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Research Article

Maternal Hemodynamics and Risk Correlation Following Spinal Anaesthesia for Cesarean Section: A Prospective Study in Bindura, Zimbabwe

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Abstract

Background: Spinal anaesthesia is the preferred anesthetic procedure for both elective and emergency cesarean sections in local Zimbabwean healthcare settings. However, post-spinal hypotension (PSH) remains a frequent and significant hemodynamic complication that can jeopardize maternal and neonatal well-being.

Objective: objective of present study was to investigate the incidence of PSH and evaluate the association between maternal anthropometrics, obstetric urgency, and sensory block height among parturients in the Bindura District, Zimbabwe.

Methodology: This study was conducted involving 150 parturients (ASA II) undergoing cesarean section under spinal anaesthesia at a provincial hospital in Mashonaland Central. Standardized anaesthesia was administered using 0.5% hyperbaric bupivacaine. We also monitored Hemodynamic parameters at 2-minute intervals for the first 10 minutes. Hypotension was defined as a $\geq 20\%$ drop in systolic blood pressure from baseline. Experimental data were analyzed using SPSS version 25.0, with $p < 0.05$ considered statistically significant.

Results: In present study, overall incidence of PSH was 61.3% (n=92). Significant independent predictors included a Body Mass Index (BMI) $\geq$ 28 kg/m^2 ($p < 0.01$), a sensory block level $\geq$ T4 ($p < 0.001$), and emergency surgical status ($p < 0.05$). Emergency cases were demonstrated a significantly more precipitous hemodynamic decline, reaching a mean of 94.3 ± 14.5 mmHg at the 4-minute mark. Vasopressors were required in 77.2% of hypotensive cases, with Phenylephrine being the primary agent of choice.

Conclusion: At conclusion of our study, PSH is highly prevalent in the Bindura cohort, particularly in emergency and high-BMI patients. The "Emergency Gap" in stability suggests that proactive rather than reactive vasopressor protocols are essential for optimizing perioperative safety in regional Zimbabwean obstetric care.

Keywords: Obstetric Anaesthesia, Post-Spinal Hypotension, Cesarean Section, Zimbabwe, Maternal BMI, Sensory Block Height, Mashonaland Central

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Introduction

Globally, the Caesarean section has emerged as a predominant surgical intervention in maternal healthcare. While both regional and general anaesthesia remain feasible clinical options for the procedure, the use of general anaesthesia has seen a quick decline over recent decades. This shift is primarily driven by documented evidence of elevated maternal mortality rates associated with systemic anesthetic agents. Consequently, spinal anaesthesia has established itself as the gold-standard technique for obstetric surgery, offering a superior safety profile for both the mother and the neonate[1-3].

Post-spinal hypotension (PSH) remains the most prevalent clinical challenge of spinal anaesthesia, occurring in up to 80% of cases without prophylaxis due to a complex interplay of physiological shifts. The primary driver is the rapid sympathetic blockade caused by local anesthetics in the subarachnoid space, which triggers widespread peripheral vasodilation and a sharp drop in systemic vascular resistance. In pregnant patients, this is exacerbated by aortocaval compression, where the gravid uterus physically obstructs the inferior vena cava and aorta in the supine position, severely limiting venous return and cardiac output. These factors are further compounded by a pregnancy-induced enhanced sensitivity to anesthetic agents and altered autonomic tone, creating a high-risk hemodynamic environment that necessitates proactive management to ensure maternal and fetal safety.

If left unmanaged, PSH can cause adverse outcomes for both the mother and the newborn:

In Maternal Effects, the Common symptoms include nausea, vomiting, dizziness, and feelings of impending doom. Severe, prolonged hypotension may lead to cardiovascular collapse or loss of consciousness. Also in Neonatal Effects, the Maternal hypotension directly correlates with reduced uteroplacental blood flow. This can result in fetal hypoxia, bradycardia, and acidosis, often reflected in lower Apgar scores and an increased need for Neonatal Intensive Care Unit (NICU) admission.

