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Target Controlled Infusion with Propofol and Propofol Combined Lidocaine Versus Inhalational on Stress Response in Lower Abdominal Surgery

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Abstract
Background: *This study aimed to investigate the impact of target-controlled infusion (TCI) using propofol alone and propofol combined with lidocaine in comparison to inhalational anesthesia on stress response, by examining serum insulin growth factor (IGF) levels.*
Methods: *This prospective, randomized study was conducted on 90 patients, with lower abdominal malignancies. Patients were given intravenous anesthesia for induction. They were then divided into three equal groups: group P received propofol through TCI, group S received sevoflurane, and group PL received a combination of propofol and lidocaine TCI. Patients were observed for stress response by serum level of IGF, haemodynamics, BIS, visual analogue scale (VAS), LANSS score and satisfaction score.*
Results: *IGF levels were significantly higher in group S. Group S had greater intraoperative heart rate, mean arterial pressure, and bispectral index score (BIS) than groups P and PL .Fentanyl consumption and the first request for analgesia were significantly different, where group S shows a significantly earlier request for analgesia, while group PL has the longest. Group PL reported lower pain levels than groups P and S according to VAS. Group PL scored lower than groups P and S on the assessment of neuropathic symptoms and signs (LANSS).*
Conclusions: *TCI propofol lidocaine demonstrated a superior effect compared to TCI propofol and inhalation anesthesia alone. It was associated with stable hemodynamics, lower GF levels, opioid consumption, pain score and longest first request analgesia.*
Key words: *Target Controlled Infusion, Inhalational Anesthesia, Insulin Like Growth Factor.*

Introduction

The stress response to anesthesia can significantly impact surgical outcomes and recovery. Target-controlled infusion (TCI) of propofol and lidocaine is an emerging technique aimed at achieving optimal sedation and analgesia with potentially reduced stress responses compared to inhalational anesthesia. Anesthetic techniques can modulate this response, influencing hemodynamic stability, postoperative pain, and overall patient satisfaction [1, 2].

Propofol is highly lipophilic, allowing for rapid onset and offset of action; this allows for easy titration based on patient response in TCI, linked to a decreased rate of nausea and vomiting following surgery when compared to inhalational medications [3].

Lidocaine is appropriate for TCI because to its quick onset and brief duration of effect. It generally follows a one-compartment model when administered intravenously [4]. It provides effective analgesia during and after surgical procedures [5].

Target controlled infusion (TCI) is an advanced method of drug delivery in anesthesia that allows for precise control of drug concentration in the plasma or effect site. The combination of propofol and lidocaine in TCI can enhance sedation and analgesia, offering benefits such as reduced side effects and improved recovery times. The effect of Target Controlled Infusion (TCI) of propofol and lidocaine on the stress response during anesthesia

compared to inhalational anesthesia has been a topic of interest in anesthesiology research. The stress response to surgery can significantly impact recovery, and insulin-like growth factor (IGF) levels are often used as biomarkers for this response.
Synergistic effects of propofol and lidocaine can lead to enhanced sedation and analgesia [6] and potentially reduce total drug consumption, which can minimize adverse effects, facilitate quicker recovery times, and improve overall patient satisfaction [7].
Insulin-like growth factor (IGF) is increasingly recognized for its role in modulating the stress response during anesthesia and surgery. It influences various physiological processes that can impact recovery and overall outcomes.
IGF may help regulate the levels of stress hormones, such as cortisol and catecholamines. Lower stress hormone levels are linked to a reduced surgical stress response and better outcomes [8].
This work aimed to compare the effect of TIVA-TCI propofol and TCI propofol lidocaine with inhalational anesthesia on stress response, measuring serum levels of IGF, hemodynamics, BIS levels, and VAS score.

