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" *Ultrasound-Guided Caudal Block versus Spinal Anesthesia for Anesthesia of Anorectal Surgeries in Adults* "

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Abstract

Background: Spinal anaesthesia (SA), local infiltration, general anaesthesia (GA), or caudal epidural blocks (CEB) are frequently used for anorectal surgery. Every one of these methods has advantages and disadvantages of its own.

Aim of the study: Contrasting peri-operative patient satisfaction regarding anesthetic efficacy, duration of anesthesia, post-operative pain control of ultrasound-guided caudal block versus spinal anesthesia in patients undergoing anorectal surgery.

Methods: A randomized, comparative, prospective study on 60 patients of both sexes, aged ≥21, with non-oncological anorectal disorders, American Society of Anaesthesiologists I or II physical status, and undergoing elective anorectal procedures participated in this prospective randomised trial. There were two equal groups of patients: Group I received US-guided CEB, whereas Group II received SA.

Results: Group I had a longer anaesthetic technique time than group II (P<0.001). Group I experienced a considerably longer time to initially request rescue analgesia than group II (P<0.001). Both the total amount of pethidine consumed and the number of patients in need of it were considerably lower in group I than in group II (P <0.001). Visual analogue scale was significantly lower at 4h, 5h and 6h in group I than group II (P<0.05). Bradycardia, hypotension and postoperative nausea and vomiting and patient satisfaction, and rate of success of the block were insignificantly different between both groups. In both groups, no patient experienced respiratory depression.

Conclusions: The US -guided CEB patients exhibited superior hemodynamic stability, reduced analgesic consumption, and prolonged time to rescue analgesia, along with reducing pain scores compared to SA patients.

Keywords: Ultrasound-Guided Caudal Block, Spinal Anesthesia, Anesthesia, Anorectal Surgery, Adults

Introduction:

Non-oncological anorectal diseases as hemorrhoids, anal fissure and anal fistula are prevalent in adults [1].

Spinal anaesthesia (SA), local infiltration, general anaesthesia (GA), or caudal epidural blocks (CEB) are frequently used for anorectal surgery. Every one of these methods has advantages and disadvantages of its own [2].

Routine anesthetic methods, low side effects, and excellent analgesia in the early postoperative period are often necessary for these operations, which are conducted ambulatorily in the majority of instances [3].

Rapid onset and offset are two benefits of SA, the most popular regional anaesthetic method for anorectal surgery [4].

However, following anorectal surgery, patients experience prolonged hospital admissions due to hypotension and the severe sensory and motor blockages induced by SA [5].

CEB is a common technique that is performed in pediatric patients. It can be used especially for postoperative analgesia in surgeries mainly below the umbilicus with high success rate. The incidence of complication rate is lower than the other neuroaxial techniques. It may also be used for surgical anesthesia especially in high-risk patients to decrease incidence of postoperative respiratory complications [6].

In pediatric patients, caudal epidural anesthesia is a frequently employed method. Under fluoroscopic guidance, the process mainly treats low back pain in adults. Due to anatomical variances, the landmark-based approach has a significant failure rate, which is one of the primary reasons why this technique is unpopular among adults. Aside from fewer attempts, bone contact, blood aspiration, and unintentional subcutaneous injections, ultrasound (US) guidance during caudal injections shows

higher success rates. While the process takes less time under US supervision, the treatment result, complication rates, and adverse events were similar to those of the fluoroscopic approach[7].

Ultrasound (US) is now a gold standard for peripheral nerve blockade but increasingly been using during central neuroaxial interventions. The application of US may determine the position, needle direction, and the anatomic changes of sacral canal [8].

This study's objective was to contrast peri-operative patient satisfaction regarding anesthetic efficacy, duration of anesthesia, perioperative pain control of ultrasound-guided caudal block versus spinal anesthesia in patients undergoing anorectal surgery.

