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A Comparative Study on Influence of Epidural Volume Extension on the Block Characteristics of Subarachnoid Plain Bupivacaine for Lower Abdominal Surgeries

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Central neuraxial block is a common anaesthetic technique for lower abdominal surgeries. Epidural volume extension is a technique that involves the injection of saline into the epidural space immediately following intrathecal injection, after the institution of combined spinal-epidural anaesthesia. This technique has some advantages over general anaesthesia like a circumvention of laryngeal response to airway manipulation. It also provides an effective sensory and motor blockade. The aim of this study was to assess the influence of epidural volume extension on the block characteristics of subarachnoid plain bupivacaine administered for lower abdominal surgeries.

Results: All the forty-two patients recruited completed the study. The mean time to request for the first analgesia was significantly longer in group Subarachnoid plus Epidural volume extension (SEVE) (208.63 $\pm$ 84.14 minutes) than in group Subarachnoid (S) (148.95 ± 40.55 minutes), *P= 0.02*. The maximum median level of sensory block was significantly higher in the Subarachnoid plus Epidural volume extension (SEVE) group compared with the Subarachnoid (S) group and this was recorded at the 8th minute; T_4 (T_4-T_6), and T_5 (T_5-T_7), respectively. (*P=0.01*). The mean time to reach T_6 sensory level was significantly less in group Subarachnoid plus Epidural volume extension

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(SEVE); 6.00 ± 1.80 minutes compared with group Subarachnoid (S); 7.00 ± 1.10minutes. (*P=0.04*). The systolic and diastolic blood pressure, mean arterial pressure, pulse rate and peripheral oxygen saturation recorded during the duration of surgery was within normal limits in both Subarachnoid (S) and Subarachnoid plus Epidural volume extension (SEVE)groups. There was no statistically significant difference between the two groups. The side effects recorded were hypotension and shivering. Hypotension occurred in 19.0% of patients in both groups, while shivering occurred in 9.5% in group Subarachnoid plus Epidural volume extension (SEVE) and 4.8% in group Subarachnoid (S) (*P=0.575*).

Conclusion: This study showed that epidural volume extension when using intrathecal low dose plain bupivacaine for lower abdominal surgeries not only provided adequate sensory and motor block but also a prolongation of anaesthesia. The incidences of side effects noticed in both groups were low and similar. Therefore, this study underscores the relevance of epidural volume extension on the subarachnoid block characteristics.

Keywords: Epidural Volume Extension; Plain Bupivacaine; Subarachnoid Block; Block Characteristics; Lower Abdominal Surgeries.

ABBREVIATIONS

ASA : American Society of Anesthesiologists
BMI : Body Mass Index
BP : Blood Pressure
C8 : Cervical Vertebra 8
DBP : Diastolic Blood Pressure
EVE : Epidural Volume Extension
HR : Heart Rate
Kg : Kilogram
Kg/m^2 : Kilogram per meter square
L3 : Lumbar Vertebra 3
MAP : Mean Arterial Pressure
µg : Microgram
Mg : Milligram
Mg/kg : Milligram per kilogram
Ml : Millilitre
mmHg : Millimetre of Mercury
Min : Minute
SPO_2 : Peripheral Oxygen Saturation
PACU : Post Anaesthesia Care Unit
SSS : Single-shot spinal
SD : Standard Deviation
S : Subarachnoid group
SEVE : Subarachnoid plus Epidural volume extension group
SBP : Systolic Blood Pressure
SPSS : Statistical Package for Social Sciences
T : Time
T4 : Thoracic Vertebra 4
TIVA : Total Intravenous Anaesthesia
VAS : Visual Analogue Scale

1. INTRODUCTION

Central neuraxial block is a common anaesthetic technique for lower abdominal surgeries [1], with single-shot subarachnoid block being the most commonly used technique due to its simplicity and ease of administration. However, its short duration of action limits its usefulness as surgeries lasting beyond two hours may sometimes require augmentation with or complete conversion to general anaesthesia [2]. Studies have shown that the duration of action of intrathecal plain bupivacaine is about 2 hours [3,4]. In order to circumvent this shortcoming,