Patient and method:
Ninety patients, both male and female, between the ages of 18 and 60, with a body mass index (BMI) of less than 35 kg/m2, who were scheduled for open radical cystectomy and hysterectomy and who were in grade I or II physical status according to the American Society of Anaesthesiologists (ASA), participated in this prospective, randomised, single-blinded study. Following clearance by the South Egypt Cancer Institute's Ethical Committee at Assiut University in Assiut, Egypt, and clinicaltrials.gov registration (ID: NCT06024733), the research was conducted from October 2023 to December 2024. The patients gave their signed, informed permission.
Patients with substantial organ failure, mental retardation, coagulopathy, BMI > 35 kg/m2, and ASA physical status > II were excluded.
Randomization and blindness
Following the induction of balanced general anesthesia and intubation (all premedicated with midazolam 0.0 3 mg/kg). Each group underwent IV anaesthesia and was randomly divided into three equal groups. Group P was administered propofol, with target induction concentrations of 4-6 mic/ml. Propofol with target-controlled infusion (TCI) was used to maintain anaesthesia at effect site concentrations of 3-6 mic/ml in order to keep the Bispectral Index (BIS) between 40-60. The patient's age and weight were input into the TCI unit, specifically the Agilia SP TIVA system manufactured by Fresenius Kabi in Germany, allowing target propofol concentrations to be established and the infusion to be initiated. Anesthesia in group S was maintained using sevoflurane at 2-2.2% concentrations to keep the BIS levels between 40 and 60, whereas group PL received TIVA, comprising propofol and lidocaine TCI. During the procedure, patients received a one-time dose of lidocaine 1% at 1.5 mg per kilogram of body weight and a continuous supply of propofol mixed with lidocaine 1% at 2 mg per kilogram of body weight per hour in order to keep the BIS score between 40 and 60. General anesthesia was initiated in all patients using intravenous fentanyl at a dose of 1 microgram per kilogram. Tracheal intubation was then performed following sufficient neuromuscular paralysis with rocuronium administered at 0.6 milligram per kilogram. Rocuronium at 0.3 milligram per kilogram was subsequently given to maintain neuromuscular blockade, and patients were mechanically ventilated to keep end-tidal carbon dioxide (ETCO2) levels between 35-40 millimeters of mercury. The BIS electrode, manufactured by Aspect Medical Systems in Norwood, MA, USA, was placed according to the manufacturer's guidelines. Blood samples, each consisting of two milliliters, were collected from each patient to establish baseline serum IGF levels prior to the induction of anesthesia. Patients were given 100% oxygen via a face mask for a period spanning 2–3 minutes. In all patients, general anesthesia was induced with intravenous 1 mic/kg fentanyl; tracheal intubation was performed after adequate neuromuscular blockade with rocuronium 0.6 mg/kg; rocuronium 0.3 mg/kg was given for maintenance; and patients were mechanically ventilated to maintain end tidal (ETCO2) between 35-40 mmHg.
An oxygen-and-air mixture was used to achieve an inspired oxygen fraction (FIO2) of 0.5. During surgery, all patients received ketorolac at a dosage of 0.5-0.75 mg/kg for pain relief. To keep anesthesia stable, the levels of sevoflurane and propofol infusion were changed based on the BIS target range of 40-60. When BIS values

exceeded 60, the propofol infusion rate or sevoflurane concentration was raised by 0.5-1mic/ml for propofol and 0.5% for sevoflurane every 30 seconds until BIS reached 40–60. If the patient's age was less than 40, the rate of propofol infusion or the concentration of sevoflurane was reduced. If the mean arterial pressure (MAP) dropped by over 20% from initial levels, the infusion rate of crystalloid solution was raised. If this was inadequate, the rate of propofol infusion or the sevoflurane concentration was lowered. If low blood pressure was caused by bleeding, colloids and blood products were given. Extreme low blood pressure was ultimately managed using intravenous ephedrine at a dose of 0.1 mg/kg. Additional administrations of fentanyl were provided if heart rate (HR) and blood pressure rose by 20% from the initial value. Approximately fifteen minutes prior to the conclusion of the operation, sevoflurane and propofol doses were lowered to aid in the quick awakening from anesthesia. They were calibrated to a BIS reading of 70. By the end of the surgery, both lungs were receiving ventilation with 100% oxygen at a minimum flow rate of 6 liters/min. Sugammadex 2-4 mg/kg was used to reverse neuromuscular block for all patients, leading to extubation in the operating room. Patients were extubated from the trachea when they exhibited hemodynamic stability, sufficient muscle strength, full consciousness, and appropriate breathing rate and ventilation (10 to 30 breaths/min, $PaCO_2$, 30 to 45 mmHg).

During surgery, measurements of hemodynamic factors like heart rate and mean arterial pressure were taken just before anesthesia began, after intubation, and every 15 minutes until the operation was finished. Hypotension was defined as a systolic blood pressure below 85 mmHg and treated with intravenous ephedrine at a dosage of 0.1 mg/kg. Bradycardia is defined as a heart rate below 50 beats per minute and was treated with atropine at a dosage of 0.01 mg per kg. IGF serum levels were assessed at four different time points: before surgery, one hour after intubation, at the end of the operation, and 24 hours after surgery. Time durations were monitored and documented, such as the time from the end of anesthesia to extubation. Time taken for a patient to regain consciousness after the anesthesia wears off and their eyes open. Time of orientation (from end of anesthesia until patient states name, birth date, and ward number). Anesthesia depth is continuously monitored and noted using BIS at all times, with recordings taken at baseline (2-3 min before anesthesia induction), post-intubation, and every 15 min until the surgery is complete.

All patients were sent to the postoperative care unit after surgery, where their vital signs were recorded. The visual analogue scale (VAS) is used to quantify the degree of pain at rest and during painful movements [9] rated at the following time intervals (immediately postoperative, then at 2, 4, 6, 12, and 24 hours postoperatively), with 0 denoting no pain and 10 denoting the greatest pain possible within the first 24 hours postoperatively. Morphine patient-controlled analgesia (PCA) with an initial bolus of 0.1 mg/kg morphine during a locked period of 15 minutes without background infusion was permitted as rescue postoperative analgesia if the VAS score was > 3. We tracked how long it took to request analgesia for the first time and how much analgesia was used overall in the first 24 hours. The Ramsay sedation score was used to measure the patient's level of sedation [10] as follows: 1 denotes anxiety, agitation, restlessness, or both; 2 denotes cooperation, focus, and composure; 3 denotes just responsiveness to directions; 4 means responding quickly to a loud auditory stimuli or light glabellar tap; 5 means responding slowly to a loud auditory stimulus or light glabellar tap; and 6 means not responding at all. immediately after surgery, and then two, four, six, twelve, and twenty-four hours later. Patient satisfaction following surgery [11] was examined and divided into five categories: 1-completely unhappy, 2-unsatisfied, 3-not satisfied nor dissatisfied, 4-satisfied, or 5-completely satisfied. Issues were seen and recorded. At the pain clinic, chronic pain was evaluated using the LANSS score at one and three months after surgery [12] rated on a 24-point scale. A patient is classified with having some degree of neuropathic pain if they score 12 or above on this scale.