Patients and Methods:

60 patients, both male and female, aged ≥21 years, with the American Society of Anesthesiologists' (ASA) classification of physical state I or II, non-oncological anorectal diseases, and elective anorectal surgeries, who were admitted to El Salam Port Said Hospital and affiliated hospitals, participated in this prospective randomised study. The Ethical Committee at El Salam Port Said Hospital and related hospitals in Port Said, Egypt, as well as the Faculty of Medicine at Port Said University in Port Said (ERN:MED (3/3/2024) s.no (145) ANE 821_001), Egypt, gave their approval for the study to be conducted. Informed consent was signed by the patients.

Exclusion criteria were reported coagulopathy, infection at the site of injection, history of medication allergies, history of psychiatric problems, pregnancy, body mass index < 40, oncological anorectal diseases, and spine deformities or previous spine surgeries.

Randomization:

Each patient's code was stored in an opaque sealed envelope, and computer-generated randomization numbers were utilized for random allocation. In parallel fashion,

patients were divided into two groups at random using a 1:1 allocation ratio: Group I (US guided caudal block): received US guided CEB and Group II (spinal anaesthesia): received spinal anaesthesia (SA).

Prior to surgery, the patients' medical and surgical histories were obtained, and a clinical examination was conducted, and routine laboratory investigations (complete blood count (CBC), prothrombin activity and international normalised ratio (INR)) were done. Each patient was taught how to quantify postoperative pain using the Visual Analogue Scale (VAS). A VAS score of 0 indicates "no pain," while a score of 10 indicates "the worst pain imaginable" [9].

Intraoperatively, on entering the operating room, all patients were attached to a multichannel monitor (GE B40) that provided continuous electrocardiography monitoring, including peripheral oxygen saturation (SpO_2), noninvasive arterial blood pressure (NIBP), and heart rate (beats / minute) and rhythm, skin-surface temperature probe (T).

Each patient received a 20 G peripheral cannula. Midazolam (0.02 mg/kg) was administered as a premedication to all patients. Ringer's solution (10–20 ml/kg) was administered to each subject while the anesthetic procedure was being performed [10].

Anesthetic technique

Group I: (US guided CEB): The GE LOGIQ e, a US gadget, was utilized. The lumbosacral area was aseptically prepared while the patient was in prone posture before the injection was given. The CEB procedure was carried out using a linear high-frequency US probe. The liner transducer is placed transversely (axially) in the midline, proximal to the anus, when the sacral bone is visible. The sacrococcygeal ligament, sacral hiatus, two sacral cornua, and the base of the sacrum were visible when the transducer was positioned cranially, which resembles a frog's face. The

sacral cornua and the basal region of the sacrum were two hyperechoic features seen. The sacral gap was discernible between the hypoechoic area and the hyperechoic structures. **Figure (1).**

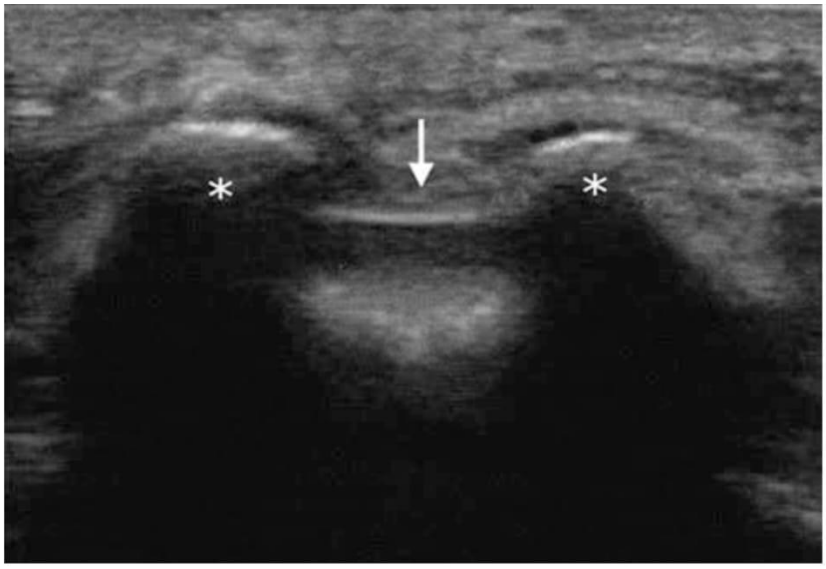

Figure (1): Transverse ultrasound view showing the two sacral cornua (asterisk) as two hyperechoic structures. Arrow indicates sacrococcygeal ligament covering sacral hiatus.

