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COMPARISON OF PRAM SCALE AND PERFUSION INDEX IN PREDICTING SPINAL ANESTHESIA-INDUCED HYPOTENSION IN CESAREAN SECTION PATIENTS

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ABSTRACT

Background:
Spinal anesthesia–induced hypotension is a common complication during cesarean section and is associated with adverse maternal and fetal outcomes. Early prediction is essential for timely intervention. Non-invasive tools such as the Perfusion Index (PI) and the PRAM score have been proposed as predictors, but direct comparative evidence remains limited.

Objective:
To compare the predictive accuracy of baseline Perfusion Index and PRAM score in identifying parturients at risk of developing spinal anesthesia–induced hypotension during cesarean section.

Methods:
This observational cross-sectional study was conducted on 131 parturients undergoing elective cesarean section under spinal anesthesia. Baseline hemodynamic parameters, PRAM score, and Perfusion Index were recorded preoperatively. Hypotension was defined as a decrease in systolic blood pressure to <80% of baseline or <90 mmHg. Diagnostic performance was evaluated using sensitivity, specificity, predictive values, and receiver operating characteristic (ROC) curve analysis.

Results:
Hypotension occurred in 71.5% of patients. A higher baseline Perfusion Index (>3.5) was significantly associated with increased incidence and severity of hypotension ($p < 0.001$). The Perfusion Index demonstrated sensitivity of 61.7%, specificity of 86.5%, and an area under the curve (AUC) of 0.848, indicating good predictive accuracy. In contrast, the PRAM score showed higher sensitivity (80.9%) but low specificity (29.7%) and poor discriminative ability (AUC = 0.528), with no statistically significant association with hypotension ($p = 0.189$).
Conclusion:
Baseline Perfusion Index is a more reliable predictor of spinal anesthesia–induced hypotension compared to the PRAM score. Its higher specificity and better discriminative ability make it a valuable tool for early risk stratification in cesarean section under spinal anesthesia.

Keywords:
Spinal anesthesia, hypotension, cesarean section, perfusion index, PRAM score, obstetric anesthesia, predictive tools

Introduction

Cesarean section is one of the most commonly performed obstetric procedures worldwide, with rising rates and significant regional variation. Regional anesthesia is preferred due to better maternal and neonatal outcomes, with spinal anesthesia being the most widely used technique because of its rapid onset, simplicity, and effectiveness (1). Although it has the benefits, the spinal anesthesia is often linked with hypotension which is a significant clinical issue in obstetric practice (2). This is generally characterized by a decrease in systolic blood pressure to less than 80% of normal or below 100 mmHg. It is mostly caused by sympathetic blockade that causes vasodilation, which is further aggravated in pregnancy due to aortocaval compression and sensitivity to local anesthetics (3).

Among obstetric patients, hypotension is more common with a frequency over 5080 percent, and is linked to poor maternal and fetal outcomes. Prediction at an early stage is thus crucial, since the reactive treatment can be insufficient and a slow response can deteriorate results. Traditional methods are not predictive, and currently used non-invasive instruments like PVI, shock index, and heart rate variability demonstrate inconsistent preciseness and a lack of practicability (4) Ultrasound-based technology can potentially enhance prediction, but it is not easily practical, which is why simple and reliable (5) is essential.

PRAM score is a simple preoperative risk assessment scale which was designed to predict hypotension after spinal anesthesia in obstetric patients (6). It is founded on clinical parameters that are readily accessible such as maternal age, baseline pulse rate, and mean arterial pressure. The risk of hypotension is linked to higher PRAM scores, and it enables early detection of high-risk patients and administer preventive interventions to them specifically . The PRAM score has a physiological basis, in that a higher baseline cardiovascular status will be reflected in a higher PRAM score, with the higher heart rate possibly indicating higher sympathetic activity as well as the lower mean arterial pressure possibly indicating decreased vascular tone or decreased cardiac output. These compensatory mechanisms may be overwhelmed by the sudden sympathetic blockade following spinal anesthesia leading to hypotension (7). Its clinical utility as an easy bedside predictive tool has been supported by external validation studies (8).