The primary outcome was measuring the stress response by measuring the serum level of IGF. The secondary outcomes were intensity of pain at rest and during pain-provoking movements, hemodynamic variables, (extubation, recovery and orientation) times, depth of anesthesia by BIS, sedation, satisfaction, LANSS score and complications during the study period.

Statistical analysis

Power of the Study

The study groups were compared using ANOVA test in G Power software version 3.1.3 to determine the sample size needed, assuming a medium effect size of 0.4, an alpha error prob of 0.05, and a power of 0.90. In the current study, an attempt was made to have 30 patients in each group instead of the minimum required 28

patients to prevent dropouts.
The statistical analysis was performed using SPSS v27 software (IBM©, Chicago, IL, USA). The normality of the data distribution was assessed using the Shapiro-Wilks test and histograms. Mean and standard deviation (SD) were used to present quantitative parametric data, which were then analyzed using ANOVA (F) test and post hoc test (Tukey). Quantitative non-parametric data were displayed as the median and interquartile range (IQR) and were assessed using the Kruskal-Wallis test along with the Mann-Whitney test to compare individual groups. Qualitative variables were depicted as frequency and percentage (%) and were examined using the Chi-square test. A statistically significant result was determined with a two-tailed P value < 0.05.

Results:
Ninety patients with bladder and utrine cancer who underwent hysterectomy and cystectomy were assessed for eligibility in our study. There was no notable distinction observed among the three examined groups in terms of demographic and operative data such as age, weight, ASA, and length of surgery and anesthesia (P > 0.05). (Table 1) Group PL had longer extubation, recovery, and orientation times compared to groups P and S (P value < 0.05), whereas there were no statistically significant differences between groups P and S for any of the measured times. Table 1 depicts the information. IGF showed no significant differences across groups in preoperative levels, while postoperative levels showed significant differences emerge after 1 hour, at the end of surgery, and 24 hours postoperatively, with group S consistently exhibiting the highest IGF levels, and group PL showing a notable decrease in IGF levels. Figure (2)
The intra-operative hemodynamic variables data (heart rate and mean arterial blood pressure) indicated significant variations among the groups at several intra-operative time points. where group S consistently showed the highest values, while group PL exhibited the lowest. These differences were statistically significant at most time points. Figure (1A,B)
Regarding BIS Pre-intubation values showed no significant differences among the groups, while there were significant differences post-intubation at all subsequent time points, where group S with the highest BIS scores, while group PL demonstrated the lowest values. Figure (1c)
Postoperative haemodynamics showed no discernible changes between the groups.
There were notable variations in VAS ratings across the groups under study at different times with respect to VAS at rest (VASR) and mobility (VASM), where group PL consistently reports lower pain levels compared to groups P and S across most time points, particularly after 2-, 4-, 6-, and 12-hours post-operative. Figure (3A) VASM, Figure (3B) VASR.
The mean total postoperative dose of morphine consumption was significantly decreased in PL group (7.68 ± 0.53 mg) and P group (8.51 ± 1.45mg) compared to S group (10.51 ± 1.11mg) (P-value = 0.000), while comparison between group P and PL was not significant (p-value: 0.053). The time to first request was significantly prolonged to (6.0 (4.0-9.0)h) and (4.0 (2.0-24.0)h) in PL and P group respectively compared to S group (2.0 (1.0-6.0)h) (p-values: 0.000). The number of patients who requested analgesia was 30 (100.0%) in S group compared to only 20 (66.7.0%) and 12 (40.0%) P in PL group respectively with a significant difference (p-values: 0.000). (Table 1)
While there were no significant differences between the groups at any of the following time intervals (2, 4, 6, 12, and 24 hours), there was a significant difference in the groups' sedation ratings, with group PL having the highest score and group S the lowest, as all groups had the same median sedation score of 2.0. Table (3)
Group PL reported the highest patient satisfaction, and group S had the lowest satisfaction scores with a significant difference compared to both group P and group PL. Table (2)
After one month and three months, the LANSS scores for groups P and S were comparable, with P-values of 0.111 and 0.402, respectively, suggesting that there was no significant difference between the two groups. On the other hand, group P and group PL's LANSS scores differed significantly at both time periods with P-values well below 0.0001. Group PL consistently showed lower scores compared to groups P and S. Table (3).
There were distinct patterns of complications among the groups, with group PL showing a higher incidence of complications like bradycardia and hypotension, the incidence of injection discomfort was greater in group P. There were more cases of postoperative nausea and vomiting in Group S. Table (2).

Table 1: Demographic, clinical data, and analgesic profile of patients in the three studied groups.