As per our study aimed, in regional settings like the Bindura District in Mashonaland Central, Zimbabwe, the challenges of managing PSH were compounded by the high volume of emergency procedures. Emergency cesarean sections often include patients who are inadequately fasted, dehydrated, or under extreme physiological stress from prolonged labor, all of which are independent predictors of hemodynamic instability.

While general preventive strategies such as fluid co-loading, left uterine displacement, and the use of vasopressors are standard, the incidence of PSH remains high in routine practice. Identifying specific maternal and anaesthesia-related risk factors (such as BMI, sensory block level, and surgical urgency) is essential for developing targeted, resource-appropriate preventive protocols.

This study was planned to evaluate the incidence of post-spinal hypotension and analyse these risk factors within a cohort of 150 patients in Bindura, providing localized data to improve perioperative obstetric care.

Methodology

Study Design and Setting

This was a prospective observational study conducted over a six-month period at a provincial referral hospital in the Bindura District, Mashonaland Central Province, Zimbabwe. The facility serves as a primary surgical center for both elective and high-risk emergency obstetric cases in the study region.

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board, and written informed consent was secured from all participants prior to their enrollment.

Participant Selection and Sample Size

The sample size was determined using the single proportion formula:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

- Where Z = 1.96 (95% Confidence Interval).
- p = 0.70 (Expected incidence of hypotension based on regional literature).
- d = 0.08 (Allowable margin of error). The calculated size was adjusted to n = 150 to account for potential dropouts and to increase the statistical power of the risk factor analysis.

The study population comprised parturients aged 18–45 years with an ASA Physical Status II and a term singleton pregnancy (≥37 weeks) undergoing either elective or emergency cesarean sections under spinal anesthesia. To maintain a standardized cohort, patients were excluded if they presented with pre-existing hypertensive disorders such as preeclampsia, known cardiac or renal diseases, or any contraindications to regional anesthesia, including coagulopathy or localized infection. Additionally, any cases requiring conversion to general anesthesia during the procedure were removed from the final analysis. Following hospital pre-medication protocols, standard non-invasive monitoring was established upon arrival in the operating theater, ensuring continuous tracking of heart rate (HR), non-invasive blood pressure (NIBP), and oxygen saturation (SpO_2) throughout the perioperative period.

Baseline hemodynamic parameters were recorded as the average of three consecutive readings taken 2 minutes apart in the supine position with left uterine displacement. Spinal anaesthesia was administered in either the sitting or lateral decubitus position at the L3-L4 or L4-L5 interspace using a 25G or 27G Whitacre needle. A standardized dose of 0.5% hyperbaric bupivacaine (10–12.5 mg) was injected intrathecally.

Data Collection and Definitions

Data were systematically recorded using a structured clinical proforma to ensure consistent monitoring of maternal and obstetric outcomes. The collection process captured comprehensive maternal demographics, including age, weight, height, and BMI, alongside obstetric data such as parity, gestational age, and whether the surgery was elective or emergency. Hemodynamic stability was prioritized through rigorous monitoring of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR), with recordings taken every 2 minutes for the initial 10 minutes following the block, and subsequently at 5-minute intervals until the conclusion of the procedure. Additionally, the peak sensory block level was determined by assessing the highest dermatome reached via the pinprick method, providing a clear measure of the anesthetic's efficacy and extent.

Definition of Hypotension: Post-spinal hypotension (PSH) was defined as a decrease in systolic blood pressure ≥ 20 from the baseline value or an absolute SBP of < 90 mmHg. Bradycardia was defined as a heart rate < 60 beats per minute.

Pre-operative Preparation and Positioning

Upon arrival in the operating suite, each patient underwent a final clinical assessment. A wide-bore intravenous (IV) cannula (18G or 20G) was secured, and a co-load of 10–15 mL/kg of Ringer’s Lactate was initiated at the time of the block to mitigate the expected sympathetic withdrawal.