The Perfusion Index (PI) is a non-invasive measure based on pulse oximetry, which measures the peripheral perfusion and vascular tone (9). It is computed as the ratio of pulsatile to non-pulsatile blood flow and gives real-time data regarding the microcirculatory condition. PI is also directly associated with sympathetic response, where the higher the values, the more the

vasodilation (10). In spinal anesthesia, PI increases with peripheral vasodilation due to sympathetic blockage before the development of hypotension occurs (11). A number of studies have established that increasing baseline PI levels correlate with increased risk of hypotension, with suggested cutoff levels of approximately 3.5 demonstrating excellent diagnostic accuracy (10-13). Nevertheless, there is variability in predictive accuracy among different populations (14).

Although predictive monitoring has improved, a single tool has yet to be adopted as the most accurate predictor of spinal anesthesia-induced hypotension. PI offers a dynamic physiological evaluation of vascular tone, whereas PRAM score offers a simple method of clinical risk stratification. Nevertheless, there is still limited direct comparative evidence between the two methods especially in local population. Moreover, there is a lack of data on Pakistan, particularly Khyber Pakhtunkhwa. Since both tools are easy, non-invasive, and can be used in resource-constrained environments, they must be compared directly to each other to establish their comparative predictive validity and clinical utility.

Hence, the objective of this research was to compare the predictive validity of PRAM score and baseline Perfusion Index in predicting parturients at risk of developing spinal anesthesia-induced hypotension during cesarean section.

Literature review

Hypotension caused by spinal anesthesia is one of the most common and clinically relevant complications in the cesarean section and a clear understanding of the mechanisms, effects, and predictive measures is necessary (15). Even though spinal anesthesia is the most common because of its safety and efficiency, up to 90 percent of patients may experience hypotension unless preventive strategies are applied (16,17). Clinically, this hemodynamic instability is important because it may negatively impact maternal and fetal outcomes and thus necessitates early detection and immediate treatment. Alterations in physiology during pregnancy such as the increased sensitivity of local anesthetics and the change in the body vascular reactions also predispose them to hypotension (18,19).

Rapid sympathetic blockade after intrathecal injection of local anesthetics is the major mechanism of hypotension induced by spinal anesthesia.This causes arterial and venous vasodilation, lower systemic vascular resistance, venous pooling, and lower venous return, which eventually cause reduced cardiac output .The degree of hypotension is dependent on the degree to which the anesthetic has spread cephalad and this can exceed the sensory block threshold (18,20). Some other agents like heightened release of vasodilatory mediators (e.g. nitric oxide and prostaglandins), diminished vasopressor responsiveness, aortocaval compression also worsen hypotension in pregnant patients. A decreased preload can also trigger the BezoldJarisch reflex, which causes bradycardia and addidtional vasodilation (14,18,21,22).

The clinical implications of hypotension induced by spinal anesthesia are important. Mothers have nausea, vomiting, dizziness and discomfort and in severe cases, maternal can lose consciousness, circulatory collapse, or pulmonary aspiration (16,19,22,23,24). The decreased uteroplacental perfusion has fetal implications since blood flow in the uterus is pressure-sensitive and is not autoregulated (21). Long-term hypotension could result in fetal hypoxia, acidosis, and neurological damage, and a period of greater than four minutes is linked to poor neonatal neurobehavioral outcomes (19,22,24-25). Management of maternal blood pressure is thus very important.

Perfusion Index as a Predictive and Clinical Tool

Perfusion Index (PI) is a non-invasive index based on pulse oximetry that indicates peripheral perfusion and vascular tone. It is a ratio of pulsatile (arterial) to non-pulsatile blood flow in peripheral tissues, which is computed based on the alternating and direct components of the infrared signal (13,22,26,27,28,). PI is an indirect measure of peripheral vasomotor tone, low values are associated with vasoconstriction and high values with vasodilation (10).