Demographic data					
		Group P (n= 30)	**Group S (n= 30)**	**Group PL (n= 30)**	**P**
Age (years)		42.23±8.36	40.70±7.99	43.80±8.49	0.354
Sex	**Male**	19(63.3%)	16(53.3%)	15(50.0%)	0.557
	Female	11(36.7%)	14(46.7%)	15(50.0%)	
Weight (kg)		77.70±8.52	79.07±8.22	78.37±7.87	0.813
Height (cm)		168.87±6.64	168.10±6.10	168.90±5.65	0.850
BMI (kg/m^2)		27.40±3.83	28.04±3.18	27.48±2.51	0.704
ASA physical status	**I**	15(50.0%)	14(46.7%)	13(43.3%)	0.875
	II	15(50.0%)	16(53.3%)	17(56.7%)	
Diagnosis	**Cancer bladder**	16(53.3%)	12(40.0%)	13(43.3%)	0.559
	Cancer uterus	14(46.7%)	18(60.0%)	17(56.7%)	
Clinical data					
Duration of surgery (min)		115.83±9.83	111.67±12.75	111.83±13.74	0.332
Duration of anesthesia (min)		151.17±10.80	148.00±13.36	154.83±15.28	0.143
Extubation time (min)		9.15±2.01	8.28±2.32	14.53±2.24	**0.000***
		P1=0.127, **P2=0.000*, P3=0.000***			
Recovery time (min)		11.47±2.07	10.40±2.37	16.83±2.14	**0.000***
		P1=0.064, **P2=0.000*, P3=0.000***			
Orientation time (min)		13.98±2.16	12.92±2.43	19.09±2.37	**0.000***
		P1=0.079, **P2=0.000*, P3=0.000***			
Analgesic profile					
Total fentanyl consumption (µg)		82.33±15.41	273.50±48.09	79.17±9.48	**0.000***
1st request analgesia (hour)		4.0(2.0-24.0)	2.0(1.0-6.0)	6.0(4.0-9.0)	**0.000***
		P1=0.000*, P2=0.004*, P3=0.000*			
Number of patients requested analgesia		20(66.7%)	30(100.0%)	12(40.0%)	**0.000***
		P1=0.000*, P2=0.038*, P3=0.000*			
Total morphine dose during 24hour (mg)		8.51±1.45	10.51±1.11	7.68±0.53	**0.000***
		P1=0.000*, P2=0.053**, P3=0.000***			

Data are presented as mean ± SD or frequency (%) or median (IQR). * Significant P value <0.05. BMI: body mass index, ASA: American society of anesthesiologists, P1: comparison between group P and group S, P2: comparison between group P and group PL, P3: comparison between group S and group PL.

Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine.

Table 2: Patient satisfaction and complications of the three studied groups.

Patient satisfaction					
		Group P (n= 30)	**Group S (n= 30)**	**Group PL (n= 30)**	**P**
Patient satisfaction		4.10±0.84	2.67±1.35	4.47±0.68	**0.000***
		P1=0.000*, P2=0.159, **P3=0.000***			
Patient satisfaction	**Totally unsatisfied**	0(0.0%)	7(23.3%)	0(0.0%)	--
	Unsatisfied	2(6.7%)	8(26.7%)	0(0.0%)	
	No satisfied or unsatisfied	3(10.0%)	7(23.3%)	3(10.0%)	
	Satisfied	15(50.0%)	4(13.3%)	10(33.3%)	
	Totally satisfied	10(33.3%)	4(13.3%)	17(56.7%)	
Complications					
Bradycardia		4(13.3%)	0(0.0%)	13(43.3%)	--
Hypotension		3(10.0%)	1(3.3%)	14(46.7%)	
Shivering		1(3.3%)	3(10.0%)	2(6.7%)	
PONV		3(10.0%)	9(30.0%)	7(23.3%)	

Involuntary movement	0(0.0%)	0(0.0%)	0(0.0%)	
Coughing	0(0.0%)	0(0.0%)	0(0.0%)	
Restlessness	0(0.0%)	0(0.0%)	0(0.0%)	
Breath holding	3(10.0%)	2(6.7%)	3(10.0%)	
Laryngospasm	0(0.0%)	0(0.0%)	0(0.0%)	
Pain on injection	5(16.7%)	0(0.0%)	0(0.0%)	
Respiratory depression	0(0.0%)	0(0.0%)	0(0.0%)	

