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Original Research Article

Retrospective Study on Hypotension Incidence After Spinal Anesthesia

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Conflict of interest: Nil

Abstract:

Background: The most common complication is hypotension which is also one of the most clinically significant complications during the postoperative period after spinal surgery, particularly the obstetric and geriatric surgical patient population. Unless it is treated immediately, it can lead to poor maternal, fetal and perioperative outcomes.

Aim: To evaluate retrospectively incidence, risk factors and clinical outcome of hypotension following spinal anesthesia.

Methodology: The study was a retrospective observational one carried out in Shree Narayan Medical Institute and Hospital, Saharsa, Bihar, India, during a one-year. A total of 170 patient records of patients who had surgeries under spinal anesthesia were reviewed. Data on demographics, nature of surgery, baseline level of hemodynamic stability, incidences of hypotension and treatment strategies were obtained and analyzed using descriptive and inferential statistics.

Results: It was observed that 68 patients (40%) experienced hypotension, following the spinal anesthesia. It was more prevalent among patients that are older than 60 years (52.9%), and obstetric patients (47.1%). The elevated sensory block level, low baseline blood pressure, and increased BMI were significant risk factors. In 60.3% of hypotensive cases vasopressor support was needed.

Conclusion: Hypotension is a common post spinal anesthesia complication particularly in high-risk groups. Risk factors and prophylactic measures can be identified early and greatly decrease morbidity.

Keywords: Spinal Anesthesia, Hypotension, Retrospective Study, Vasopressors, Risk Factors, Hemodynamic Changes.

Introduction

Spinal anesthesia is particularly applied in lower abdominal, pelvic and lower limb surgery as it has rapid onset, good sensory and motor block, and less systemic anesthetic agent [1]. Better postoperative pain control and avoidance of airway manipulations are other advantages of it. Yet, despite these advantages, spinal anesthesia is linked to some complications, the most frequent, and clinically important of which is hypotension. This is mainly because of the sympathetic blockade which causes vasodilation, low venous return and a low systemic vascular resistance [2].

Hypotension with spinal anesthesia is a very variable condition which is usually between 30% to 70% depending on the patient, nature of operation and method of anesthesia [3]. It is commonly found in certain groups of persons especially those in obstetrics who have undergone cesarean section [4]. During pregnancy, physiological alterations, including compression of aorta by the growing uterus and increased sensitivity to local anesthetic agents, help make this group at increased risk of severe hypotension [5]. Also, the differences in the definition and monitoring criteria used in studies also affect reported incidence rates.

Post-operative hypotension after spinal anesthesia may be associated with various clinical outcomes, including mild symptoms, such as nausea and dizziness, and more severe, such as impaired organ perfusion and delayed recovery [6]. In obstetric patients, it can affect the uteroplacental blood flow, which could lead to fetal distress and negative neonatal outcomes [7]. There are a number of risk factors that have been identified such as old age, low baseline blood pressure, high level of sensory block, high BMI and comorbidity [8]. These aspects underscore the multifactoriality of this complication.

Hypotension is a problem that continues to trouble anesthetic practice and monitoring despite advances in anesthetic practice and monitoring [9]. Retrospective studies are useful in determining the actual patterns and risk factors in the real world, which can be utilized to come up with effective preventive measures. Thus, the proposed study will undertake a retrospective assessment of the occurrence and predictors of hypotension after spinal anesthesia in a tertiary care unit [10].

Moreover, spinal anesthesia-induced hypotension prevention and management has been a popular research topic with preventive and therapeutic options such as preloading or coloading with fluids, administration of vasopressors like phenylephrine and ephedrine, and posture to enhance venous return [11]. Regardless of these interventions, there has not been a single intervention that has universally worked and the selection of a strategy has had to be often based on individual patient considerations as well as the institutional guidelines. The inconsistency in response to such measures further stresses the importance of more effective identification of high-risk patients and the use of individual management strategies [12].

Moreover, knowing the occurrence and the causative factors of hypotension in various clinical patients is crucial to enhancing the outcome of perioperation [13]. Local data, particularly those of tertiary care facilities, can offer helpful information on patient demographics, procedure trends, and resource supply that affect clinical care [14]. The evidence is especially significant in developing countries, where differences in infrastructure and the demographics of patients can influence the incidence and control of complications. Thus, the contribution of context-specific evidence that may help to provide better anesthetic care and patient safety is another goal of this study [15].