PI is also affected by both central and peripheral hemodynamic variables such as the stroke volume and the vascular tone (29). Current pulse oximetry devices permit the constant observation of PI, making the detection of minor alterations in perfusion possible. Nevertheless, PI values can change with location of measurement and personal patient characteristics (26,27).

PI has become significant in the practice of anesthesia as an early warning of hemodynamic alterations. It is an indication of sympathectomy development after neuraxial anesthesia due to peripheral vasodilation.PI finds application in critical care units to determine circulatory condition, fluid responsiveness, vasopressor treatment, and shock treatment (30). Even though the PI value of less than 1.4 is proposed to reflect impaired perfusion, this cut-off is not universal.Constant observation of PI enables early identification of changes in perfusion and can be used as a proxy of cardiac output under steady-state situations (31,32).

Existing Research on Perfusion Index and Hypotension

PI has been evaluated as a predictor of hypotension post-spinal anesthesia in several studies.

Baseline PI values of 3.5 or more have been linked to an increased risk of hypotension. A prospective observational study by Sadek et al. of patients receiving lower abdominopelvic surgeries under spinal anesthesia revealed that patients with higher baseline PI values developed hypotension more frequently, indicating that PI could be utilized as a risk-stratification predictive tool (33). On the same note, Abdul Manap et al. found that increased baseline PI was significantly related to the larger fall in systolic and mean arterial pressure, and augmented vasopressor demand in parturients who underwent cesarean section. This has a PI cutoff value of 3.2 with high sensitivity (85.9) and specificity (87.5) to predict hypotension (34).

A prospective study by Bansal et al. on parturients who had a cesarean section showed that patients with PI above 3.5 had a much higher prevalence of hypotension (73.3) than those with PI below 3.5 (40), indicating that higher PI at the time of delivery is a marker of diminished vascular tone and increased predisposition to vasodilation (13).

Other investigations have also provided the same results with evidence that patients with PI value above 3.5 are at a substantially higher risk of hypotension than those with PI values below 3.5, further proving the predictive nature of PI.

Nonetheless, not every research has presented the same findings. As an illustration, Şen and Ekemen have found out that baseline PI did not significantly predict hypotension in non-obstetric patients hence the predictive power of PI might be higher in obstetric patients because of the physiological changes associated with pregnancy (35).

This information implies that PI can be considered as a promising tool; however, its predictive ability could be influenced by time and the clinical setting.

PRAM Scale as a Predictive Tool

PRAM score is a clinical scoring tool that was invented to be used to predict hypotension due to spinal anesthesia among obstetric patients. It involves 3 preoperative conditions, including maternal age of over 25 years, baseline pulse rate of more than 90 beats per minute and mean arterial pressure of less than 90 mmHg. The score is determined on the basis of evidence that such parameters are important predictors of hypotension during cesarean section. The PRAM score is an effective way of stratifying risks of pre-operation by combining these variables and using available clinical data (6).

Previous Studies on PRAM Scale

PRAM score was derived by a prospective observational study conducted on 504 parturients undergoing cesarean section with the use of spinal anesthesia. Maternal age, baseline heart rate, and mean arterial pressure were found as independent predictors of hypotension when examined using logistic regression analysis. Good predictive ability was established when patients with higher PRAM scores were at a higher risk of developing hypotension than those with lower PRAM scores. PRAM score is also useful in the context of limited resources, since it does not demand any special equipment and can be used readily in a bedside. But its single-center design and the necessity of external validation are its limitations (6).