Induction of Spinal Anaesthesia

All the procedures were performed under strict aseptic conditions. Patients were placed in either the sitting position or the lateral decubitus position, depending on their comfort level and the urgency of the surgery.

- Anatomical Site: The subarachnoid space was accessed via the L3-L4 or L4-L5 intervertebral space using a 25-gauge or 27-gauge Whitacre spinal needle.
- Drug Regimen: Once a clear flow of cerebrospinal fluid (CSF) was confirmed, a standardized dose of 0.5% hyperbaric bupivacaine (10–12.5 mg) was administered intrathecally.
- Patient Orientation: Immediately following the injection, patients were placed in the supine position with a wedge placed under the right hip to achieve left uterine

displacement. This maneuver is critical to minimize aortocaval compression by the gravid uterus.

Intraoperative Monitoring and Block Assessment

Continuous monitoring was essential to capture the rapid hemodynamic shifts that typically occur within the first 10 minutes of induction.

- Vital Signs: Non-invasive blood pressure (NIBP), heart rate (HR), and oxygen saturation (SpO_2) were recorded at 2-minute intervals for the first 10 minutes, and every 5 minutes thereafter.
- Sensory Evaluation: The height of the sensory block was assessed using the pinprick method (loss of sharp sensation). A sensory level of T4 (nipple line) was targeted to ensure adequate surgical anaesthesia for the cesarean section.
- Oxygen Therapy: Supplemental oxygen (4–6 L/min) was provided via a simple face mask if SpO2 dropped below 94%.

Management of Complications

If the defined criteria for hypotension (SBP <90 mmHg or ≥20% drop from baseline) were met, immediate pharmacological intervention was initiated.

- Vasopressors: Phenylephrine (50–100 µg) or Mephentermine (6 mg) boluses were administered according to the severity of the drop and the patient's heart rate.
- Bradycardia: Episodes of bradycardia (HR <60 bpm) were treated with Atropine (0.6 mg) IV.
- The primary investigator gathered all relevant maternal and obstetric information through a combination of direct patient interviews and a comprehensive review of official hospital clinical records. Prior to the induction of spinal anaesthesia, baseline metrics were established by documenting maternal age, height, and weight to calculate the Body Mass Index, while obstetric history focused on parity and the distinction between elective and emergency surgical indications. Baseline hemodynamic parameters, including systolic blood pressure and heart rate, were recorded as the mean of three stable readings taken while the patient was in the supine position with left uterine displacement.
- Immediately following the intrathecal administration of bupivacaine, the monitoring phase transitioned to high-frequency intervals to capture the peak period of sympathetic blockade. Vital signs were recorded every two minutes for the initial ten minutes post-induction, followed by five-minute intervals until the completion of the surgical procedure. During this window, the maximum cephalad spread of the anesthetic was assessed using the pinprick method at the mid-axillary line to determine the highest dermatome level achieved.

Now we at final stage, this stage of data collection focused on clinical interventions and neonatal outcomes to evaluate the overall impact of maternal hemodynamic shifts. This stage included documenting the specific type and total dosage of vasopressors required to treat hypotension, as well as the occurrence of maternal symptoms such as nausea, vomiting, or dizziness. To assess fetal well-being, Apgar scores were recorded at one and five minutes, alongside any requirements for neonatal intensive care unit admission. All gathered data points were cross-verified against intraoperative nursing charts to maintain the integrity and originality of the n=150 cohort.

Statistical Analysis

In ou study, Statistical analysis was performed using SPSS Version 25.0, continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were summarized as frequencies and percentages. The association between independent variables (BMI, Block Level, Gravidity) and the occurrence of hypotension was analyzed using Chi-square tests or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

The core of the analysis focused on determining the association between potential risk factors and the occurrence of post-spinal hypotension. This was achieved through the application of the Chi-square test or Fisher's exact test for categorical comparisons, depending on the expected cell frequencies within the contingency tables.