several techniques with varying degrees of advantages and disadvantages have been employed. These include a single-shot subarachnoid block with local anaesthetic plus adjuvants, epidural technique and combined spinal-epidural anaesthesia. Single-shot subarachnoid block with local anaesthetic agent and adjuvants has been used to prolong the duration of anaesthesia but this is not without the side effects of the adjuvants. The addition of fentanyl causes a high incidence of pruritus while the addition of clonidine is associated with drowsiness and sedation [5]. Also, the addition of morphine may be associated with delayed respiratory depression, nausea and vomiting as well as urinary retention [6,7]. Epidural technique and combined spinal-epidural technique with a catheter *in situ* for intermittent injection of a local anaesthetic agent can prolong the duration of anaesthesia. These can be associated with epidural catheter migration as a side effect [8]. The epidural catheter migration could be into the epidural vein leading to local anaesthetic systemic toxicity or into the subarachnoid space causing total spinal anaesthesia when a local anaesthetic agent is injected [9]. A recent clinical modification of the combined spinal-epidural anaesthesia technique is epidural volume extension [10]. Epidural volume extension (EVE) refers to the injection of normal saline into the epidural space immediately after a subarachnoid injection, aiming to rapidly increase the sensory block level and by extension the duration of action resulting from intrathecal injection of local anaesthetic [10]. Thus epidural volume extension may be used to raise the level of post-spinal sensory block, hence it is a useful tool in the Anaesthetist's armamentarium [11].

The mechanism by which epidural volume extension increases the cephalad spread of intrathecal local anaesthetic is not fully understood. However, a myelographic study demonstrated dural sac compression by the fluid in the epidural space causing cephalad spread of the local anaesthetic already present in the subarachnoid space [12]. A study has shown that injection of 10 ml of normal saline into the epidural space after 10 minutes of spinal anaesthesia at L_4-L_5 intervertebral space significantly increased the height of the sensory block (*P<0.001*) [12]. Tiwari et al., in their case series also highlighted the efficacy of this novel technique (EVE) in lower abdominal surgeries [13]. Some of the lower abdominal surgeries that will benefit from this technique are abdominal myomectomy, total abdominal hysterectomy, vaginal hysterectomy and open prostatectomy. Some works have shown that the use of subarachnoid plain bupivacaine followed by epidural volume extension increased the level of sensory block and duration of the block [2]. However, a paucity of studies on epidural volume extension observed in our environment prompt this study. The study, therefore, sets to examine the influence of epidural volume extension on the block characteristics of the subarachnoid block using plain bupivacaine in this sub-region.

2. METHODOLOGY

2.1 Study Design, Setting and Population

This was a randomised double-blinded, controlled study on the influence of epidural volume extension on the block characteristics of subarachnoid plain bupivacaine for lower abdominal surgeries. The study took place in the main operating theatre of the University of Port Harcourt Teaching Hospital. This is one of the tertiary hospitals in Nigeria. The main operating theatre where the research was carried out has six well equipped operating suites that offer anaesthesia services to various surgical specialities such as General Surgery, Urology, Orthopaedics Surgery, Gynaecological Surgery, Neurosurgery and Cardiothoracic surgery. The study population was American Society of Anesthesiologists' (ASA) class I or II patients aged between 18 and 70 years who were scheduled for elective lower abdominal surgeries under the central neuraxial block.

2.2 Determination of the Sample Size

The sample size was calculated using the formula for comparison of means [14] and using standard deviations in the two groups in the work by Mochamat H et al (comparison of duration of motor block of isobaric Bupivacaine SD=32 minutes and hyperbaric Bupivacaine SD=24 minutes [3].

2.3 Randomisation

The investigator provided 42 equal, square pieces of paper. Twenty-one (21) of them were labelled S (subarachnoid group) and the other 21 pieces were labelled SEVE (subarachnoid + epidural volume extension group) and each of them placed in an opaque envelope and sealed. After the envelopes were thoroughly mixed together in a bag, each patient for the study was asked to pick an envelope from the bag and was subsequently assigned to whatever group picked.

2.4 Pre-operative Assessment and Preparation

Patients were seen in the wards the day prior to surgery and relevant history was obtained. Full general and systemic examinations were carried out and the patient's back was inspected for any local sepsis or anatomical deformity. Weight and height were checked and Body Mass Index (BMI) calculated. The airway was assessed using the Mallampati scoring system [15]. Basic investigations such as packed cell volume, urinalysis, serum electrolytes, urea and creatinine were reviewed appropriately. Preoperative fast was prescribed according to ASA fasting guidelines (8 hours before surgery for fried and fatty food, 6 hours before surgery for light meals and non-human milk and 2 hours before surgery for clear fluids). Typed blood was made available depending on the anticipated blood loss and no premedication was given. The anaesthetic technique was fully explained to the patients and they were assured that there would be no harm or pain.

2.5 Details of Anaesthesia

On the day of surgery, the anaesthetic machine was checked and preparations for both regional and general anaesthesia were made in theatre. A functional laryngoscope with two blades alongside three tracheal tubes of appropriate sizes was made available. An emergency tray containing drugs for resuscitation (atropine, adrenaline, ephedrine, aminophylline and hydrocortisone) was made available. Drugs for general anaesthesia (thiopentone, propofol, suxamethonium, and pancuronium) were made available in case of any failed block. The subarachnoid block was considered failed if the patient reacted to a painful stimulus after 10-15 minutes of intrathecal injection of bupivacaine.

