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RELATIONSHIP BETWEEN HEART RATE VARIABILITY AND HYPOTENSION WITH BRADYACARDIA FOLLOWING SPINAL ANAESTHESIA IN PATIENTS UNDERGOING ELECTIVE SURGERY

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ABSTRACT

Background: **Hypotension is a common complication of spinal anaesthesia and occurs due to the sympatholytic effect of local anaesthesia on the cardiovascular system and consequence effects on the autonomic nervous system. Heart rate variability (HRV) is currently a well-known predictive tool for hypotension and the commonly associated bradycardia.**

Objective: **To evaluate the relationship between preoperative measured HRV and hypotension with bradycardia among patients undergoing elective surgeries under spinal anaesthesia.**

Method: **Eighty-four patients aged between 18 and 65 years were recruited. HRV measurements were taken immediately after electrocardiographic (ECG) tracing according to the North American Society for Pacing and Electrophysiology (NASPE). Pre and intraoperative heart rate (HR), systolic and diastolic blood pressure and mean arterial blood pressure were monitored and recorded every 5 minutes from induction of spinal anaesthesia till the end of surgery. Multivariate analysis was used to determine the association between development of hypotension, bradycardia and age, systolic and diastolic blood pressure and Heart Rate Variability in the low frequency (LF) and high Frequency (HF) domains.**

Results: **Hypotension occurred in 55 patients (65.5%). Age (p= 0.015), base line systolic blood pressure (p=0.003) and base line diastolic pressure (p=0.027) were significantly associated with the development of hypotension. Low frequency (LF) was significantly associated with the development of hypotension, while high frequency (HF) was significantly associated with bradycardia.**

Conclusion: **Heart rate variability was useful in predicting development of hypotension and bradycardia in patient undergoing elective surgery under spinal anaesthesia.**

Keywords: Spinal anaesthesia, Heart rate variability, Spinal hypotension, Bradycardia

INTRODUCTION

Hypotension is a common and severe complication of spinal anaesthesia. It is a physiological response of the cardiovascular system to the sympatholytic effect of the local anaesthetic agent used and it occurs in a third of all patients undergoing spinal anaesthesia.[1]

Decrease in systemic vascular resistance precedes the onset of hypotension that usually develops rapidly within the first 5-20 minutes of induction of spinal anaesthesia and this period is considered the most critical period for the patient.[2]

The definition of spinal hypotension varies according to the criteria used. Using the Mean Arterial Blood Pressure (MAP), it has been defined as a decrease in MAP more than 30% from the baseline.[3,4] Based on the systolic blood pressure, it has been defined as systolic blood pressure < 90 mmHg while bradycardia was defined as a heart rate less than 60 beats per minute.[2] Bradycardia usually occurs within 5 -20 minutes of spinal anaesthesia, though it may occur much later in some patients.

The risk factors that have been identified to be associated with higher incidence of hypotension and bradycardia includes age, weight, BMI, amount of colloid infusion given before puncture, chronic alcohol consumption, American Society of Anesthesiologist (ASA) physical status, preoperative history of hypertension, long term antihypertensive therapy, and frequency of puncture.[2,3,5]

In an attempt to reduce the occurrence and severity of hypotension and bradycardia in patients undergoing spinal anaesthesia, recent research efforts have been to predict the occurrence of spinal induced hypotension and bradycardia preoperatively.[5] The ability to predict the occurrence and severity of spinal induced hypotension will enable adequate preoperative preparation and will potentially help in reducing the incidence of hypotension. It would also lead to improved outcome for patients managed for hypotension.[5,6]

The difference between a person's lowest and highest heart rate is a reflection of the heart rate variability.[7-9] Unlike the heart rate that can be calculated by counting the pulse, electrocardiography is the gold standard for measuring Heart Rate Variability (HRV).[8,10]

Heart rate variability (HRV) is a very good measure of the efficiency and performance of the cardiovascular system.[9,11,12] Low HRV is indicative of reduced parasympathetic cardiac control and has been associated with disorders ranging from diabetes mellitus to sleep problems, as well as difficulty regulating emotions. Determination of the HRV preoperatively may therefore be a useful tool in predicting the occurrence of hemodynamic events, especially in high risk patients who are at risk of severe perioperative complications. This study was carried out to preoperatively determine the relationship between the incidence of post spinal hypotension and bradycardia in patients using preoperative assessment of heart rate variability parameters.