A sagittal image of the caudal space was acquired by moving the probe longitudinally [11]. A 23-G needle was used to inject 2 mL of 2% Xylocaine (a local anesthetic) into the needle insertion site. 20 ml of 0.5% bupivacaine (a local anesthetic) was administered to CEB in-plane using a 22-G spinal needle. After verifying the needle tip with a transverse view, a few milliliters of medication were administered pulsatilely, and the epidural space was seen to expand. **Figure (2).**

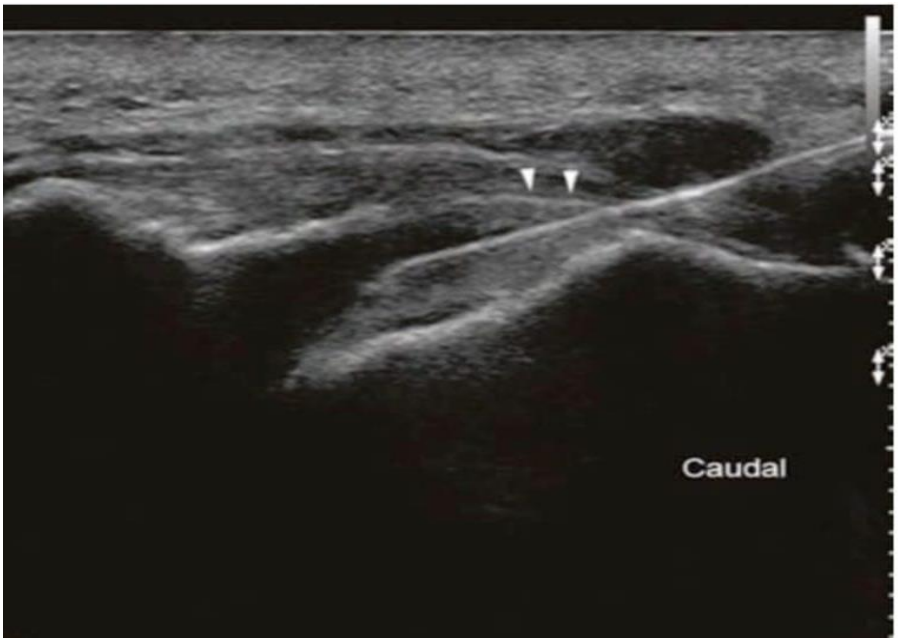

Figure (2): Longitudinal ultrasound image showing the needle (in-plane) inside the caudal epidural space. Arrows point at the sacrococcygeal ligament.

Group II (SA): utilizing a median approach, SA was administered while seated at the L3–4 level. A 25-G spinal needle was used to perform a subarachnoid block. Following confirmation that cerebrospinal fluid was flowing freely from the hub, 2 milliliters of bupivacaine 0.5% was given [12]. Positioning and manipulation were not allowed until two minutes have passed from the end of the anesthetic technique. All patients were given 1000 mg paracetamol intravenously at the end of surgery.

Postoperatively, standardized analgesic regimen was prescribed in the postoperative period. All patients receive paracetamol 1 gm every 6 h as routine analgesia. Rescue analgesia in the form of pethidine (50mg) was given intravenous when VAS score is ≥ 4 at any time post-operative in the first 6 hours and was repeated every 30 minutes till VAS score is <4. VAS was assessed for 6 hours post operatively and was recorded every 1 hour.

Analgesia duration is the time interval between the end of block administration and the first time a rescue analgesic is needed.The total dose of pethidine given to the patients postoperatively was calculated and elaborated statistically.