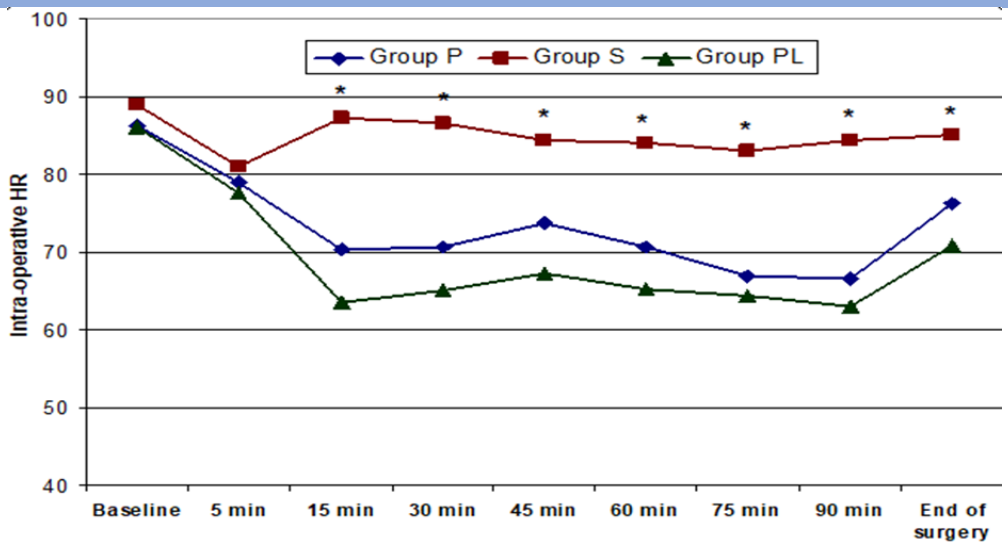
Data are presented as mean ± SD or frequency (%). * Significant P value <0.05. PONV: postoperative nausea and vomiting. Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine.

Table 3: Post-operative sedation and LANSS scores of the studied groups

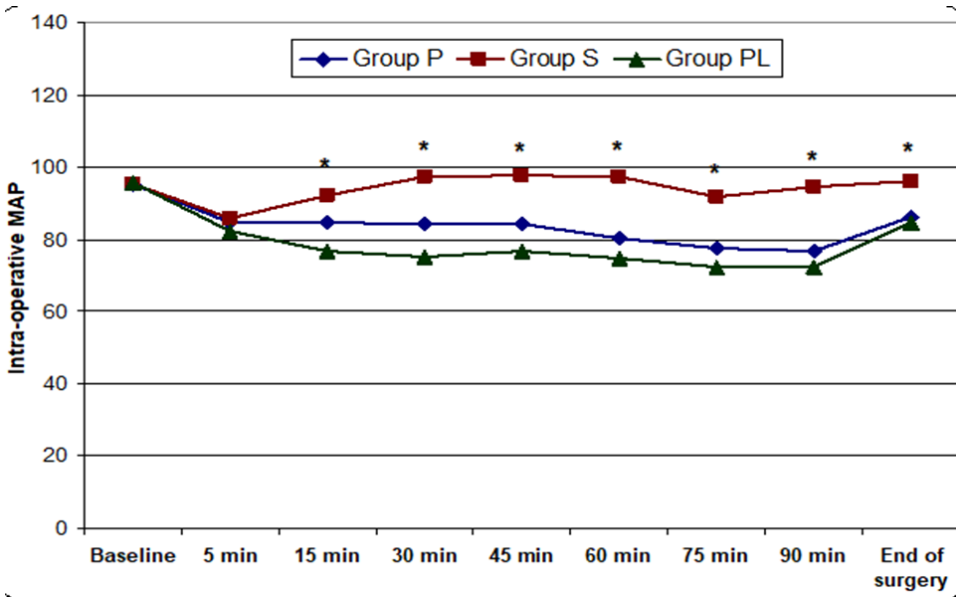
Post-operative sedation score				
	Group P (n= 30)	**Group S (n= 30)**	**Group PL (n= 30)**	**P**
	P1=0.000*, P2=0.000*, P3=0.000*			
After 2 h	2.0(2.0-3.0)	2.0(2.0-3.0)	2.0(2.0-3.0)	1.000
	P1=1.000, P2=1.000, P3=1.000			
After 4 h	2.0(2.0-3.0)	2.0(2.0-3.0)	2.0(2.0-3.0)	1.000
	P1=1.000, P2=1.000, P3=1.000			
After 6 h	2.0(2.0-3.0)	2.0(2.0-3.0)	2.0(2.0-3.0)	1.000
	P1=1.000, P2=1.000, P3=1.000			
After 12 h	2.0(2.0-3.0)	2.0(2.0-3.0)	2.0(2.0-3.0)	1.000
	P1=1.000, P2=1.000, P3=1.000			
After 24 h	2.0(2.0-3.0)	2.0(2.0-3.0)	2.0(2.0-3.0)	1.000
	P1=1.000, P2=1.000, P3=1.000			
LANSS score				
After 1 month	11.47±2.08	12.40±2.01	7.53±2.60	**0.000***
	P1=0.111, **P2=0.000*, P3=0.000***			
< 12	15(50.0%)	13(43.3%)	30(100.0%)	**0.000***
≥ 12	15(50.0%)	17(56.7%)	0(0.0%)	
	P1=0.605, **P2=0.000*, P3=0.000***			
After 3 months	8.90±1.69	9.30±1.62	6.00±2.17	**0.000***
	P1=0.402, **P2=0.000*, P3=0.000***			
< 12	28(93.3%)	27(90.0%)	30(100.0%)	0.227
≥ 12	2(6.7%)	3(10.0%)	0(0.0%)	
	P1=1.000, P2=0.492, P3=0.237			

Data are presented as mean ± SD or frequency (%) or median (IQR). * Significant P value <0.05. LANSS: Leeds assessment of neuropathic symptoms and signs, P1: comparison between group P and group S, P2: comparison between group P and group PL, P3: comparison between group S and group PL. Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine.