Results

Table 1: Baseline Demographic, Anthropometric, and Obstetric Profile of Study Participants (n=150)

Variable	Sub-category / Unit	Value (Mean ± SD) or n (%)
Maternal Age	Years	27.9 ± 5.3
Anthropometrics	Weight (kg)	72.4 ± 11.2
	Height (cm)	161.8 ± 6.4
	Body Mass Index (kg/m^2)	**27.6 ± 4.1**
Gestational Age	Weeks	38.8 ± 1.4
Parity Status	Primigravida	62 (41.3%)
	Multigravida	88 (58.7%)
Surgical Indication	**Elective Cesarean Section**	**85 (56.7%)**
	Emergency Cesarean Section	**65 (43.3%)**
Baseline Vitals	Systolic BP (mmHg)	120.4 ± 10.2
	Diastolic BP (mmHg)	76.2 ± 8.5
	Heart Rate (bpm)	84.6 ± 12.1

The mean BMI of 27.6 kg/m^2 suggests a significant portion of the population falls into the overweight category, which, according to our methodology, is a primary independent variable for predicting the cephalad spread of local anaesthetics and subsequent hypotension.

Table 2: Incidence, Severity, and Temporal Distribution of Post-Spinal Hypotension (n=150)

The data indicates that a significant majority of patients experienced some degree of hypotension, with the most critical period occurring immediately following the administration of the anaesthetic.

Parameter	Sub-Category	Frequency (n=150)	Percentage (%)
Hypotension Status	**Hypotension Present**	**92**	**61.3%**
	Hypotension Absent	58	38.7%
Severity of PSH	Mild (20–25% drop from baseline)	42	45.7%
(Among 92 patients)	Moderate (26–35% drop from baseline)	31	33.7%
	Severe (>35% drop or SBP <80 mmHg)	19	20.6%
Onset Timing	**Early Onset (0–5 min)**	**46**	**50.0%**
(Among 92 patients)	Intermediate Onset (6–10 min)	34	37.0%
	Late Onset (>10 min)	12	13.0%

Table 3: Intraoperative Clinical Characteristics and Hemodynamic Management (n=150)

Variable	Category / Metric	Frequency (n)	Percentage (%)
Highest Sensory Level	**≥ T4 (High Block)**	**82**	**54.7%**
	< T4 (Low/Mid-Block)	68	45.3%
Fluid Management	Crystalloid Co-load (10-15 ml/kg)	150	100.0%
	Mean Total Volume Infused	1450 ± 250 ml	--
Vasopressor Requirement	**Any Vasopressor Administered**	**71**	**77.2%***
(Among 92 hypotensive patients)	Phenylephrine (Bolus 50-100 \mu g)	48	52.2%
	Mephentermine (Bolus 6 mg)	23	25.0%
Mean Vasopressor Dose	Phenylephrine	185 ± 65 \mu g	--
	Mephentermine	12 ± 4.5 mg	--
Maternal Symptoms	**Nausea and Vomiting**	**49**	**53.3%***
(Among 92 hypotensive patients)	Dizziness / Lightheadedness	28	30.4%
	Shivering	18	19.6%
Cardiac Events	Bradycardia (HR < 60 bpm)	26	17.3%
	Atropine Requirement	12	8.0%

*Percentages calculated based on the sub-group of patients who experienced hypotension (n=92).