The adverse effects in post anaesthesia care unit (PACU) also were assessed. Blood pressure below 20% of normal and was treated by giving intravenous infusion of 20ml/kg normal saline, tachycardia above 100 beats per minute and was managed by pain assessment by VAS and giving rescue analgesia if needed and vagal maneuvers (carotid sinus massage and Valsalva maneuver), and bradycardia below 60 beats per minute was treated by intravenous atropine (0.01mg.kg).Hypotension, tachycardia and bradycardia are all signs of hemodynamic instability.

Block failure: failure to anesthetize the area of surgery or patient recognized any pain during surgery and was treated by induction of GA by intravenous (IV)fentanyl (1μg.kg) and propofol (2-2.5 mg.kg) injected slowly till loss of verbal communication and bag mask ventilation using by isoflurane (1.2%) in oxygen-air mixture (70/30%) and atracurium (0.5 mg.kg) as a muscle relaxant. Maintenance of anesthesia was done by isoflurane (1.2%) in oxygen-air mixture (70/30%) using laryngeal mask airway.

Tinnitus, perioral numbness, vertigo, confusion, seizures, coma, respiratory depression, arrhythmias, and cardiovascular depression are among risks associated with local anesthetic poisoning. To treat postoperative nausea and vomiting (PONV), 4 mg of ondansetron was injected intravenously.

The primary outcome was to compare patient satisfaction regarding anesthetic efficacy of US guided caudal block versus spinal anesthesia in patients undergoing anorectal surgery. The secondary outcome was monitoring peri-operative complications, comparing patient satisfaction regarding duration of anesthesia, post-

operative pain control of ultrasound-guided caudal block versus spinal anesthesia in patients undergoing anorectal surgery.

Calculating the Sample Size:

The sample size was calculated using the difference in patient satisfaction between spinal anaesthesia (20.8%) and US -guided caudal block (68.1%) in another study [13], with a power of 0.9, and a significance level of 0.05, a total of 54 patients (27 per group) was required. To avoid drop out of participants, we increased the number of patients per group to 30, so the total required sample size was 60 patients.

Statistical analysis

SPSS v26 was used to do the statistical analysis (IBM Inc., Chicago, IL, USA). The normality of the data distribution was assessed using histograms and the Shapiro-Wilks test. The mean and standard deviation (SD) of quantitative parametric variables were displayed, and the unpaired Student's t-test was used to compare the two groups. The Mann Whitney test was utilized to analyze quantitative non-parametric data, which were then displayed as the median and interquartile range (IQR). The Chi-square test or Fisher's exact test, as applicable, were used to analyze the qualitative variables, which were expressed as frequency and percentage (%). Statistical significance was defined as a two-tailed P value < 0.05.

Results:

Eight individuals refused to participate in the study, while 11 patients did not meet the eligibility standards after 79 participants had their eligibility assessed. From the remaining patients, two equal groups of thirty patients each were chosen randomly. Each assigned patient was located and statistical analysis was performed.**Figure (3)**