PATIENTS AND METHODS

Eighty-four consenting adult male and female patients between the ages of 18-65 years scheduled for elective lower abdominal surgeries under spinal anaesthesia were recruited following approval of research by the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee.

Exclusion criteria included the following: refusal to consent, American Society of Anaesthesiology (ASA) 3 or 4, more than two attempts at locating the subarachnoid space, newly diagnosed hypertensive, poorly controlled hypertension with diastolic BP greater than 110mmHg and presence of co-morbidities like hyperthyroidism, cardiovascular diseases, pheochromocytoma, active viral, fungal, or bacterial infection, psychiatric illness and requirement for conversion to general anaesthesia.

Study Procedure

All patients found eligible were reviewed preoperatively at least 24 hours before surgery. Routine investigations done included full blood count, electrolyte/urea and creatinine, chest radiography and electrocardiography. Patients were counseled and informed consent was obtained.

Electrocardiography was done at the patient's bed side by the attending cardiologist and analysis of the heart rate variability from the electrocardiographic tracing was done afterwards. Heart rate variability readings were recorded in a computer with patient lying comfortably in supine position. The duration of the ECG recording for the HRV study was 5 minutes. Recordings of the fast peaks of R waves on the electrocardiogram measuring the beat to beat variability of consecutive R waves of the sinus rhythm were taken.

The HRV parameters acquired was analyzed according to the North American Society for Pacing and Electrophysiology/European Society of Cardiologists (NASPE/ESC) guidelines using a commercial PC—ECG 1200 HR recorder. The HRV parameters analyzed included time domain parameters such as: Minimum interval between normal sinus beats (R-R interval), Maximum R-R interval, Average R-R interval, Average heart rate, Standard Deviation of R-R intervals (SDNN) representing the cyclic variability of the heart rate during the recording period. The root mean square of successive differences of R-R intervals (RMSSD), the number of intervals differing by more than 50 ms from the preceding interval (NN50); percentage of successive NN intervals that differ by 50ms (PNN50), was calculated by dividing NN50 by the total number of R-R intervals; and HRV triangular index measurement, the integral of the density distribution divided by the maximum of the density distribution. Frequency domain parameters generated included; low frequency (LF), high frequency (HF) and LF:HF ratio. All the parameters were recorded and stored on a personal computer. The analysis was performed by the attending cardiologist who was blinded to the hemodynamic changes after spinal anaesthesia and his analysis was blinded to the investigator. All other preoperative review plan was carried out by the attending anaesthetists and fasting guidelines was ensured.

Intraoperative Care

Routine monitoring including heart rate, electrocardiogram, non-invasive blood pressure, mean arterial pressure (MAP), pulse oximetry (SpO2) and axillary temperature were commenced before establishment of spinal anaesthesia. Intravenous access was secured and all patients received intravenous pre-medication with IV metoclopramide 10 mg and crystalloid preloading with 0.9 % saline at 20 ml/kg body weight over 15 minutes, following which a sub-arachnoid

block was established under sterile conditions by the attending anaesthetist. The identified space to be used was infilrated with 2% plain lidocaine (local anaesthetic agent) after which a size 25G Quincke spinal needle was used for all patients, at L3/L4 intervertebral space with patients in sitting position. Heavy bupivacaine 10 - 12.5 mg, plus 20 mcg of fentanyl, was administered intrathecally depending on patient's physique. Time of induction of spinal anaesthesia, level of sensory block, time surgery started and ended, intraoperative blood loss was documented. Throughout surgery, the patients were monitored for hypotension defined as >10 % reduction in baseline systolic blood pressure and also for bradycardia, defined as heart rate less than 60 beats per minute or reduction in heart rate >20% of pre-operative value. Time of occurrence of hypotension and bradycardia, drugs used for treatment, other side effects and any other medications used were documented.

Postoperative Care: At completion of surgery, all patients were transferred to the Post-Anaesthesia Care Unit (PACU)/recovery room and handed over to the attending PACU nurse. Patients were observed every five minutes in the first hour, and every 15 minutes in the second hour till a minimum Aldrete score of 8 was achieved before subsequent transfer to the ward.

Primary outcome measure was the prevalence of abnormal HRV using frequency domain and time domain. Also, the prevalence of hypotension and bradycardia, factors related to the occurrence of hypotension and bradycardia following spinal anaesthesia and surgical procedure were documented as secondary outcome measures.

