undergoing lower abdominal and pelvic surgeries.

**Ethical approval**

Ethical approval was obtained from the Institutional Review Board (IRB) of the Addis Ababa University, College of Health Sciences with a reference number: Anes07/2020/2021.

**Consent**

Informed written consent was taken from every individual participant. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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**Author contribution**

H.S., B.G., M.N., and E.M. contributed to the study conception, design, and data collection, and performed statistical analysis and interpretation of the result. H.S. and M.N. contributed to writing up and preparing the manuscript. All the authors read the manuscript and approved the final submission.

**Conflict of interest disclosure**

The authors have no conflicts of interest to declare.

**Research Registration number**

Research registry 8345

**Guarantor**

Hirbo Samuel.

**Availability of data and material**

The data used in this study were collected by trained data collectors and authors are willing to share the data upon request from peer researchers.

**Provenance and peer review**

Not commissioned, externally peer-reviewed.

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