On arrival in the operating room, monitors were attached and the baseline vital signs (Non-invasive blood pressure, arterial oxygen saturation, pulse rate, temperature and electrocardiogram) were measured and recorded with a multiparameter monitor (Dash 4000$^{(R)}$ manufactured by G.E Medical system information technologies Inc. USA). Intravenous access was secured with a 16G cannula on the dorsum of the non-dominant hand and 15 ml/kg of warmed 0.9% saline was infused over 15 minutes prior to establishing the block, and thereafter maintained with 1.5-2 ml/kg/hr in addition to replacing the on-going losses. The researcher, having observed the aseptic technique and with the patient in the sitting position on the operating table, cleaned the back with cetrimide and povidone-iodine. The back was then draped. The L_3 - L_4 intervertebral space was identified, the overlying skin and the subcutaneous tissue was infiltrated with 2 ml of 1% Lidocaine using a 23G hypodermic needle. Epidural anaesthesia was performed by the researcher at the level of L_3-L_4 intervertebral space via a midline approach using 16G Tuohy epidural needle after making a nick on the skin with a size 11 scalpel blade. Loss of resistance to normal saline was used to identify entry into the epidural space and care was taken to limit the volume of the normal saline to not more than 1 ml. Thereafter an 18-guage multi-fenestrated catheter was placed 4 cm into the epidural space and the Tuohy needle gradually but carefully removed. A test dose using 3 ml of 1.5% lidocaine with 1:200000 adrenaline was given to rule out both intrathecal and intravascular placement of catheter.

Then subarachnoid block was performed at L_4-L_5 interspace after skin infiltration with 2 ml of 1% lidocaine using a 26G Quincke spinal needle via an introducer needle. Following a free flow of cerebrospinal fluid, 10mg of 0.5% plain bupivacaine was injected intrathecally in both groups. The spinal needle was withdrawn and a sterile dressing applied. The epidural catheter was then secured with an adhesive tape to the shoulder and the patient placed in the supine position with a pillow under the shoulder and head to achieve a 15^0 head-up tilt.

After five minutes of intrathecal injection of plain bupivacaine, patients in the SEVE group had 10 ml of normal saline injected into the epidural space via the epidural catheter. No patient received general anaesthesia since there was no case of failed subarachnoid block. In both groups, sensory and motor blockade were assessed every 2 minutes after placing the patient supine until 10 minutes following the intrathecal injection and thereafter every 10 minutes till the end of surgery. The BP, MAP and Pulse were checked every 2 minutes for the first 15 minutes and thereafter every 5 minutes till the end of surgery. The level of sensory blockade was assessed by loss of pain sensation to neurotip in the midclavicular line. These assessments were done by another anaesthetist, a senior registrar who was taught how to collect the needed data but was blinded to the anaesthetic technique by shield using drape.

Motor blockade was assessed using the modified Bromage motor score, [2] wherein

0= Able to move hip, knee and ankle.
1= Unable to move hip, able to move knee and ankle.
2= Unable to move hip and knee, able to move ankle
3= Unable to move hip, knee and ankle

The position of the operating table was kept neutral without any tilting during the block and surgery. Surgery was allowed to commence when the modified Bromage score reached its maximum point (3) and sensory block ascended to T_6 level for the SEVE group and T_8 for the S only group. The incidence of intraoperative adverse effects such as hypotension, bradycardia, and shivering was monitored and recorded. Hypotension, defined as a fall in systolic blood pressure greater than 20% from baseline value or less than 90 mmHg when occurred was treated with normal saline infusion only without the use of ephedrine. Bradycardia was defined as a heart rate less than 60 /beats/minutes. When shivering occurred, it was treated.

Data regarding the highest dermatome level of sensory blockade and time to reach modified Bromage 3 were ascertained by testing for sensory loss to neurotip and getting patients to perform straight leg raising with knee bending respectively. This was done every 2 minutes until the determination of the highest level of sensory block and modified Bromage 3, thereafter the patient was draped and surgery commenced.

At the end of the surgery, the patient was transferred to the post anaesthetic care unit (PACU) and the monitoring of the blood pressure, pulse rate, oxygen saturation and MAP were continued every 5 minutes there for 20 minutes before discharge to the ward.

2.6 Data Analysis

Data were analysed using the statistical package for social sciences (SPSS) version 20 (IBM, USA) for windows. Tables and figures were used to present the results. Variables were expressed as median (interquartile range), proportion (number of patients), and mean $\pm$ standard deviation as appropriate. The student's t-test was used to examine the differences in the normally distributed variables such as the age, weight, height, duration of surgery, baseline blood pressure between the two groups (S and SEVE groups). Mann –Whitney U test was used to evaluate the difference in sensory block level, maximum motor block score, time to first analgesia, time to 2-segment sensory regression, time of motor regression to Bromage 0 and the quantities of ephedrine used between the two groups. A *P-value* of less than 0.05 was considered statistically significant.