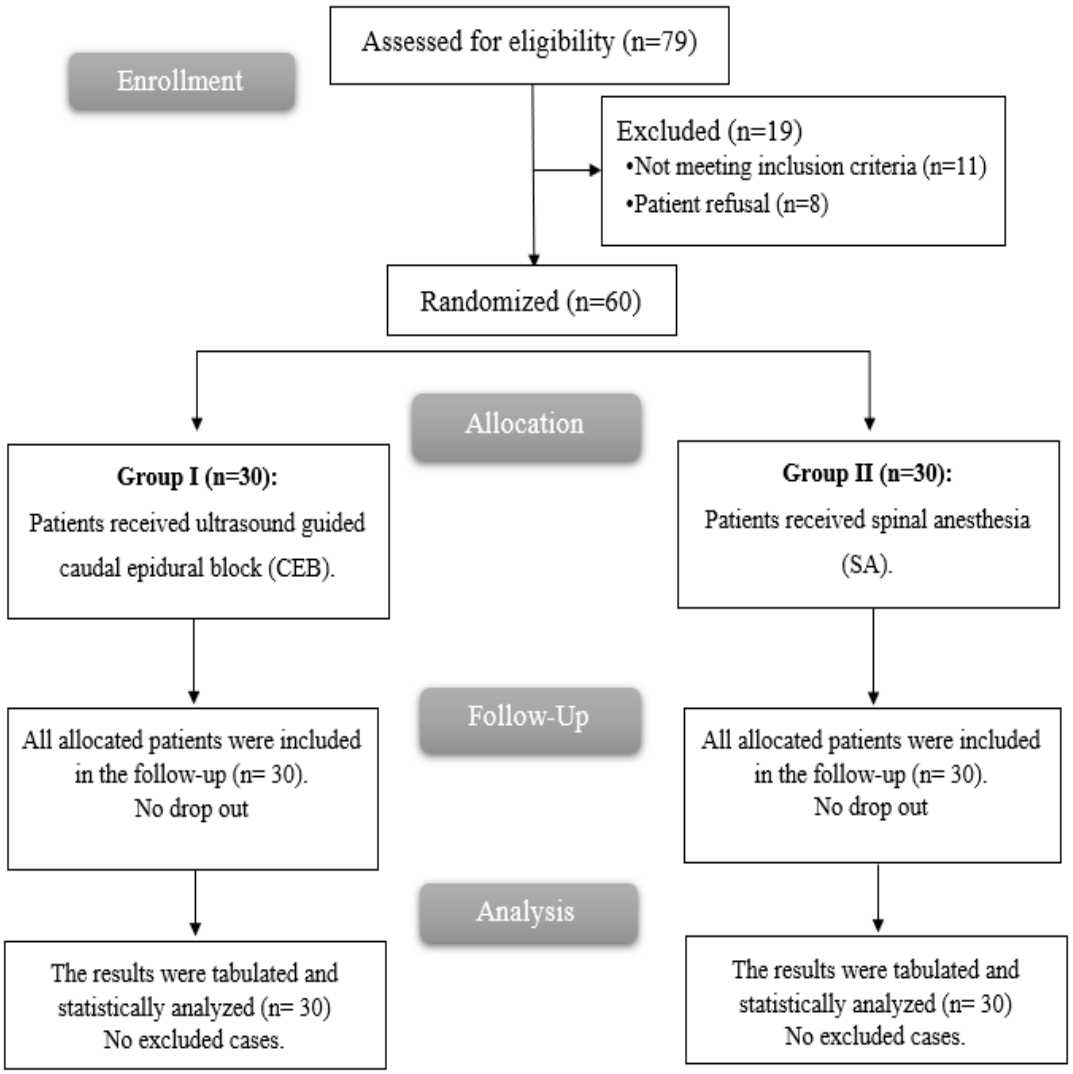

Figure (3): Enrolled patients' CONSORT flowchart

Age, sex, height, weight, BMI, ASA physical status, and duration of operation did not significantly differ between the two groups. Group I had a substantially longer anaesthetic technique time than group II (P <0.001).**Table 1**

Table 1: Demographic data, duration of surgery and time of aesthetic technique of the studied groups

		Group I (n=30)	Group II (n=30)	P value
Age (years)		46.57 ± 16.12	44.43 ± 18.73	0.638
Sex	**Male**	12 (40%)	14 (46.67%)	0.602
	Female	18 (60%)	16 (53.33%)	
Weight (kg)		77.67 ± 10.12	80.17 ± 11.15	0.367
Height (cm)		169.47 ± 7.69	171.63 ± 5.2	0.206
BMI (kg/m^2)		26.99 ± 4.19	27.2 ± 3.39	0.835
ASA physical status	**I**	17 (56.67%)	19 (63.33%)	0.598
	II	13 (43.33%)	11 (36.67%)	
Duration of surgery (min)		26.33 ± 3.7	27.67 ± 2.54	0.109
Time of anesthetic technique		12.1 ± 1.6	1.57 ± 0.5	**<0.001***

The data are displayed as frequency (%) or mean ± SD. ASA: American Society of Anaesthesiologists; BMI: Body Mass Index.