Dayal et al. performed a prospective study to externally validate the PRAM score in 371 parturients undergoing cesarean section. In 49.3% of the cases, hypotension was experienced, usually during the initial few minutes of spinal anesthesia. The PRAM score had good predictive ability, especially with hypotension being defined up to the delivery date, and the sensitivity was 89% at the cutoff of 1. (8) The study also pointed out that early post-spinal tachycardia can improve predictive accuracy but this constrains its purely preoperative usefulness. On the whole, the results indicate the PRAM score as a useful and effective instrument to predict hypotension during obstetric anesthesia.

Silwal et al. tested the Shock Index as a predictor of hypotension and had small predictive validity (AUC 0.53-0.56). The research highlighted that single-parameter indices have lower validity when compared to composite scoring systems, which makes the utilization of multi-parameter indirects like the PRAM score suitable (36).

Direct Comparison of Predictive Models

The Perfusion Index as well as PRAM score are non-invasive scales, which are used to anticipate hypotension in patients undergoing a cesarean section under spinal anesthesia. PI is a direct reflection of peripheral perfusion and vascular tone, whilst PRAM is a composite clinical score which is founded on demographic and hemodynamic factors. Research has shown PI to be highly predictive with baseline cutoff values of approximately 3.5 being highly sensitive and specific.Conversely, the PRAM score has also proven to be a good predictive tool, especially in the presence of more than one risk factor. These tools, however, differ essentially in their approach. PI is a real-time physiological measurement whereas PRAM is a straightforward risk assessment that is performed prior to the surgical procedure.

Although there is increased literature that supports the use of both approaches, there are few studies that directly compare them using the same sample of patients. Thus, more information is required to assess the predictive accuracy and clinical usefulness of PI and PRAM compared in the same cohort to find out the most efficient one to use to identify high-risk patients early and streamline perioperative treatment.

Study Design and Setting

This observational cross-sectional study was conducted in the Department of Gynecology and Obstetrics at Women and Children Hospital, Bannu, Khyber Pakhtunkhwa, Pakistan, over a period of 6 months.

Study Population and Sample Size

Population and sampling size of the study. A 95% confidence interval was used to compute the initial sample size of 381 participants by estimating the rate of spinal anesthesia induced hypotension at 41% in prior regional studies. Since the study population was limited during the study period, a finite population correction method was used to adjust the sample size to 131 parturients. A simple random sampling method was used to select the participants.

Eligibility Criteria

Inclusion criteria included parturients aged 18 to 40 years of physical status I or II in the American Society of Anesthesiologists (ASA) scales, term pregnancy, and elective cesarean section under spinal anesthesia. The baseline parameters of hemodynamics were normal in all participants and informed consent was presented before enrollment. Patients with preexisting cardiovascular disease (hypertension or arrhythmias), diabetes mellitus or gestational diabetes, obstetric complications such as preeclampsia, placenta previa, or abruptio placentae were excluded. Another exclusion criterion was patients who had an emergency cesarean section, were exposed to drugs affecting autonomic tone (e.g., beta-blockers), and that had failed or incomplete spinal block.

Ethical Considerations

The Institutional Review Board of Superior University, Lahore, and the hospital ethics committee of Women and Children Hospital, Bannu gave ethical approval. All participants provided informed consent in written form. Anonymity was also used to guarantee confidentiality and access was only restricted to authorized personnel.

Data Collection Procedure

Informed consent was obtained and eligible patients planned elective cesarean section under spinal anesthesia were enrolled. Initial demographic and clinical measurements were taken, such as age, weight, height, body mass index, and parity. The hemodynamics parameters were measured before the spinal anesthesia and included systolic blood pressure, diastolic blood pressure, and mean arterial pressure, pulse rate, oxygen saturation, and perfusion index. Preoperative parameters were used to calculate the PRAM score. A standardized anesthesia protocol, with fluid preloading and hyperbaric bupivacaine administration, was used on all patients. Patients were laid in a supine position following spinal anesthesia. Hemodynamic data were collected through the non-invasive blood pressure and 3 minutes during the initial 10 minutes of the experiment and 5 minutes during the remaining 20 minutes of the experiment. Incidence of hypotension and other parameters were noted.