Methodology

Study Design: The present study was formulated as retrospective observational study to assess the incidence and risk factors of hypotension after the spinal anesthesia. The retrospective method was selected to facilitate a systematic review of the past-recorded clinical data within a specified timeframe to identify the trends, patterns and relationships within a real-life clinical practice to avoid affecting patient management.

Study Area: The research was carried out in the Department of Anaesthesiology of Shree Narayan Medical Institute and Hospital, Saharsa, Bihar, India for one year

Study Participants

Inclusion Criteria

- Surgical patients who were put under spinal anesthesia and who were of age 18 years and above
- Patients whose anesthesia records are complete and well documented and include intraoperative hemodynamic monitoring
- Elective as well as emergency surgery

Exclusion Criteria

- Patients who have incomplete/ missing clinical/anesthesia records
- Patients undergoing combined spinal-epidural anesthesia, or other regional methods
- Patients who have a history of severe hemodynamic instability, shock, or need vasopressor support before anesthesia
- Patients who have contraindications to the use of spinal anesthesia

Sample Size: The study involved 170 records of patients who met the eligibility criteria. The sample size was decided on the basis of the availability of complete records at the time of study and was deemed sufficient to determine the occurrence and the factors that were linked with hypotension in the study population.

Procedure: The medical records department and anesthesia registers of the hospital were used to retrieve patient data in a structured data extraction format. The information regarding the applicable clinical and perioperative variables were systematically recorded including:

- **Demographic details:** body mass index (BMI), age, gender
- **Clinical characteristics:** type of surgery (obstetric or non-obstetric), comorbid conditions (where available)
- **Anesthetic details:** type and dose of local anesthetic, degree of spinal block
- **Baseline hemodynamic parameters:** preoperative heart rate and blood pressure
- **Intraoperative parameters:** frequency and time of hypotension, variations in heart rate
- **Definition of hypotension:** systolic blood pressure (SBP) less than 90mmHg or more than 20% decrease in baseline measurements
- **Management measures:** intravenous fluids, intravenous vasopressors (such as phenylephrine, ephedrine) and intravenous oxygen help.

Care was also taken to ensure that the data was collected to prevent inaccuracy and inconsistency. To ensure confidentiality, all the identifiers of the patients were removed. The research complied with the ethics through the Institutional Ethics Committee and ethics of the study were adhered to with reference to retrospective research.

Statistical Analysis: The data received were entered into SPSS version 27.0 (IBM, USA) to be statistically analyzed.

- The data was summarized using descriptive statistics where the continuous variables are described as means ± standard deviation (SD) and categorical variables are described in terms of frequencies and percentages
- The Chi-square test was used to test the relation between categorical variables like incidence of hypotension and patient characteristics
- Comparison of continuous variables was done using independent t-tests where necessary
- The data were analyzed using multivariate logistic regression to determine the independent predictors of hypotension with the possible confounding variables
- A p-value that was less than 0.05 was taken to be significant

Results

Table 1 shows the demographics of the participants of the study. The age distribution showed the age group of 18-40 years (41.2%), 41-60 years (32.4%) and the age group of over 60 years (26.5%) had the highest percentage. There was a slightly higher difference in the gender distribution with a higher proportion of females (52.9%) compared to male patients (47.1%). Concerning the body mass index (BMI), 50% of the patients (BMI normal), 29.4% overweight and 20.6% obese. Overall, the population of the study was predominantly comprised of younger adults and gender was balanced with a higher proportion of patients with an increased BMI, which may influence perioperative hemodynamic reactions.

Table 1: Demographic Characteristics (n = 170)

Parameter	Frequency (n)	Percentage (%)
Age (years)		
18–40	70	41.2
41–60	55	32.4
>60	45	26.5
Gender		
Male	80	47.1
Female	90	52.9
BMI		
Normal	85	50
Overweight	50	29.4
Obese	35	20.6

Table 2 represents the general results of the prevalence of hypotension after spinal anesthesia in the study group. 68 patients (40%) experienced hypotension, and 102 patients (60%) had stable hemodynamic parameters. This shows that hypotension is a frequent complication among patients who are placed under spinal anesthesia as almost two out of every five patients of the study population developed hypotension, thus showing its clinical importance.