Data analysis was with Statistical Package for Scientific Solutions (SPSS) version 20 software. Qualitative data were summarized using frequencies and percentages and presented using tables and appropriate charts. Quantitative data were present using mean, median, standard deviation and inter-quartile range as appropriate. Test of association was done using chi square test and factors associated up to 10% fitted into logistic regression model to determine predictors of hypotension. Level of statistical significance for all tests (p- value) was at 5%.

RESULTS

A total of 30 males (35.7%) and 54 females (64.3%) were recruited to participate in this study. The age range was between 18 and 65 years, with a mean age of 38.98±10.38 years. Age group 31-40 years had the highest number of participants 38 (45.2%), followed by age group 41-50 years with 18 (21.4%) participants,

Table 1: Baseline characteristics of patients

Parameter	Mean±SD	Frequency	Percentage
Gender			
Male	-	30	35.7
Female		54	64.3
Age (years)	38.9±10.4		
20-30	-	16	19.0
31-40	-	38	45.2
41-50	-	18	21.4
>50	-	12	14.3
Weight (kg)	67.9±14.0		
BMI (Kg/m²)			
Underweight (<18.5)		6	7.1
Normal (18.5-30)		68	81.0
Obese (>30)		10	11.9
ASA			
1		5	6.0
2		79	94.0
Comorbidities			
Hypertension		11	73.3
Diabetes mellitus		3	20.0
Parkinson's disease		1	6.7
Surgical Units			
Urology		9	10.8
General surgery		27	32.3
Gynaecology		31	36.9
Orthopaedic surgery		11	13.1
Plastic surgery		6	7.1

BMI-Body Mass Index, ASA- American Society of Anaesthesiologist

age group 20-30 years with 16 (19.0%), and age group >50 with 12 (14.3%) patients. The sociodemographic characteristics are as shown in Table 1.

The procedures done among participants were; 9 in urology unit, 27 in general surgery, 31 in gynaecology, 11 in orthopaedics and 6 patients in plastic surgery unit.

Heart rate variability parameters (HRV)

Table 2 shows the mean ± SD of the frequency domain and time domain parameters of heart rate variability parameters HR (p=0.036), LF normalized unit (p= 0.035), HF normalized unit (p=0.035), and the LF/HF ratio (p=0.035).

Peri-operative Parameters

The mean ± (SD) of the preoperative vital signs for heart rate (HR), systolic blood pressure and diastolic blood pressure 94.1±12.7/min, 130.8±16.9mmhg and 82.6±11.7mmhg respectively (Table 3). Intraoperative vital signs were as shown in Table 4.

The mean duration of surgery was 126.79±55.15mins, and the median (IQR) intraoperative blood loss was found to be 400 (200) mls. However, the range of

Table 2: Baseline heart rate variability parameters

Variables	Total (n=84)	Female (n=54)	Male (n=30)	P-value
Max RR(ms)	1009.8±439.32	973.3±322.29	1075.5±596.33	0.357
Min RR(ms)	644.1±112.07	639.4±99.46	652.5±133.24	0.709
Average RR(ms)	770.8±139.91	743.3±113.11	820.4±169.39	0.038*
Average HR(bpm)	79.6±13.49	82.0±12.91	75.1±13.56	0.036*
SDNN(ms)	53.9±84.91	44.3±42.24	71.3±129.98	0.097
rMSSD(ms)	53.3±105.06	45.2±56.55	67.9±159.37	0.550
NN50	17.2±26.47	18.6±30.59	14.6±16.90	0.711
pNN50	5.45±8.462	5.70±9.488	5.00±6.331	0.604
Low Frequency LF (msec2)	153.4±64.35	148.1±59.96	163.1±71.64	0.293
High Frequency HF (msec2)	156.5±83.31	164.7±85.46	141.7±78.51	0.122
LF:HF Ratio	1.42±1.633	1.42±1.965	1.41±0.759	0.035*
LF normalised units	0.51±0.162	0.49±0.167	0.54±0.147	0.035*
HF normalised units	0.49±0.162	0.51±0.167	0.46±0.147	0.035*

*Values are Median (IQR), Mann-Whitney U test, *Significant at p<0.05.*
SDNN: Standard deviation of RR intervals
rMSSD: Root mean square of successive differences of RR intervals
NN50: The number of intervals differing by more than 50 ms from the preceding interval
pNN50: NN50 divided by the total number of RR intervals
SBP: Systolic Blood Pressure
LF: Low frequency
HF: High frequency
Time-domain parameters (ms)
Frequency-domain parameters (ms2)