Study Variables

Predictor Variables

- *PRAM score*
- *Baseline Perfusion Index (PI)*

Outcome Measures

- ***Primary outcome:*** *Incidence of spinal anesthesia–induced hypotension*

- ***Secondary outcomes:***
    - *Number of hypotensive episodes*
    - *Lowest systolic blood pressure*
    - *Requirement of vasopressor therapy*

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were stated in mean standard deviation and categorical variables were stated in frequencies and percentage. Chi-square test was used to evaluate associations between predictors and hypotension. Non-normally distributed variables were compared by means of the Mann-Whitney U test. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were used to determine the diagnostic performance of PRAM score and Perfusion Index. To assess the predictive accuracy, Receiver Operating Characteristic (ROC) through the analysis of the curve was conducted and the area under the curve (AUC) was calculated using the variables. A p-value lower than 0.05 was taken to be statistically significant.

RESULTS

The study involved 131 parturients who had elective cesarean section under spinal anesthesia. Every study participant met the study protocol and was analyzed.

Baseline Characteristics

Table 1, gives the baseline demographic and clinical characteristics of the study population. The average age of the participants was 28.56 years old with a standard deviation of 5.72 years. The mean body mass index was 23.99 ± 3.53 kg/m², and the mean gestational age was 36.76 ± 1.74 weeks. The baseline hemodynamic parameters were normal with the mean systolic blood pressure of 128.65 ± 12.36 mmHg and mean arterial pressure of 98.46 ± 11.93 mmHg. The average baseline perfusion index was 3.24 +2.04.

Table 1. Baseline Characteristics of Study Participants (n = 131)

Variable	*Mean ± SD*	*Range*
Age (years)	*28.56 ± 5.72*	*17–42*
Weight (kg)	*67.61 ± 9.58*	*50–95*
BMI (kg/m²)	*23.99 ± 3.53*	*15–34.5*
Gestational age (weeks)	*36.76 ± 1.74*	*27–41*
SBP (mmHg)	*128.65 ± 12.36*	*108–158*
DBP (mmHg)	*83.30 ± 13.28*	*50–118*
Pulse rate (bpm)	*106.55 ± 14.98*	*69–166*
MAP (mmHg)	*98.46 ± 11.93*	*76–127*
Perfusion Index	*3.24 ± 2.04*	*0.41–7.60*

Incidence of Hypotension

Hypotension was found in 93 participants (71.5%), whereas 37 participants (28.5%) were normotensive. The average frequency of hypotensive events was 2.53 with a standard deviation of 2.61. In 94 patients (71.8%), vasopressor assistance was needed, usually during the first 10 minutes of post-spinal anesthesia.

Perfusion Index and Hypotension

The patients were divided into two according to baseline perfusion index (PI ≤3.5 and >3.5). The percentage of patients who developed hypotension was much higher in the high PI group than in the low PI group (Table 2).

Table 2. Association Between Perfusion Index and Hypotension (n = 131)

PI Category	Hypotension (Yes)	Hypotension (No)	Total
> 3.5	58	5	63
≤ 3.5	36	32	68

Baseline perfusion index showed moderate sensitivity (61.7) and high specificity (86.5) in predicting hypotension. The positive predictive value was 92.1 and negative predictive value was 47.1. The receiver operating characteristic (ROC) analysis indicated a good discriminative ability with an area under the curve (AUC) of 0.848. Also, patients with higher PI values had much more hypotensive episodes than patients with lower PI values ($p < 0.001$).

PRAM Score and Hypotension

The PRAM scores were distributed such that the majority of patients were classified in the upper-risk group (PRAM ≥2). Hypotension was more prevalent among patients with elevated PRAM scores; the association was not statistically significant ($p = 0.189$) (Table 3).