3. RESULTS

Table 1 shows the comparison of patients' characteristics. The mean age of the patients in group S was 49.81 $\pm$ 15.13 years compared to 51.43 $\pm$ 14.08 years in the SEVE group (*P*=0.722). Male patients were 5 (23.8%) among group S and 6 (28.6%) among group SEVE while female patients were 16 (76.2%) among group S and 15 (71.4%) among group SEVE (*P*=0.726). Table 2 shows the Block characteristics and the mean time to reach T_6 sensory level was less in group SEVE; 6.00 $\pm$ 1.80 minutes compared to group S; 7.000 $\pm$ 1.10 minutes (*P*=0.04). Table 3 shows that the mean baseline systolic blood pressure of the patients in SEVE and S only groups were within the normal range (134.4±20.6 mmHg and 127.5±14.3 mmHg respectively (*P*=0.204). Table 4 showed the immediate post-operative median pain score using VAS between the groups. The median (range) pain scores of SEVE and S groups were 3 (2-4) and 3 (3-5) respectively (*P*=0.288). Table 5 shows the haemodynamic profiles of the patients in PACU. It showed the mean systolic blood pressure, mean diastolic blood pressure, mean arterial pressure, mean pulse rate and peripheral oxygen saturation (SPO_2) being monitored over this period.

Fig. 1 shows the trend of systolic blood pressure (SBP) and diastolic blood pressure (DBP) during the period of surgery among the groups. Fig. 2 shows the trend of MAP over the duration of surgery. The MAP for the SEVE group was consistently above those of the S only group but they were all within normal limits. Fig. 3 shows the trend of the pulse rate as the SEVE group maintained a trend consistently below that of the S only group. The trend for SpO_2 the duration of surgery was shown in Fig. 4. Fig. 5 shows the trend for systolic and diastolic blood pressure in PACU. The values were all within normal limits but the trend for SEVE group was consistently above the S only group.

Fig. 6 shows the trend for MAP in the PACU. The values were within normal limits. Fig. 7 shows the trend for the pulse rate in the PACU. The pulse rate for both groups was within normal limits.

Table 1. Comparison of patients' characteristics

	Group			
	SEVE	**S-Only**		
	Mean ± S.D	**Mean ± S.D**	**t-test**	***P-value***
Age (years)	51.43±14.08	49.81±15.13	0.359	0.722
BMI (kg/m^2)	25.50±2.97	24.59±2.33	1.111	0.273
	n (%)	**n (%)**	**Total**	**Chi-square (*P-value*)**
Sex				
Male	6 (28.6)	5 (23.8)	11 (26.2)	
Female	15 (71.4)	16 (76.2)	31 (73.8)	0.123 (0.726)
Total	**21 (100.0)**	**21 (100.0)**	**42 (100.0)**	
ASA Classification				
ASA - I	18 (85.7)	17 (81.0)	35 (83.3)	1.00$^{\mu}$
ASA - II	3 (14.3)	4 (19.0)	7 (16.7)	
Total	**21 (100.0)**	**21 (100.0)**	**42 (100.0)**	
Types of surgery				
Total abdominal hysterectomy	4 (19.0)	5 (23.8)	9 (21.4)	
Abdominal myomectomy	9 (42.9)	9 (42.9)	18 (42.9)	1.00$^{\mu}$
Vaginal hysterectomy	2 (9.5)	2 (9.5)	4 (9.5)	
Open prostatectomy	6 (28.6)	5 (23.8)	11 (26.2)	
Total	**21 (100.0)**	**21 (100.0)**	**42 (100.0)**	
	Mean ± S.D	**Mean ± S.D**	**t-test**	***P-value***
Duration of Surgery (minutes)	117.33±36.50	115.52±36.02	0.162	0.872

μ=Fisher's exact p

Table 2. Comparison of time to Bromage 3, time to median level of sensory block and time to two segments regression

	Group			
	SEVE Mean ± S.D	**S-Only Mean ± S.D**	**t-test**	***P-value***
Time to Bromage 3 (minutes)	2.90±1.00	2.90±0.70	0.000	1.000
Time to T6 (minutes)	6.00±1.80	7.00±1.10	2.185	0.04*
Time to two segment regression (minutes)	74.81±16.28	79.38±25.09	0.700	0.488

**Statistically significant (p<0.001)*

Time of assessment (minutes)	**SEVE Median level of sensory block (range)**	**S-Only Median level of sensory block (range)**	**Mann-Whitney U test**	***P-value***
2 minutes	T8 (T7 – T10)	T8 (T8 – T10)	148.500	0.05*
4 minutes	T8 (T6 – T8)	T8 (T6 – T10)	189.000	0.361
6 minutes	T6 (T5 – T7)	T6 (T5 – T8)	170.500	0.166
8 minutes	T4 (T4 – T6)	T5 (T5 – T7)	127.000	0.01*
10 minutes	T4 (T4 – T6)	T5 (T5 – T7)	75.000	0.001*