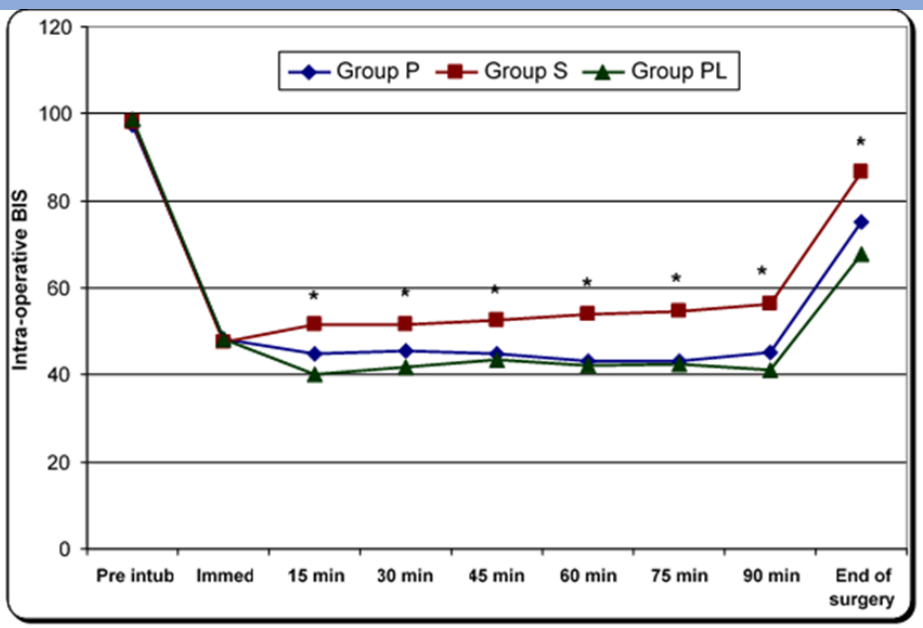
Figure (1) show intraoperative HR,MAP,BIS of three studied groups



(A)Intraoperative HR



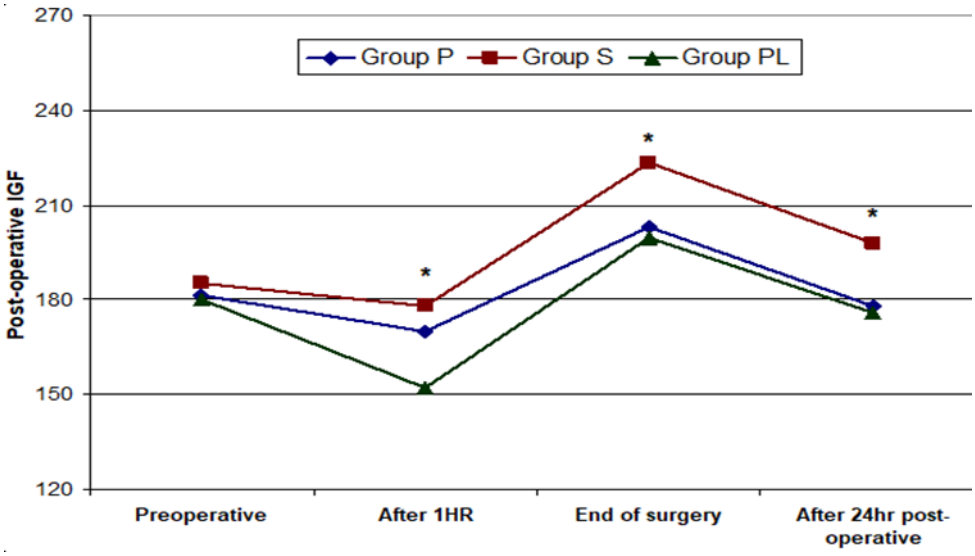
(B)Intraoperative MAP



(C)Intraoperative BIS

Baseline: befor induction of anesthesia and surgery, Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine, * indicate significant value.HR: heart rate,MAP:mean arterial pressure, BIS: bispectral index.

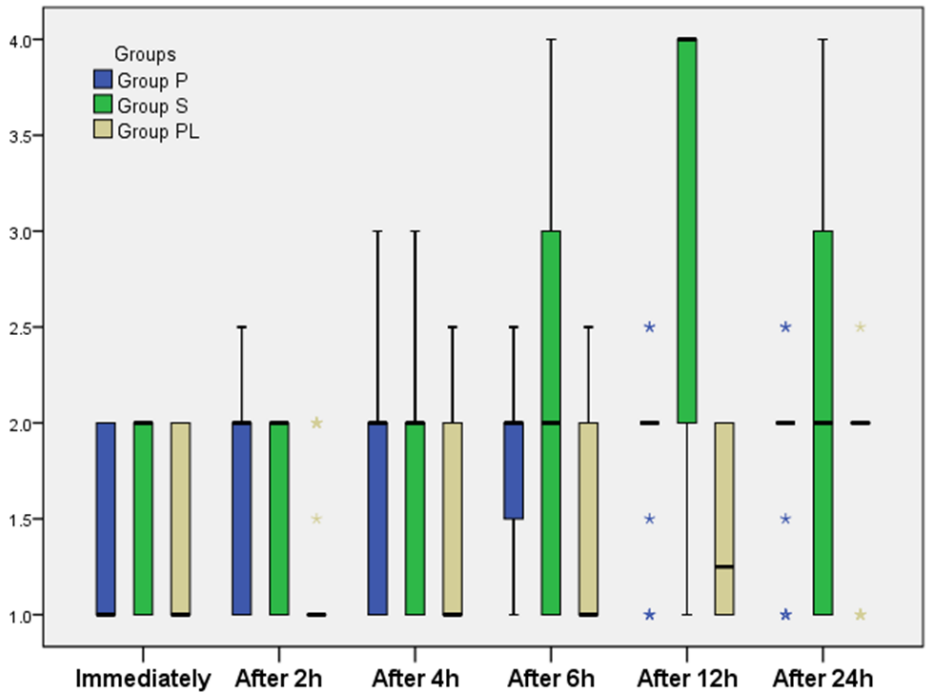
Figure (2) show intra and post-operative insulin like growth factor of the studied groups.