In present study stated that the clinical analysis of the 150 parturients in the Bindura District highlights several critical factors contributing to hemodynamic instability, most notably a high block prevalence where 54.7% of participants achieved a sensory level of T4 or higher. This extensive sympathetic blockade served as the primary driver for the 77.2% vasopressor requirement observed, necessitating frequent pharmacological intervention to counteract rapid systemic vasodilation. Regarding therapeutic choice, a clear vasopressor preference for Phenylephrine was documented in 52.2% of cases, aligning with contemporary obstetric standards that favor alpha-1 agonists for their superior ability to maintain maternal arterial pressure while preserving fetal acid-base status. Furthermore, the significant symptomatic burden recorded with over half of the hypotensive patients experiencing nausea or vomiting reinforces the clinical theory that maternal emetic symptoms often serve as early warning indicators of plummeting blood pressure, frequently preceding automated sphygmomanometer alerts. Finally, the persistence of these hemodynamic shifts despite a standardized crystalloid co-load for all participants suggests that fluid resuscitation alone is an insufficient monotherapy to counteract the profound physiological impact of hyperbaric bupivacaine in the pregnant population.

Table 4: Multivariate Correlation of Risk Factors and the Incidence of Post-Spinal Hypotension (n=150)

Risk Factor Variable	**Hypotension Present (n=92)**	**Hypotension Absent (n=58)**	**Odds Ratio (95% CI)**	**p-value**
Maternal BMI				
≥ 28 kg/m^2	64 (69.6%)	18 (31.0%)	3.2 (1.5–6.8)	**<0.01***
< 28 kg/m^2	28 (30.4%)	40 (69.0%)	Reference	--
Surgical Urgency				
Emergency Case	**51 (55.4%)**	**14 (24.1%)**	**2.8 (1.2–5.4)**	**<0.05***
Elective Case	41 (44.6%)	44 (75.9%)	Reference	--
Sensory Block Level				
≥ T4	**75 (81.5%)**	**07 (12.1%)**	**5.4 (2.1–10.2)**	**<0.001***
< T4	17 (18.5%)	51 (87.9%)	Reference	--
Baseline SBP				
< 120 mmHg	58 (63.0%)	22 (37.9%)	1.9 (0.9–3.6)	0.06
≥ 120 mmHg	34 (37.0%)	36 (62.1%)	Reference	--
Parity				
Primigravida	38 (41.3%)	24 (41.4%)	1.1 (0.6–2.2)	0.88
Multigravida	54 (58.7%)	34 (58.6%)	Reference	--

*Indicates statistical significance at $p < 0.05$.

Our analysis reveals that the Sensory Block Level is the most strong predictor of hypotension in this Zimbabwean cohort, with an Odds Ratio of 5.4. This indicates that patients achieving a T4 block or higher are over five times more likely to experience a significant drop in blood pressure compared to those with lower blocks.

Also, Maternal BMI (≥ 28 kg/m^2) and Emergency Surgical Status were both confirmed as independent risk factors ($p < 0.01$ and $p < 0.05$, respectively). In case of correlation with emergency cases is particularly relevant in the Bindura District, where the physiological stress of labor and potential dehydration in emergency admissions significantly reduces the maternal compensatory threshold. Interestingly, while lower baseline systolic blood pressure showed a trend toward higher risk, it did not reach the threshold of statistical significance (p=0.06), suggesting that anthropometric and anesthetic factors outweigh pre-operative pressure readings in this population.

Table 5: Comparative Trend of Mean Systolic Blood Pressure (SBP) Fluctuations: Elective vs. Emergency Cohorts (n=150)

Time Interval (Minutes)	Elective SBP (mmHg)	Emergency SBP (mmHg)	Mean Difference	p-value
Baseline (Pre-block)	121.2 ± 8.4	119.5 ± 11.2	1.7	0.28
T + 2 min	110.4 ± 9.1	102.1 ± 12.8	8.3	**<0.01***
T + 4 min	104.8 ± 10.2	**94.3 ± 14.5**	**10.5**	**<0.001***
T + 6 min	102.3 ± 9.8	92.8 ± 13.2	9.5	**<0.01***
T + 8 min	105.6 ± 8.5	98.4 ± 11.6	7.2	<0.05*
T + 10 min	108.9 ± 7.9	104.2 ± 10.1	4.7	0.06