**Statistically significant (p<0.001)*

Table 3. Haemodynamic Status changes during the duration of surgery

Vital Sign	Group	N	Statistics		Test of Significance	
SBP (mmHg)			**Mean**	**Std. Deviation**	**t-test**	***P-value***
Baseline	S-Only	22	127.45	14.26	1.291	0.204
	SEVE	22	134.36	20.65		
2 -120 minutes	S-Only	22	113.21	15.94	1.40	0.168
	SEVE	22	119.41	13.29		
DBP (mmHg)						
Baseline	S-Only	22	84.00	5.72	0.325	0.747
	SEVE	22	85.09	14.66		
2-120 minutes	S-Only	22	73.13	12.60	0.678	0.502
	SEVE	22	74.57	7.50		
MAP (mmHg)						
Baseline	S-Only	22	98.82	10.89	1.297	0.187
	SEVE	22	103.36	15.57		
2 -120 minutes	S-Only	22	84.20	12.67	1.30	0.198
	SEVE	22	88.58	9.35		
Pulse rate(b/min)						
Baseline	S-Only	22	82.91	7.32	0.363	0.718
	SEVE	22	81.45	17.31		
2 -120 minutes	S-Only	22	78.43	8.06	1.26	0.213
	SEVE	22	75.11	9.33		
SPO_2 (%)						
Baseline	S-Only	22	99.27	0.46	1.225	0.227
	SEVE	22	99.09	0.53		
2 -120 minutes	S-Only	22	98.66	0.46	0.10	0.94
	SEVE	22	98.67	0.36		

Table 4. Comparison of immediate Post-operative median pain scores

	Group			
	SEVE Median (range)	**S-Only Median (range)**	**Mann-Whitney U**	***P-value***
Immediate post-Operative VAS Score	3 (2-4)	3 (3-5)	188.0	0.288

Table 5. Haemodynamic profiles in the Post-anaesthesia care unit.

Vital Sign	Group	N	Statistics		Test of Significance	
SBP (mmHg)			**Mean**	**Standard Deviation**	**t-test**	***P-value***
1-20 minutes	S-Only	22	117.16	11.62	1.07	*0.14*
	SEVE	22	119.41	10.52		
DBP (mmHg)						
1-20 minutes	S-Only	22	72.0	8.91	2.25	*0.03**
	SEVE	22	77.32	6.59		
MAP (mmHg)						
1-20 minutes	S-Only	22	83.89	9.22	2.71	*0.01**
	SEVE	22	91.05	8.26		
Pulse (b/min)						
1-20 minutes	S-Only	22	75.77	4.52	0.66	0.51
	SEVE	22	74.98	7.29		
SPO_2 (%)						
1-20 minutes	S-Only	22	98.77	0.203	1.32	*0.23*
	SEVE	22	98.95	0.305		

**Statistically significant (p<0.001)*

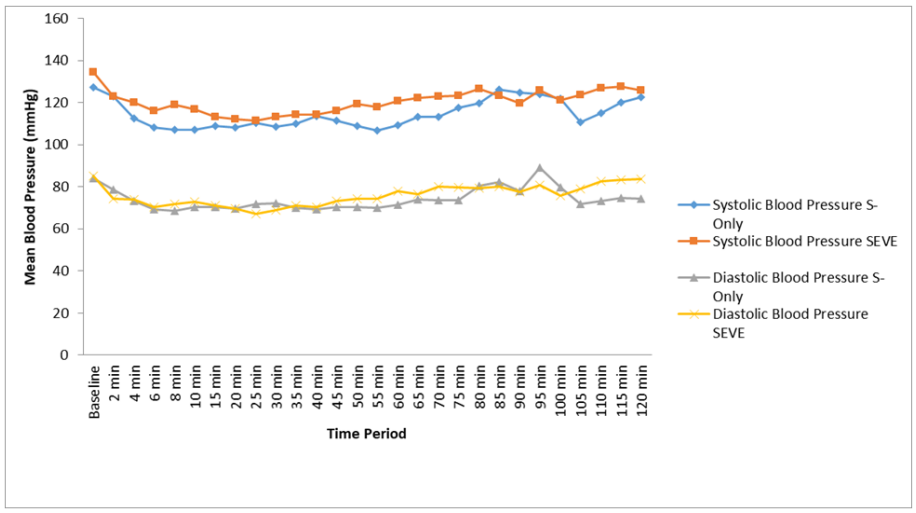

Fig. 1. Trends of Systolic and Diastolic Blood Pressure over the duration of surgery