Table 3. Association Between PRAM Score and Hypotension (n = 131)

PRAM Category	Hypotension (Yes)	Hypotension (No)	Total
< 2	18	11	29
≥ 2	76	26	102

The PRAM score was highly sensitive (80.9) and low in specificity (29.7) in predicting hypotension. The positive predictive value was 74.5 and the negative predictive value was 37.9. The analysis of ROC had a low discriminative ability with an AUC of 0.528. The hypotension episode incidence difference between PRAM risk groups was not found to be statistically significant ($p = 0.065$).

Comparative Diagnostic Performance

A comparison of the diagnostic performance of baseline perfusion index and PRAM score is presented in ***Table 4****.*

Table 4. Comparison of Predictive Performance

Parameter	Perfusion Index	PRAM Score

Sensitivity	*61.7%*	*80.9%*
Specificity	*86.5%*	*29.7%*
PPV	*92.1%*	*74.5%*
NPV	*47.1%*	*37.9%*
AUC	***0.848***	***0.528***

Overall, baseline perfusion index demonstrated superior diagnostic performance, particularly in terms of specificity and overall discriminative ability, compared to the PRAM score

DISCUSSION

The current paper assessed and compared the predictive value of baseline Perfusion Index (PI) and the PRAM score in the prediction of spinal anesthesia-induced hypotension among parturients undergoing a cesarean section. Results indicated that hypotension is still very common with a prevalence rate of 71.5% among patients and this outcome is in line with incidence rates of 50-80% among obstetric patients reported previously.This demonstrates the persistence of clinical significance of early prediction and prevention measures.

Perfusion Index as a Predictor

The predictive ability of baseline perfusion index in this study was very good in predicting hypotension, having good predictive ability (AUC = 0.848), high specificity (86.5%), and high positive predictive value (92.1%). Patients with increased baseline PI (>3.5) had an increased likelihood of developing hypotension and their hypotensive episodes were more frequent. These results are in line with other studies that have established the usefulness of PI as a predictor of hypotension. According to Toyama et al., a PI cutoff of 3.5 at baseline was found to be highly sensitive and specific in predicting hypotension in patients undergoing cesarean section (9). Likewise, Bansal et al. reported much greater prevalence of hypotension among patients with PI over 3.5 (13). Abdul Manap et al. also indicated high predictive value of PI, sensitivity, and specificity of PI were more than 85 percent with a cutoff of 3.2 (34). The physiological rationale of this association is the association between PI and the peripheral vascular tone. An increase in the baseline PI suggests less vasomotor tone and relative vasodilation, which means there is a lack of compensatory reserve. The sympathetic blockade also increases the vasodilation after the spinal anesthesia, leading to a greater decrease in blood pressure (9-11). Moreover, PI alterations are early and in most cases, they precede hypotension that can be identified clinically, hence it is an effective predictor in real time (13).

The results of this research also support the meta-analytic evidence that pulse oximetry indices such as PI are moderately to highly predictive of spinal anesthesia-induced hypotension (4). Nonetheless, the differences in cutoff values and predictive accuracy among studies indicate that its performance might depend on patient population and the clinical setting.

PRAM Score as a Predictor

PRAM score exhibited a poor predictive ability of spinal anesthesia-induced hypotension in the current research. It has a relatively high sensitivity (80.9%), but low specificity (29.7%),