Table 3: Preoperative clinical monitoring

Vital signs	Mean±SD	Minimum value	Maximum value
Pre-operative			
Pulse rate	92.7±13.3	62	140
Heart rate	94.1±12.7	72	147
Systolic blood pressure	130.8±16.9	102	190
Diastolic blood pressure	82.6±11.7	60	121
SpO_2	99.2±0.8	98	100
Pre-Spinal Anaesthesia			
Heart rate	96.4±12.3	60	124
Systolic blood pressure	134.4±15.9	110	180
Diastolic blood pressure	88.4±12.8	62	118
SpO_2	98.8±0.9	98	100

Table 4: Intraoperative vital signs

Time	Heart rate Mean±SD	Systolic blood pressure Mean±SD	Diastolic blood pressure Mean±SD	SpO_2 Mean±SD
T0	106.17±66.59	137.01±18.43	89.23±14.67	98.90±0.83
T2	97.75±13.36	134.83±17.30	84.52±15.39	99.07±0.67
T5	93.45±13.26	127.74±15.94	79.88±13.77	99.07±0.67
T10	89.55±14.19	121.57±16.05	75.38±11.85	99.20±0.71
T15	86.92±15.12	119.44±16.90	74.61±12.43	99.12±0.67
T20	85.29±14.77	116.77±16.56	73.85±12.41	99.07±0.67
T25	85.25±14.52	118.18±15.77	73.48±13.66	99.26±0.75
T30	86.19±13.79	116.81±15.38	74.30±12.40	99.07±0.67
T35	87.87±12.58	120.93±14.16	76.69±11.21	99.20±0.60
T45	89.83±13.04	122.70±13.55	76.54±10.02	99.25±0.58

Table 5: Sensory block, fluid administered and duration of surgery

Parameters	Frequency	Percentage
Sensory block		
T6	23	27.4
T8	46	54.8
T10	15	17.9
Fluid Administered (ml)		
1500	10	11.9
1000	64	76.2
750	2	2.4
500	8	9.5
Duration of surgery min (mean±SD)	126.8±55.2	

intraoperative blood loss was found to be between 500 to 1500ml as shown in Table 5.

Prevalence of hypotension and bradycardia

Fifty-five (65.5%) patients developed hypotension while 13 patients (15.5%) developed bradycardia. Hypotension occurred mostly at 5 and 10 minutes after establishment of spinal anaesthesia in 23 (41.38%) patients, at 15 minutes in 6 patients (10.9%) and at 20 minutes in 3 patients (5.5%). Bradycardia occurred mostly at 15 minutes post spinal anaesthesia in 7 (53.8%) patients, while it was observed in 1 (7.7%) at 10 minutes post spinal anaesthesia as shown in Table 6.

Table 6: Time to hypotension and bradycardia development

Parameters	Frequency	Percentage	Cumulative frequency	% Cumulative frequency
Hypotension development			-	-
Yes	55	65.5	-	-
Time developed (mins)				
T5			23	41.8
T10			46	83.6
T15			52	94.5
T20			55	100
T25-60			0	0
Bradycardia development				
Yes	13	15.5		
Time developed (mins)				
T5	-	-	-	-
T10			1	7.7
T15			8	61.5
T20			13	100
T25-60			0	0

Table 7: Factors associated with the development of hypotension

Parameters (Factors)	Hypotension Yes n (%)	No n (%)	P value
AGE			
20-30	6 (10.9)	10 (34.5)	0.015*
31-40	27 (49.1)	11 (37.9)	
41-50	11 (20.0)	7 (24.1)	
>50	11 (20.0)	1 (3.4)	
BMI			
<18.5	4 (7.3)	2 (6.9)	0.929
18.5 – 30	45 (81.8)	26 (79.3)	
>30	6 (10.9)	4 (13.8)	
Level of Sensory Block			
T6	13 (23.6)	10 (34.5)	0.564
T8	32 (58.2)	14 (48.3)	
T10	10 (18.2)	5 (17.2)	
ASA			
1	1 (1.8)	4 (13.8)	0.046*
2	54 (98.2)	25 (86.2)	
Types of Intercurrent illnesses			
Hypertension	8 (72.7)	3 (75)	0.709
Diabetes mellitus	2 (18.2)	1 (25)	
Parkinson's disease	1 (9.1)	0 (0.0)	
Volume of fluid administered			
1500	8 (14.5)	2 (6.9)	0.104*
1000	43 (78.2)	21 (72.4)	
750	0 (0.0)	2 (6.9)	
500	4 (7.3)	4 (13.8)	
Intraoperative haemodynamic parameters			
Baseline HR	109.3±82.1	100.3±10.0	0.561
Baseline SBP	141.2±16.0	129.0±20.3	0.003*
Baseline DBP	91.8±14.2	84.4±14.6	0.027*
Baseline SPO2	98.9±0.9	99.0	0.301