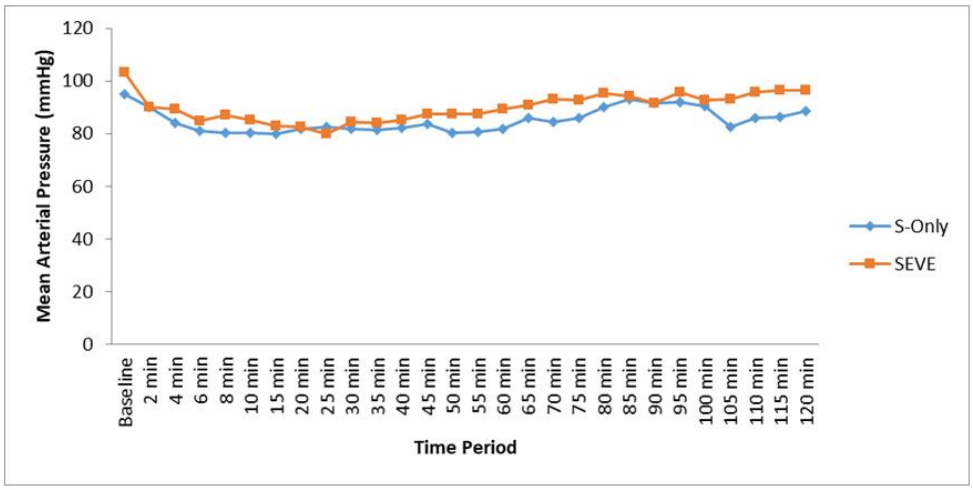

Fig. 2. Trends of mean arterial pressure over the duration of surgery

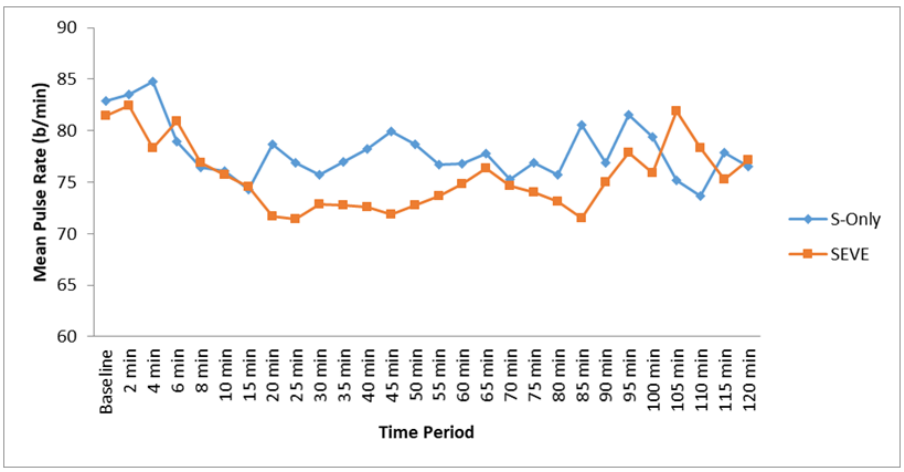

Fig. 3. Trends of pulse rate over the duration of surgery

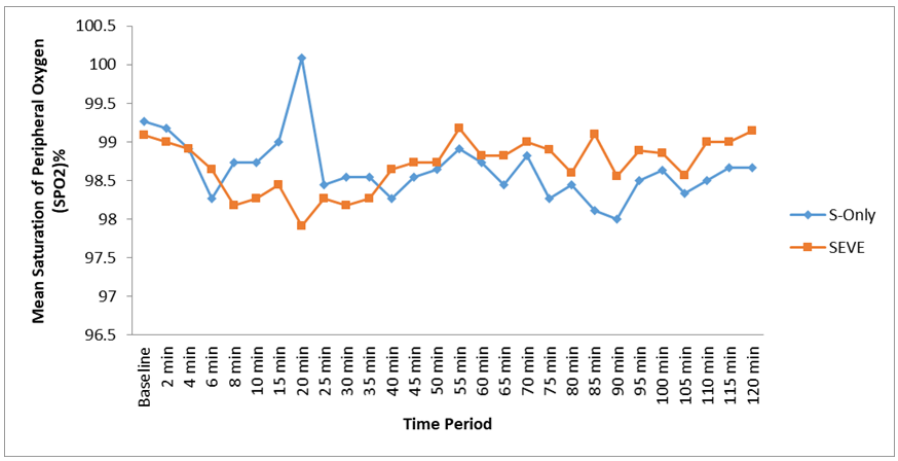

Fig. 4. Trends of peripheral oxygen saturation (SPO2) % over the duration of surgery