with a positive predictive value of 74.5% and negative predictive value of 37.9%. The receiver operating characteristic analysis showed low discriminative ability (AUC = 0.528), and no statistically significant correlation was found between PRAM risk categories and the presence of hypotension (p = 0.189). Furthermore, the severity of hypotension, assessed by the number of hypotensive episodes, did not differ significantly across PRAM categories (p = 0.065). These results suggest that the PRAM score in this study population was less able to effectively stratify patients based on risk. The PRAM score was initially designed as an easy tool to use during preoperative assessment, which relies on the maternal age, initial heart rate, and mean arterial pressure, and early investigations showed moderate predictive accuracy (AUC ≈ 0.626) and the higher the score, the higher the risk of hypotension among the patients (6). Its clinical usefulness was further assessed by external validation by Dayal et al., who found a small but statistically significant predictive value with an AUC of 0.578 (95% CI: 0.520-0.636; p = 0.008) when hypotension was considered up to the time of delivery (8). In that study, the sensitivity was around 89% at a cutoff of 1 and above, which is similar to the high sensitivity of the current study. Nevertheless, the discriminative ability was generally low. Notably, the predictive performance was better with the inclusion of early post-spinal tachycardia, which raised the AUC to 0.601 (95% CI: 0.5440.659; p = 0.001) indicating that dynamic physiological alterations contribute to predictive accuracy.

Comparatively, the results of the current study indicate even worse discriminative performance with AUC of 0.528, which means the ability to predict is near chance. This can be explained by the fact that population traits and study design may differ, but it is also one of the basic shortcomings of PRAM score. Since it is based on the constant baseline parameters, it fails to capture the dynamic and quick hemodynamic variability that immediately follows spinal anesthesia. This especially applies in obstetric patients wherein hypotension normally occurs within minutes of sympathetic blockade. Also, the dominance of intermediate PRAM scores in the current cohort could have diminished its discriminatory capacity, making it less able to differentiate risk groups. As a whole, although the PRAM score is a simple and easy-to-use instrument with reasonable sensitivity, its low specificity and low discriminative power restrict its usefulness as a predictor of its own. These results, which are in line with earlier research, indicate that PRAM can be more effectively used with the dynamic or physiological monitoring parameters as opposed to being employed as a standalone predictive measure of spinal anesthesia induced hypotension.

Comparison Between Perfusion Index and PRAM Score

One of the strengths of this study is the direct comparison of a physiological parameter (PI) with a clinical scoring system (PRAM). These findings strongly indicate that PI was superior to the PRAM score in specificity, positive predictive value, and overall diagnostic accuracy. Although PRAM was more sensitive, it is less useful in clinical decision-making due to its low specificity, as it might erroneously increase risk and cause unnecessary interventions. Conversely, PI was more effective in distinguishing high-risk and low-risk patients, which is why it is more appropriate to preventive strategies. These results are consistent with the general literature indicating that dynamic physiological measures are more likely to perform better in prediction than fixed clinical measures (4). This is probably because PI is more effective because of its capability to represent real-time variations in vascular tone and microcirculation.

Limitations of the Study

There are various limitations of this study. It was carried out in one center, which might restrict the generalization of the results. The sample size was not excessive but rather small.

Also, differences in patient characteristics and clinical practices can affect predictive performance of the indices studied. More multicenter research using bigger sample sizes are suggested to confirm these results and to set standardized cutoff values to be used in the clinical practice.

CONCLUSION

Hypotension which is a complication associated with the use of spinal anesthesia has been a very common issue among parturients undergoing cesarean section. Baseline perfusion index showed better predictive accuracy than PRAM score in this study. The perfusion index was statistically significant as a predictor of hypotension, with good discriminative ability, specificity and high positive predictive values. In comparison, the PRAM score was found to be weak in specificity and the overall diagnostic performance. The findings imply that baseline perfusion index is a more efficient instrument to identify patients who are at risk of hypotension earlier and can be more appropriate when applied in clinical practice to direct preventive measures.

RECOMMENDATIONS

Clinical Practice:
Routine preoperative assessment of cesarean section under spinal anesthesia should include baseline perfusion index (PI). Patients with high PI (>3.5) ought to be regarded as high-risk and preemptively treated using early preventive strategies which include fluid optimization and prophylactic administration of vasopressors.

Future Research:
More extensive, multi-centric studies are needed to confirm these results. Subsequent research must be concerned with producing unified predictive models that combine PI with clinical scoring systems and standardizing PI cutoff values for various populations.

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Conflicts of interest

There are no conflicts of interest.

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