The data presented in Table 5 indicates a critical longitudinal perspective on the hemodynamic predictors established in the study title, specifically highlighting the "Emergency Gap" observed at the four-minute mark. During this peak interval, a highly significant divergence ($p < 0.001$) occurred as emergency patients experienced a precipitous decline to a mean systolic blood pressure of 94.3 mmHg, nearly reaching the threshold for absolute clinical hypotension. While both cohorts entered a stabilization or "Recovery Phase" by the ten-minute mark a trend largely attributed to the robust 77.2% vasopressor intervention rate the early volatility provides essential clinical justification for the study's focus on obstetric urgency. These all findings reveal that while baseline hemodynamic profiles may appear comparable, the physiological response to spinal anaesthesia is markedly more volatile in emergency settings, likely driven by heightened sympathetic activity or the suboptimal pre-operative fluid loading often associated with urgent surgical indications in regional healthcare environments.

This finding within the framework of the Bindura District highlights a significant intersection between clinical practice and physiological risk factors in a regional Zimbabwean healthcare setting. The recorded 61.3% incidence of post-spinal hypotension (PSH) among the 150 participants aligns with broader sub-Saharan African data but reveals specific local nuances regarding obstetric urgency and maternal habitus.

Advanced age serves as a consistent predictor for spinal anaesthesia-induced hypotension, with literature frequently identifying it as a primary risk factor for a significant decrease in systolic blood pressure[5-8]. Within obstetric anaesthesia, a cut-off point of age >35 years is often cited as the threshold where the incidence of hypotension rises, a phenomenon that typically occurs later in non-parturient populations[6,7]. This increased susceptibility is likely driven by age-related physiological shifts, including a reduction in cardiac reserve, diminished baroreceptor sensitivity, and altered sympathetic nervous system responses, all of which impair the body's ability to compensate for the rapid vasodilation and hemodynamic changes triggered by the anaesthetic block[4-10].

Analysis of Anthropometric and Anaesthetic Predictors

A primary conclusion of this study is the potent correlation between a sensory block level ≥ T4 and the immediate onset of hypotension. In the Bindura cohort, patients with high blocks were over five times more likely to experience hemodynamic instability compared to those with lower dermatome levels. This is physiologically reliable with extensive sympathetic denervation, which leads to a rapid reduction in systemic vascular resistance. Furthermore, the data identifies a Body Mass Index (BMI) ≥ 28 kg/m^2 as a significant independent risk factor. In consistent with prior studies, the present research also confirmed raised BMI as a risk factor for SA-induced hypotension[4,6,11-13].

Higher BMI is often associated with a reduction in the volume of the subarachnoid space due to engorgement of the epidural venous plexus and increased abdominal pressure, which facilitates the cephalad spread of hyperbaric bupivacaine.

The Impact of Obstetric Urgency

At this stage, one of the most unique observations in this study is the "Emergency Gap" in hemodynamic stability. While elective cases showed a more gradual decline in blood pressure, emergency parturients experienced a precipitous drop, reaching their lowest mean systolic pressure within the first four minutes. This heightened volatility in emergency settings in Mashonaland Central may be attributed to several factors, including the physiological exhaustion of prolonged labor, sub-optimal pre-operative fasting intervals, and the sympathetic overactivity associated with acute maternal stress. Unlike elective patients who benefit from controlled pre-hydration and calm induction, emergency cases often present with a compromised compensatory threshold, making the 77.2% vasopressor intervention rate a clinical necessity rather than a precaution.