Table 8: Association of HRV parameters and hypotension

Variable	No	Yes	P-value
Max RR(ms)	886.0±222.0	920.0±274.0	0.3029
Min RR(ms)	640.0±96.0	656.0±89.0	0.2057
Average RR(ms)	737.0±177.0	772.0±149.0	0.7313
Average HR(bpm)	80.8±12.9	78.9±13.8	0.7171
SDNN(ms)	36.3±18.2	35.7±32.3	0.9812
RMSSD(ms)	28.5±16.3	28.9±30.7	0.4239
NN50	5.00±19.00	7.00±22.00	0.9661
pNN50	1.28±6.650	2.13±6.845	0.8246
Low Frequency LF (msec2)	113.9±54.4	151.3±70.0	0.0421*
High Frequency HF (msec2)	135.4±98.2	151.7±93.8	0.4024
LF:HF Ratio	0.98±1.094	1.10±0.869	0.6314

Median (IQR) with non-parametric statistic
*Values are Median (IQR), *Significant p<0.05;*
Mann Whitney U test TD-Time domain,
FD-frequency domain
TP: Total power
LF/HF: low frequency/high frequency ratio
LF: low frequency
HF: high frequency

Factors associated with the development of hypotension

Age and ASA classification showed a statistically significant association with the development of hypotension (p=0.015, and p= 0.046 respectively), while no significant association was found between the other socio-demographic and clinical characteristics of participants. Intraoperatively, baseline systolic and diastolic blood pressure values also showed statistically significant association with the development of hypotension (p= 0.003 and p= 0.027) respectively. (Table 7)

ratio of the two groups was comparable. HF parameter was found to be significantly associated p=0.0094) with the development of bradycardia. (Table 8 & 9)

The binary logistic regression, with development of hypotension as dependent variable, and age, BMI, development of bradycardia, intraoperative blood loss, duration of surgery and the SDNN, and LF/HF ratio as the independent variables. Only SBP at baseline showed significant association with the development of hypotension (OR=1.05, p= 0.001).

Table 9: Factors associated with development of hypotension

Factors	Hypotension Odds Ratios	CI	P- value
Age (years)	1.08	1.00 – 1.18	0.0762
Gender	2.85	0.68 – 14.11	0.1679
Body Mass Index (kg/m2)	0.91	0.79 – 1.04	0.1997
SBP – (Baseline)	1.05	1.01 – 1.10	0.0165*
Bradycardia (Present)	6.78	1.16 – 67.51	0.0579
Duration of Surgery (min)	1.00	0.99 – 1.02	0.6153
Type of Surgery: (General Surgery)	4.28	0.53 – 36.90	0.1708
Type of Surgery: (Gynaecology)	1.07	0.16 – 7.25	0.9409
Type of Surgery: (Orthopaedic Surgery)	2.52	0.29 – 23.21	0.3997
Type of Surgery: (Plastic Surgery)	0.47	0.04 – 4.90	0.5228
SDNN(ms)	1.00	1.00 – 1.02	0.6183
LF:HF Ratio	1.22	0.88 – 1.87	0.2281

**Significant, p-value<0.05*

Association of HRV parameters and hypotension/ bradycardia

The low frequency (LF) parameter of HRV was associated with the development of hypotension. The maximum RR interval, minimum RR interval, and average RR interval were comparable in participants who developed hypotension. The rMSSD, pNN50, pNN50, were comparable in both participants who had hypotension and those who did not. The LF/HF

The binary logistic regression model with the development of bradycardia as dependent variable and age, gender, BMI, baseline SBP, intraoperative blood loss, duration of surgery, type of surgery, SDNN, LF/HF ratio as independent variables. None of these variables showed a significant association to bradycardia. (Table 10).