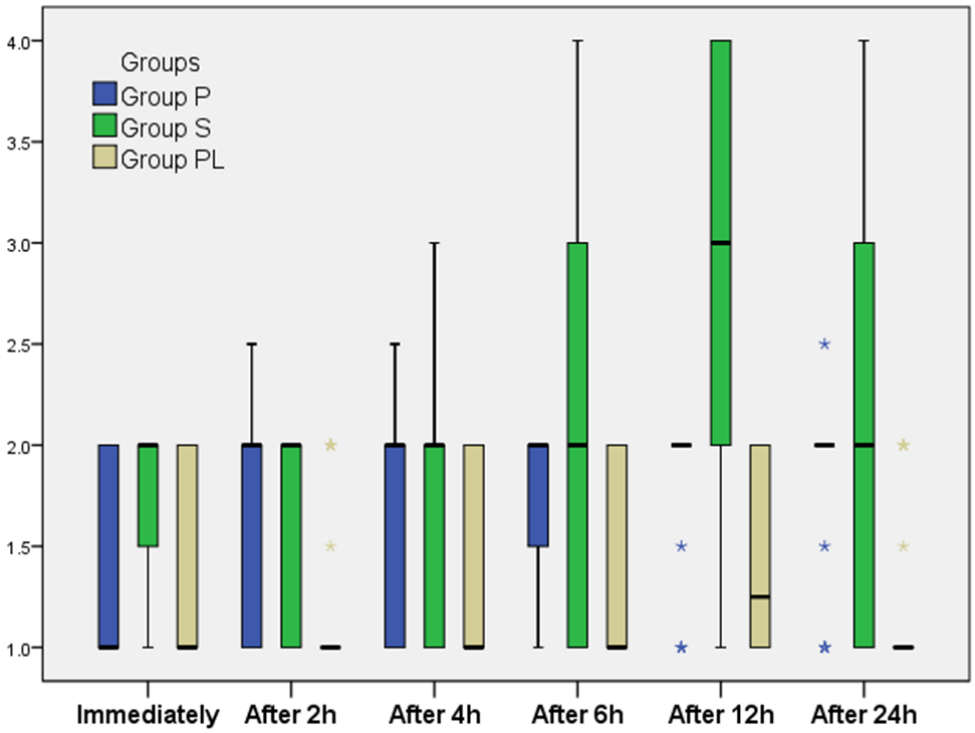
intra and post-operative insulin like growth factor of the studied groups

Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine, IGF: insuline like growth factor, * indicate significant value.

Figure (3) show both VAS at rest (VASR) and movement (VASM) changes of the three studied groups.



(A)VAS (Visual Analogue Scale) changes at movement of the three studied groups.
Group (p): TCI propofol, Group (S):sevoflurane ,Group(PL) TCI propofol and lidocaine , * indicate significant value.



(B) VAS (Visual Analogue Scale) changes at rest of the three studied groups.
Group (p): TCI propofol, Group (S): sevoflurane, Group (PL) TCI propofol and lidocaine, * indicate significant value.

Discussion

General anaesthesia is routinely employed for major abdominal surgery. TIVA and inhalation anaesthesia are now the two primary methods for maintaining anaesthesia during surgery. The impact of anaesthesia type on perioperative pathophysiology is still largely unclear [13].

The stress response to anesthesia can significantly impact surgical outcomes and recovery. Target controlled infusion (TCI) of propofol and lidocaine is an emerging technique aimed at achieving optimal sedation and analgesia with potentially reduced stress responses compared to inhalational anesthesia. In this study, the effects of TCI on the stress response versus the inhalational method by measuring IGF levels were compared.[14]. The current study revealed that IGF at postoperative levels showed significant differences, with group S consistently exhibiting the highest IGF levels and group PL showing a notable decrease in IGF levels after 1 hour.

Insulin-like growth factor (IGF) plays a pivotal role in various physiological processes, including cellular growth, development, and metabolism. Its significance extends into the realm of anesthesia, where the modulation of IGF levels can influence perioperative outcomes and recovery. Anesthetics, particularly inhalational agents like sevoflurane, have been shown to affect the secretion and activity of IGF, potentially impacting tissue repair and regeneration following surgical procedures [15, 16].