There were negligible differences in intraoperative HR, MAP, and SPO2 between the two groups at baseline, after anaesthesia was administered, after patient placement,every 15 minutes till the end of the surgery, and at the conclusion of the procedure. There were negligible differences in postoperative HR and MAP between the two groups at PACU, 1h, 2h, and 3h. Group I's postoperative HR and MAP were considerably lower than group II's at 4 hours, 5 hours, and 6 hours (P <0.05). After surgery, there was no appreciable change in SPO2 between the two groups at PACU, 1h, 2h, 3h, 4h, 5h, and 6h.**Figure (4).**

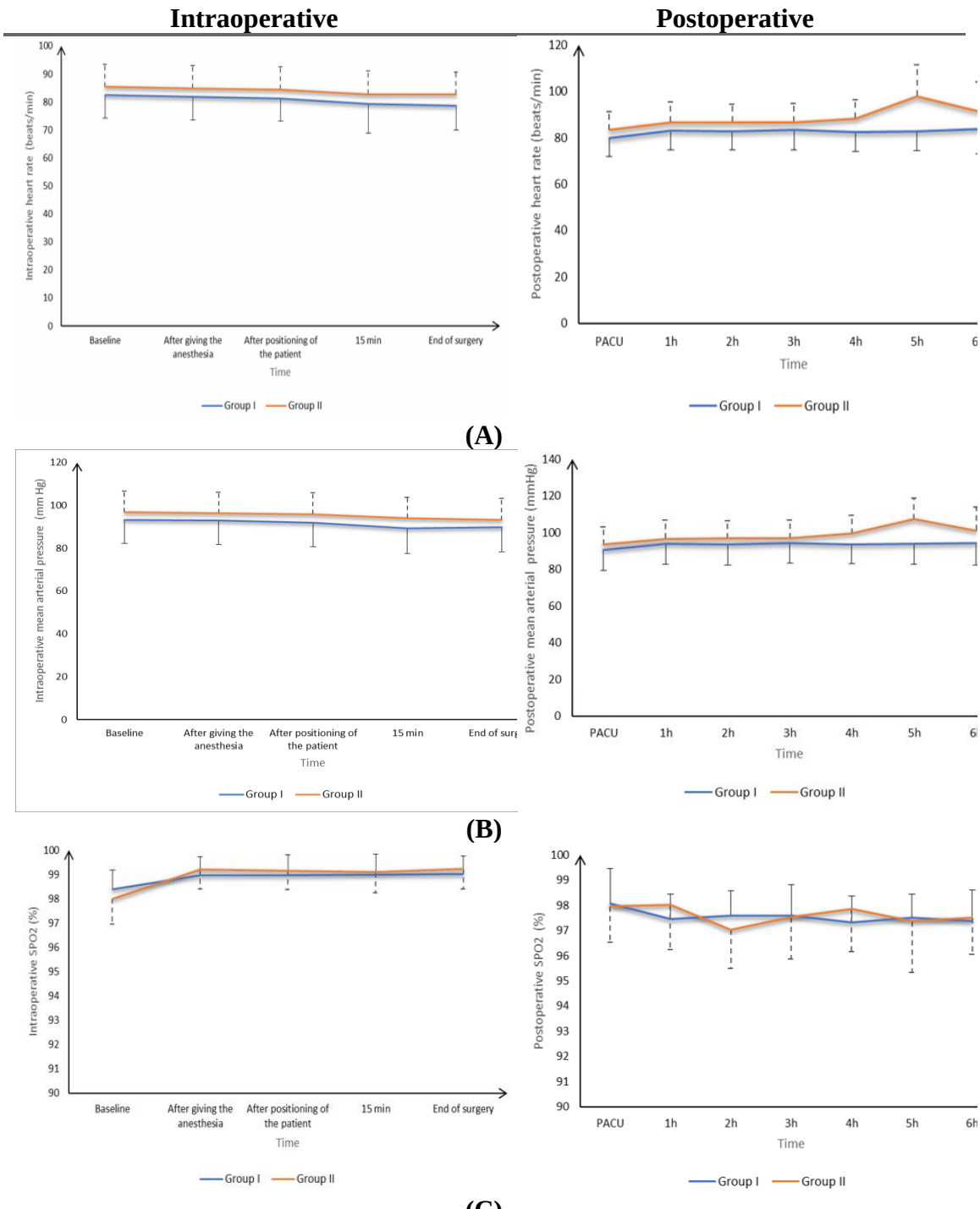

Figure (4): shows the study groups' (A) heart rate, (B) mean arterial pressure, and (C) oxygen saturation.