Table 10: Factors associated with bradycardia

Factors	Bradycardia Odds Ratios	CI	P - value
Age (years)	0.96	0.88 -1.03	0.2464
Gender: Male	0.39	0.06 – 1.68	0.2408
BMI	1.05	0.92 – 1.20	0.4407
SBP baseline	0.98	0.95 – 1.02	0.3835
Intra-operative Blood Loss (ml)	1.00	1.00 – 1.00	0.3075
Duration of Surgery(min)	0.99	0.98 – 1.01	0.4832
Surgery region: Limb	1.26	0.23 – 5.79	0.7750
SDNN(ms)	1.00	0.98 – 1.01	0.8553
LF:HF Ratio	0.92	0.50 – 1.27	0.6807

DISCUSSION

This study shows that Heart Rate Variability measurements in the preoperative period could predict occurrence of spinal anaesthesia induced hypotension in patients undergoing elective surgery as low frequency (151.3±7.0), high frequency (224.3±109.0), and baseline systolic blood pressure (141.2±16.0) had significant association with hypotension. This study also shows that age, ASA class 2, baseline systolic blood pressure, and baseline diastolic blood pressure were associated with hypotension but not with bradycardia. However high frequency (HF) was significantly associated with bradycardia.

The incidence of hypotension was 65.5% in participants studied similar to the findings of Hanss and Bein[1] who reported an incidence rate of 5-66% in non-obstetric patients while Stalin[13] and Adigun *et al.*[14] reported an incidence of 69% and 24.4% in obstetric patients. Application of different definitions of hypotension used in different literatures to a cohort of different categories of patients may explain the varied and high incidence of spinal hypotension and also the wide range of variables associated with different degrees of spinal induced hypotension.

Bradycardia defined as heart rate less than 60 beats per minute is also a frequent complication of spinal anaesthesia due to the effect of the local anaesthetic agent in blocking the cardiac sympathetic nerves with resultant loss of chronotropic and inotropic drive. Bradycardia occurred in 13 (15.5%) participants which is minimally higher than the one reported by Carpenter *et al.*[3] who reported an incidence of 13%. The development of bradycardia has been documented to occur more in healthy and younger age group and this was also found in this study. There is a physiologic decline in ANS function and limited cardiovascular reserve with increasing age, therefore it is possible that patients aged 40 years and above are at risk of developing hypotension following spinal anaesthesia.[3]

In this study, patients within ages 31-40 years were found to have the highest incidence of hypotension following spinal anaesthesia similar to the findings of Atousa *et al.*[9] who reported a high incidence of hypotension in patients whose age is greater than 35 years in obstetric patients. This is contrary to the report by Chinachoti[11] who observed that ages greater than 50 years was a strong factor for development of hypotension post spinal anaesthesia.

Level of sensory block has been suggested by different authors to be related to hypotension and bradycardia. A dose of 10-12.5 mg of local anaesthetic agent was used for all the participants in this study and the occurrence of hypotension and bradycardia was noticed in patients who had up to T8 sensory block. Various studies have suggested that a high incidence of spinal induced hypotension occurs at sensory block levels of T5 or T4. This correlates with Atousa *et al.*[9] and Kyokong *et al.*[12] studies where sensory level of T4 was documented to be associated with hypotension.

American Society of Anesthesiology (ASA) classification is an important predictor of surgical outcome. Associations between ASA scores and specific surgical complications and outcomes have been reported in different literatures. In this study ASA class 2 (which by definition is patient with mild systemic disease) developed hypotension and bradycardia which is comparable to the findings of Atousa *et al.*[9]

Heart rate variability is currently becoming a well-accepted predictive tool for hypotension. In this study, the low frequency and high frequency parameters were found to be of better predictive value than baseline heart rate and systolic blood pressure. In this study, low frequency (LF) index of HRV was associated with hypotension and increased HF correlated with hypotension and bradycardia. The reduction in LF confirms the sympatholytic effect of spinal anesthesia on the ANS and an increased vagal activity. This correlates with the findings of Hanss *et al.*[15] on the prediction of hypotension in non-obstetric patients where he demonstrated the sympatholytic effect of spinal anaesthesia as the patients had significantly higher LF/HF and lower HF before induction of spinal anaesthesia and significant decrease in LF/HF, LF and increase in HF after spinal anaesthesia. This implies that there was a reduction in sympathetic activity and increased parasympathetic activity post spinal anaesthesia. The HF parameter of frequency domain had a significant association with bradycardia in this study as it is well established that efferent vagal activity is a major contributor of HF values.

CONCLUSION

This study found that alteration in heart rate variability (LF) is associated with hypotension and bradycardia in patients undergoing elective surgery under spinal anaesthesia. Heart rate variability measurements contain important prognostic information that can be used to detect high risk patients for proper management thus further studies on HRV as a diagnostic and therapeutic tool among Nigerian population is recommended.

Conflict of Interest: None

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