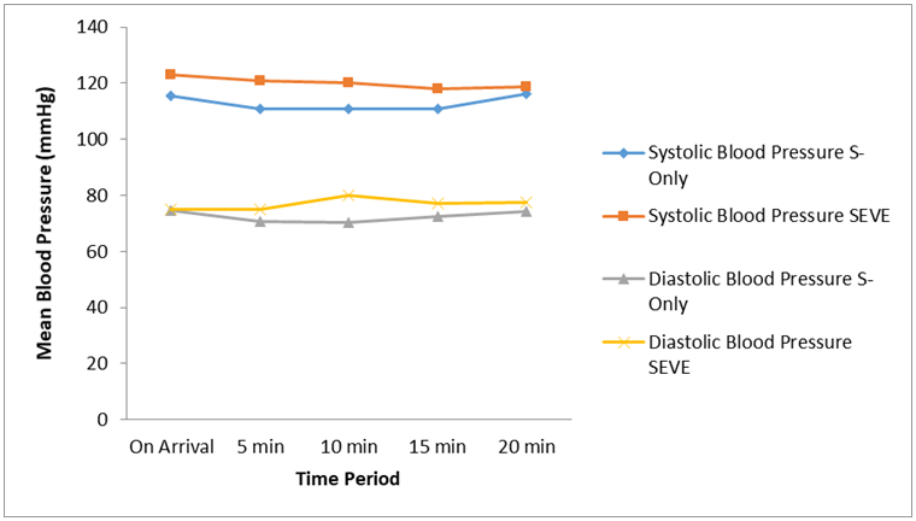

Fig. 5. Trends of systolic and diastolic blood pressure in the post-anaesthesia care unit