Group I experienced a considerably longer time to initially request rescue analgesia than group II (P<0.001). Both the total amount of pethidine consumed and the number of patients in need of it were significantly lower in group I than in group II

(P<0.001). The difference in time to ambulation between the two groups was negligible. **Table 2**

Table 2: Time to ambulation for the examined groups, number of patients in need of pethidine, total amount of pethidine used, time to first request rescue analgesia, and time to ambulation.

	Group I (n=30)	Group II (n=30)	P
Time to first request of rescue analgesia (h)	8.97 ± 1.1	4.67 ± 0.8	**<0.001***
Number of patients need pethidine	2 (6.67%)	30 (100%)	**<0.001***
Total pethidine consumption (mg)	3.33 ± 12.69	73.33 ± 36.51	**<0.001***
Time to ambulation (h)	12.9 ± 3.79	14.7 ± 3.51	0.061

Data presented as median (IQR), *: Significant when P value ≤0.05.

VAS was insignificantly different at PACU, 1h, 2h and 3h between both groups. VAS was significantly lower at 4h, 5h and 6h in group I than group II (P<0.05). **Table 3**

Table 3: VAS of the studied groups.

	Group I (n=30)	Group II (n=30)	P
PACU	0(0 - 1)	0(0 - 1)	0.421
1h	1(0 - 1)	1(0 - 1)	0.601
2h	1(1 - 2)	2(1 - 2)	0.166
3h	2(1 - 2)	2(1 - 3)	0.063
4h	2(1 - 3)	4(1 - 5)	**0.029***
5h	2(1 - 3)	3(1 - 5)	**0.012***
6h	3(2 - 3)	3(2 - 4.75)	**0.022***

Data presented as median (IQR), *: Significant when P value ≤0.05, VAS: Visual analogue scale, PACU: Post anesthesia care unit.

Bradycardia, hypotension and PONV and patient satisfaction and rate of success of the block were insignificantly different between both groups. Respiratory depression didn't occur in any patients in both groups. **Table 4**

Table 4: Complication of the studied groups, and patient satisfaction.

		Group I (n=30)	Group II (n=30)	P value
Bradycardia		**2 (6.67%)**	**1 (3.33%)**	**1**
Hypotension		**4(13.33%)**	**2 (6.67%)**	**0.671**
PONV		**3 (10.0%)**	**5 (16.67%)**	**0.707**
Respiratory depression		**0 (0.0%)**	**0 (0.0%)**	**0.132**
Patient satisfaction	**Strongly dissatisfied**	**0 (0.0%)**	**0 (0.0%)**	**0.179**
	Dissatisfied	**0 (0.0%)**	**1 (3.33%)**	
	Neutral	**1 (3.33%)**	**2 (6.67%)**	
	Satisfied	**11 (36.67%)**	**17 (56.67%)**	
	Strongly satisfied	**18 (60.0%)**	**10 (33.33%)**	
Rate of success of the block		**29 (96.67%)**	**30(100.0%)**	**1**

Data presented as frequency (%), PONV: Postoperative nausea and vomiting.

Discussion

Minor anorectal diseases occur with the one in 2500–5000 live births [14]. Because of the incision and dissection in the region's rich innervation, patients undergoing anorectal surgery need significant doses of anesthesia [15].

Typically, spinal anesthesia (SA), caudal epidural blocks (CEB), local infiltration, or general anesthesia are used for anorectal surgery. Each of these methods has pros and cons [16].

The most popular regional anesthetic method for anorectal surgery is spinal anesthesia (SA), which has the benefits of quick onset and offset [17]. SA is a straightforward anesthetic method that uses low doses of local anesthetic drugs to generate sufficient muscle relaxation and analgesia [18]. However, SA may not be enough, especially during lengthy surgical procedures, and postoperative pain may need to be managed with other analgesics [19]. Additionally, a longer hospital stay is the result of arterial hypotension and the substantial sensory and motor block that SA provides to patients having anorectal surgery [20].