IGF has anti-inflammatory properties, which may reduce the inflammatory response triggered by surgical trauma. This can help in minimizing postoperative complications and improving recovery [17]. Also, intraoperative heart rate, mean arterial pressure, and bispectral index score (BIS) were significantly higher in group S compared to groups P and PL. Fentanyl consumption and 1st request for analgesia were significantly different between the studied groups, where group S shows a significantly earlier request for analgesia, while group PL has the longest. The immediate postoperative sedation score was significantly different between the studied groups. Also, VAS scores at rest and movement show group PL consistently reports lower pain levels compared to group P and S across most time points. Patient satisfaction was considerably greater in group PL than in groups P and S, and group PL had the lowest score on the assessment of neuropathic symptoms and signs (LANSS) after one and three months.

The present study revealed that IGF at postoperative levels showed significant differences, with group S exhibiting the highest IGF levels, comparable with group PL which shows a notable decrease in IGF levels after 1 hour.

This was consistent with the findings of Woo et al. [18], who showed that on the fifth postoperative day, the isoflurane group's IGFBP concentration was noticeably greater than the propofol groups. According to Kim et al. [19], isoflurane-assisted general anaesthesia had a less significant impact on blood IGF-1 levels than propofol.

TCI provides more consistent hemodynamic control than inhalational agents, which can lead to reduced cardiovascular stress responses [20]. This stability is critical during surgery, where fluctuations can trigger the stress response.

The result revealed that intraoperative haemodynamics showed that group S consistently showed higher HR compared to groups P and PL. groups P and PL generally have similar haemodynamic values, although significant differences are noted at certain time points.

There were no notable differences in postoperative hemodynamics between the three groups. This is consistent with the findings of Lambe et al. [21], who noted that intraoperative hemodynamics were markedly decreased in the TIVA group compared to the inhalational group. Aijima et al. [22] also found that the TIVA group had lower hemodynamic, BP, and HR levels compared to the inhalation anaesthesia group.

In this study, group PL consistently demonstrates extended extubation, recovery, and orientation times in comparison to groups P and S, whereas there is no significant discrepancy between groups P and S for any of the time intervals assessed. Orhon et al. [23] stated that extubation took significantly more time in group P compared to group S. On the other hand, Lambe et al. [21] discovered that the TIVA group had a quicker extubation time than the inhalational group. Our study revealed that BIS showed significant differences emerge

post-intubation at all subsequent time points, particularly favoring group S, which consistently exhibits the highest BIS scores, while group PL demonstrates the lowest values, especially notable at the end of surgery. This was confirmed by Ibrahim et al. [24] discovered that the sevoflurane group had a considerably greater BIS than the propofol group. In this regard, Kaskinoro et al. [25] discovered that a LOSS of consciousness with all three medications was associated with the lowest mean values for BIS.

Patients receiving TCI of propofol and lidocaine often experience lower postoperative pain scores compared to those undergoing inhalational anesthesia [26]. Reduced pain and discomfort can significantly decrease postoperative stress.

Group PL consumed much less fentanyl overall than groups P and S in the current trial. This was consistent with Chan et al. [27], who discovered that the TIVA group ingested much less opioids overall than the sevoflurane group. Hofer et al. [28] showed that the inhalation group consumed much more opioids than the I.V. anaesthesia group, which supports our findings.

Lambe et al. [21] discovered that the TIVA group's VAS score was much lower than the inhalational group's, which is consistent with the VAS results. Additionally, the TIVA group reported lower pain levels than the inhalational group, according to Chan et al. [27].

In the current study, first request analgesia, group S showed a significantly earlier request for analgesia, while group PL had the longest, patient requests: significant differences observed, with group S showing the highest percentage of patients requesting analgesia. Total dose of morphine: group S not only requested analgesia sooner but also received a higher total dose, while the comparison between group P and PL is not significant. In contrast, some intravenous anaesthetics possess analgesic properties that can persist into the recovery period, reducing immediate postoperative pain and delaying the need for additional analgesia [29].

In the present study, it was found that The LANSS scores for group P and group S are similar after both 1 month and 3 months, but group PL consistently shows lower scores compared to groups P and S. lidocaine may mitigate the development of neuropathic pain by addressing pain mechanisms at the central and peripheral levels. Sun et al. [30] concluded that patients receiving lidocaine infusions can demonstrate lower LANSS scores postoperatively, indicating reduced neuropathic pain.

We found that group PL reported the highest patient satisfaction compared to group S and somewhat higher than group P, in agreement with us Weibel et al. [31] found that patients who receive TCI report higher satisfaction scores due to smoother anesthesia management, reduced side effects, and quicker recovery times.

The incidence of PONV was considerably greater in the inhalational group than in the TIVA group, according to Lambe et al. [21], which is consistent with our findings regarding complications. This concurred with Aijima and colleagues. [22] discovered that the TIVA group saw a considerably decreased incidence of PONV compared to the volatile anaesthesia group.

Conclusion

TIVA-TCI propofol combined lidocaine had attenuated the surgical stress response more than inhalational anesthesia and propofol TCI alone as it was associated with stable hemodynamics, lower IGF levels, opioid consumption, Bispectral index score, pain score and longest first request analgesia.

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