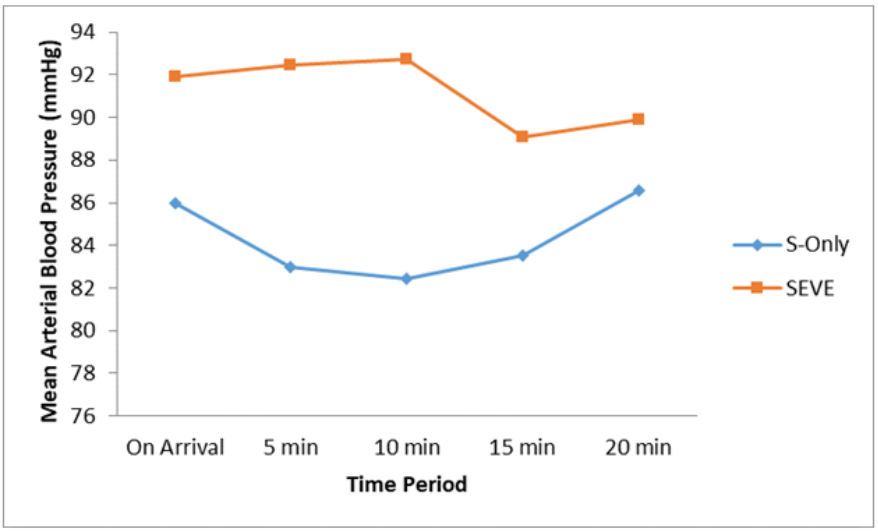

Fig. 6. Trends of mean arterial pressure in the post-anaesthesia care unit

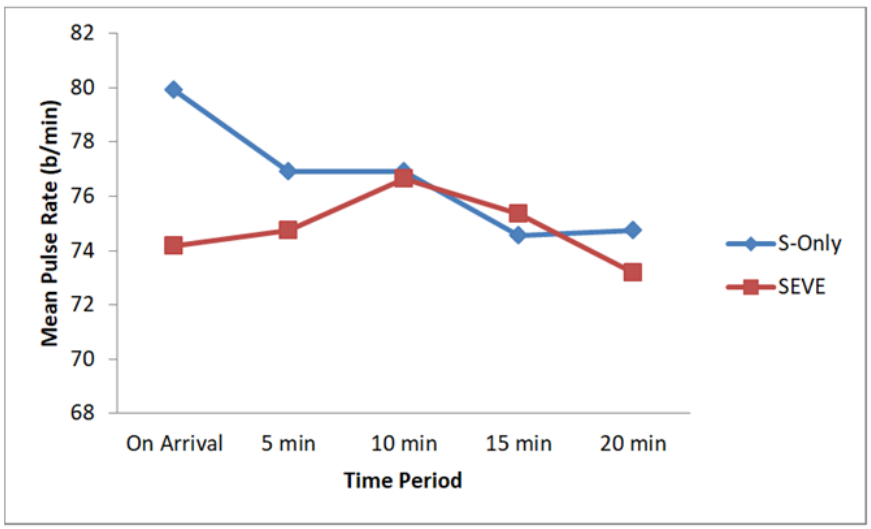

Fig. 7. Trends of pulse rate in the post-anaesthesia care unit

4. DISCUSSION

This study demonstrated that the use of a low dose of 0.5% plain bupivacaine with the application of epidural volume extension increased the height of the sensory block and the duration of anaesthesia (time to first analgesia) with minimal side effects for lower abdominal surgeries. Previous studies showing a comparison of EVE and subarachnoid block only have shown that EVE caused faster onset and higher peak sensory block level. Some authors however have reported no effect of EVE on block duration [16]. The two groups were similar for Age, Sex, Body Mass Index and American Society of Anesthesiologists (ASA) classification. We observed in the study that epidural volume extension by compression of the subarachnoid space increased the level of sensory block (*P<0.001*). The finding of this study is in agreement with the results of other researchers [17,18]. These researchers worked independently and found a significant increase in the level of sensory block in the group that had intrathecal bupivacaine with epidural volume extension (EVE) as against the group that had intrathecal bupivacaine only. The methodology used by the above-mentioned researchers for the intrathecal injection of the bupivacaine and the epidural volume extension was similar to that of the present study though the dose and volume of injectate were different. Bhandari et al. injected 10mg of hyperbaric bupivacaine intrathecally and used 10 ml of normal saline for EVE five minutes after the intrathecal injection which was the same as the present study. However, Gupta et al. used 6mg of hyperbaric bupivacaine and 25µg of fentanyl intrathecally with 5 ml of normal saline for EVE. Despite the differences in the dose and volume of injectate, the results with respect to sensory block level were similar. This could be because of the following. First, Gupta et al[48] studied pregnant patients at term while Bhandari et al studied non-pregnant patients who underwent hip surgeries. The present study was on non-pregnant patients who underwent lower abdominal surgeries. Pregnancy causes the epidural space to be contracted as a result of engorged epidural veins, which is part of the physiologic changes that occur in pregnancy [19]. This contracted epidural space coupled with the volume effect of EVE could account for the cephalad spread, even with a lesser dose of intrathecal hyperbaric bupivacaine. Secondly, the addition of fentanyl could have contributed. Fentanyl is a highly soluble, strong mu (µ) receptor agonist and strong analgesic that can be injected intrathecally [20]. The present study observed the median peak sensory block level to be T_4 and T_5 for SEVE and S groups respectively which were higher and adequate for surgery compared to the results of Gupta et al. (2012). The higher dose of 10mg plain bupivacaine and 10 ml of saline for EVE used in the present study could have accounted for the higher level of sensory block. In another study, an increase in the level of sensory block was noted in the group that received 10 ml of 0.25% bupivacaine for EVE compared to the group that normal saline was used with a maximum level increased to C8 [21]. This increase in the sensory block level was not only related to the volume effect of the injectate administered into the epidural space but in part to the type of injectate and on the other

hand the local anaesthetic dose effect. The present study recorded hypotension in 4 patients (19%) in each of the groups (SEVE and S) which was noticed in the first 10 minutes and was treated with infusion normal saline only. The higher dose of bupivacaine (15mg) as observed in another study could be responsible for the higher proportion of patients who had hypotension likely from a higher level of the block [22]. The absence of preload could also account for a higher incidence of hypotension compared to the index study. There was an initial drop in the blood pressure from the baseline (both the systolic and diastolic) in the first 10 minutes before stabilization in both groups. This initial early drop could be a result of the vasodilation that occurred in the blocked segment from the pharmacological sympathectomy. Ture et al. (2019) in their study had similar findings to the present study [23]. They recorded hypotension after subarachnoid block with 15mg plain bupivacaine and 2µg/kg of buprenorphine from 5 minutes to 60 minutes (for systolic blood pressure) and from 10 minutes to 45 minutes (for diastolic blood pressure). However, Salman et al. (2013) in contrast to the findings of Ture et al. (2019) and the present study did not record hypotension [24]. This could probably be due to the prophylactic ephedrine administered prior to instituting the subarachnoid block. The haemodynamic stability in the PACU in the present study could be because the patients were all fit and stable elective ASA 1 and 2 cases done under neuraxial block. The side effect observed in the present study was shivering. The incidence of side effects among the two groups showed no significant difference. Kaur & Jayant in their study recorded the incidence of nausea and vomiting in the groups (group with EVE and without EVE) but no shivering [25]. Although in the present study, there was no incidence of nausea and vomiting although shivering was noted. These could be due to the higher autonomic blockade and frequent hypotensive episodes.

5. CONCLUSION

The study concluded that the use of low dose intrathecal plain bupivacaine with epidural volume extension increased the height of the sensory block and the duration of analgesia. Low dose intrathecal plain bupivacaine alone, or with epidural volume extension did not eliminate haemodynamic disturbance such as hypotension. Both groups showed an incidence of hypotension.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICS APPROVAL

Ethical approval was sought and obtained from the Research and Ethics Review Committee of the University of Port Harcourt Teaching Hospital (Protocol No: UPTH/ADM/90/S.II/VOL.X/772). The details of the procedure were explained to each patient and written informed consent was then obtained from each patient before being recruited into the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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