In the present study, the intraoperative heart rate was insignificantly different at all times measured between both groups. Postoperative heart rate was significantly lower at 4h, 5h and 6h in CEB group than SA group. Also, the intraoperative mean arterial pressure was insignificantly different at all times measured between both groups. Postoperative mean arterial pressure was significantly lower at 4h, 5h and 6h in CEB group than SA group. The lower postoperative heart rate and MAP in the CEB group may indicate a more consistent analgesic effect, which could contribute to reduced sympathetic stimulation during the recovery period. The intraoperative and postoperative SPO2 was insignificantly different at all times measured between both groups. In the same line, **Chen et al.** [21] demonstrated that the CEB group's mean

arterial blood pressure was substantially lower than the SA group's. This was in line with **Seyedhejazi et al** [22], who pointed out that the CEB group's postoperative heart rate and systolic blood pressure were noticeably lower than those of the SA group.On the other hand, **Bozkurt et al.** [23] demonstrated that the heart rate and mean arterial blood pressure were insignificantly different between both groups.

According to this study, the CEB group's initial request for rescue analgesia was substantially delayed compared to the SA group. The CEB group consumed considerably less pethidine overall and had fewer patients who required it than the SA group. The difference in time to ambulation between the two groups was negligible. This agreed with **Chen et al.** [21] who found that the CEB group's initial request for rescue analgesia was much later than the SA group's. Additionally, the CEB group required far less analgesia than the SA group. The difference in time to ambulation between the two groups was negligible.

Supporting our study, **Seyedhejazi et al.** [22] stated that The CEB group required analgesia far less frequently after surgery than the SA group.

According to our results, the VAS was insignificantly different at PACU, 1h, 2h and 3h between both groups while it was significantly lower at 4h, 5h and 6h in CEB group than SA group. In harmony with our study, **Chen et al.** [21] showed that the pain scores were significantly lower in CEB group than SA group. In the same line, **Bozkurt et al.** [23] found that the pain scores were significantly lower in the CEB group than the SA group. In the same context, **Abdelrazik et al.** [24] demonstrated that the pain scores were significantly lower in the CEB group than control group which received no regional anesthetic technique and immediate rescue analgesia was given in the form of intravenous (IV)fentanyl (1µg.kg) followed by diclofenac suppository

as needed. Also the time to request of first rescue analgesia was longer and the total dose of opioids (fentanyl) was higher in the control group.

Bradycardia, hypotension, and PONV did not substantially differ between the two groups in the current study. None of the patients in either group had respiratory depression. Between the two groups, there was no discernible difference in patient satisfaction or the block's success rate. This was in line with what **Bozkurt et al.** found.[23] Who illustrated that there is no difference in the satisfaction of surgeons and patients between the CEB group and the SA group. Considering this, **Abdelrazik et al**. [24] illustrated that the postoperative complications were comparable between the CEB group than control group. No patients reported respiratory depression at the site of injection in both groups. In this context, **Ahiskalioglu et al**. [25] noted that there was no post-operative nausea or vomiting observed in either the US CEB group or the conventional CEB group. Also, the rate of success of the block was similar between the US CEB group and the conventional CEB group. On the other hand, **Chen et al.** [21] found that there was significantly higher patient satisfaction in the CEB group than the SA group. Also, **Seyedhejazi et al.** [22] observed that the failure in anesthesia rate was significantly lower in the CEB group than the SA group.

Limitations:

A single-center study that might yield findings that differ from those obtained elsewhere, limited sample size that could yield insignificant findings, not comparing both anesthetic techniques using different type of anesthetics with different doses and concentrations, not comparing both anesthetic techniques in different types of surgeries.

Conclusions:

The US-guided CEB patients exhibited superior hemodynamic stability, reduced analgesic consumption, and prolonged time to rescue analgesia, along with reducing pain scores compared to SA patients.

Sponsorship and financial assistance: Nil

Conflict of Interest: Nil

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