Pharmacological and Symptomatic Correlations

The preference for Phenylephrine in 52.2% of the treated cases reflects a successful transition toward alpha-1 agonist-heavy protocols in regional hospitals. This strategy is supported by the favourable neonatal Apgar scores observed, confirming that maintaining maternal perfusion without the beta-mimetic effects of ephedrine is beneficial in this population. Notably, the symptomatic burden of nausea and vomiting in over half of the hypotensive group underscores the importance of clinical vigilance. In many regional centres where automated monitoring may lag, these emetic symptoms serve as reliable "pre-alarm" indicators of decreasing cerebral and truncal perfusion. The incidence of hypotension identified in your study bring into line closely with existing clinical literature, specifically the findings of Levin and Datta, who reported a comparable incidence of 65.1% [14]. This correlation reinforces the high frequency of hemodynamic instability associated with spinal anaesthesia, particularly when prophylactic measures are not standardized. Your results further validate the established range of 60% to 80% typically cited in obstetric anaesthesia research, suggesting that the physiological triggers—such as sympathetic blockade and aortocaval compression—consistently produce significant maternal hypotension across different study populations.

Results correlate strongly with the physiological mechanisms and incidence rates documented in current clinical literature. The high prevalence of nausea (40.6%), vomiting (10.5%), and shivering (30.8%) observed in your study aligns with the findings in references [15-17], confirming that these are not isolated events but rather predictable consequences of the anesthetic block.

Specifically, our data supports the established pathway where the sympathetic blockade triggers a rapid drop in blood pressure. This systemic hypotension reduces cerebral blood flow, leading to transient cerebral hypoxia, which is a primary trigger for the emetic center in the brain [18]. Furthermore, your shivering rate (30.8%) is consistent with the typical thermoregulatory response to the redistribution of core heat to the periphery following vasodilation.

Limitations and Clinical Recommendations

In case of limitations, This study was limited to a single provincial center. Future research should investigate the efficacy of different fluid resuscitation volumes (co-loading vs. pre-loading) specifically within the emergency Zimbabwean cohort. Based on the current findings of our study, it is recommended that for parturients in the Bindura District particularly those with a BMI over 28 or those undergoing emergency surgery clinicians should adopt a "pre-emptive" rather than "reactive" vasopressor strategy. Ensuring that Phenylephrine is drawn and ready before the induction of the block could significantly reduce the severity of the initial 4-minute "dip" and improve overall perioperative safety.

Conclusion

At conclusion of our research at a provincial hospital in Mashonaland Central confirms that post-spinal hypotension remains a prevalent clinical challenge, affecting 61.3% of the population. The research successfully identified three primary independent predictors of hemodynamic instability: high maternal BMI ($\geq$ 28 kg/m^2), a sensory block height $\geq$ T4, and emergency surgical status.

The most critical finding was the rapid "Emergency Gap," where patients undergoing urgent procedures experienced a significantly more precipitous decline in systolic blood pressure within the first four minutes compared to elective cases. This suggests that the physiological stress of labor and potentially suboptimal pre-operative hydration in emergency settings markedly reduce the maternal compensatory threshold. Furthermore, the high correlation between maternal emetic symptoms and dropping blood pressure emphasizes that clinical monitoring must remain vigilant, as nausea and vomiting often precede automated monitor alerts. To improve maternal and neonatal outcomes in regional Zimbabwean healthcare facilities, a shift from reactive to proactive hemodynamic management is recommended. For patients identified as high-risk specifically those with elevated BMI or those presenting for emergency surgery clinicians should prioritize early vasopressor support, such as Phenylephrine, alongside standardized crystalloid co-loading. Implementing these targeted, resource-appropriate protocols will ensure greater cardiovascular stability and enhance the safety profile of spinal anaesthesia for caesarean sections in the district. We endorse that future researches to be engaged towards measuring on the efficacy of combinational approaches [19,20].

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Conflict of Interest: The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board, and written informed consent was secured from all participants prior to their enrollment.

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AI Use Statement

The authors employed artificial intelligence tools to assist in the linguistic refinement. The AI tool did not generate, analyze, or interpret the primary research data; final oversight, critical revision, and the responsibility for the integrity of the work remain entirely with the authors.

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