Table 2: Incidence of Hypotension

Parameter	Frequency (n)	Percentage (%)
Hypotension Present	68	40
Hypotension Absent	102	60

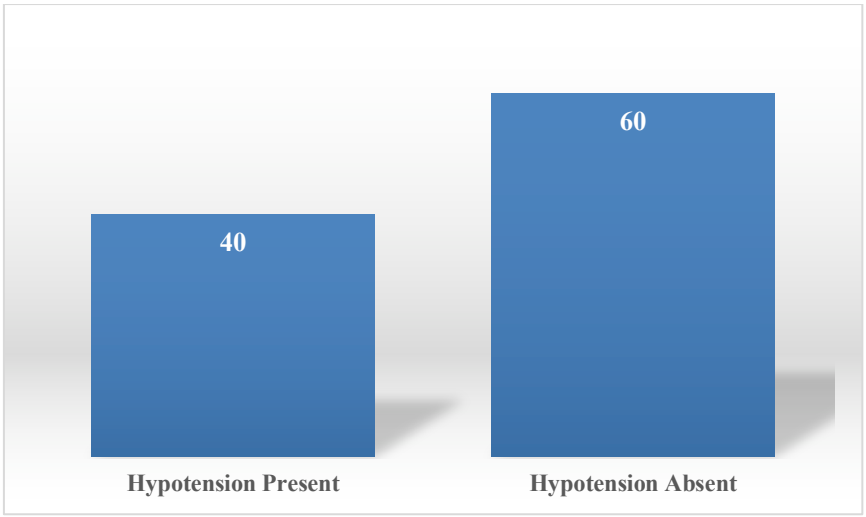

Figure 1: Visual Representation of Incidence of Hypotension

Table 3 presents the distribution of hypotension according to the type of the surgical procedure. In patients that acquired hypotension, it was found that 32 cases in obstetric surgeries (47.1%) and 36 cases in non-obstetric surgeries (52.9%) arose. Although the probability of hypotension was slightly more in non-obstetric cases, the probability in obstetric cases was significant because they are more susceptible to the effects of a hemodynamic change when undergoing spinal anesthesia.

Table 3: Incidence by Type of Surgery

Surgery Type	Hypotension (n)	Percentage (%)
Obstetric	32	47.1
Non-obstetric	36	52.9

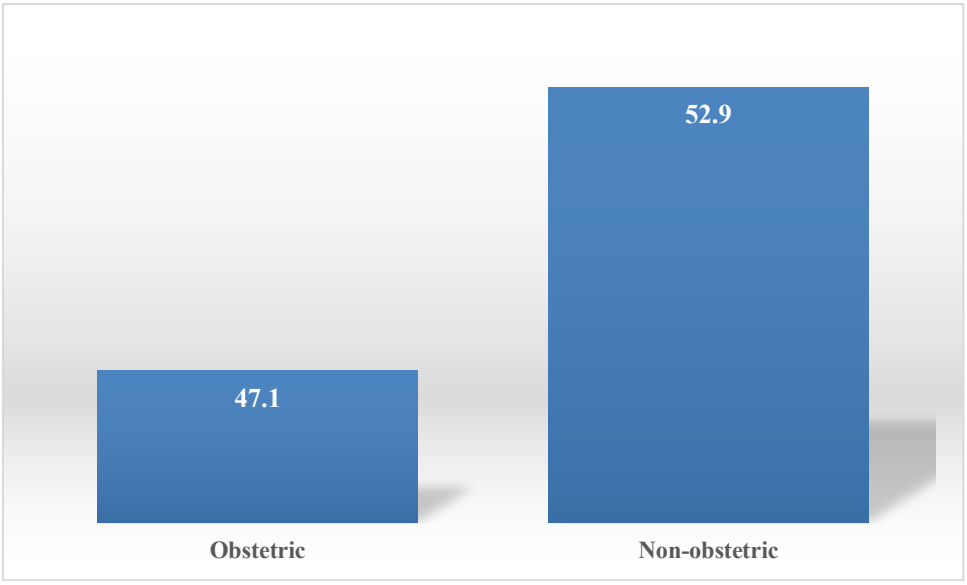

Figure 2: Visual Representation of Incidence by Type of Surgery

Table 4 has described the significant risk factors related to the presence of hypotension. The strongest factor was a high level of spinal block (>T6), which was seen in 58.8% of patients with hypotension. The prevalence of advanced age (>60 years) was observed to be at 52.9% with baseline low blood pressure (51.5) and obesity (BMI >30) at 41.2% among the patients. These results indicate that physiological and procedural elements contribute greatly to the occurrence of hypotension, and increased block levels and patient susceptibility are significant contributors.

Table 4: Risk Factors Associated with Hypotension		
Risk Factor	**Frequency (n)**	**Percentage (%)**
High spinal block (>T6)	40	58.8
Baseline low BP	35	51.5
BMI >30	28	41.2
Age >60	36	52.9

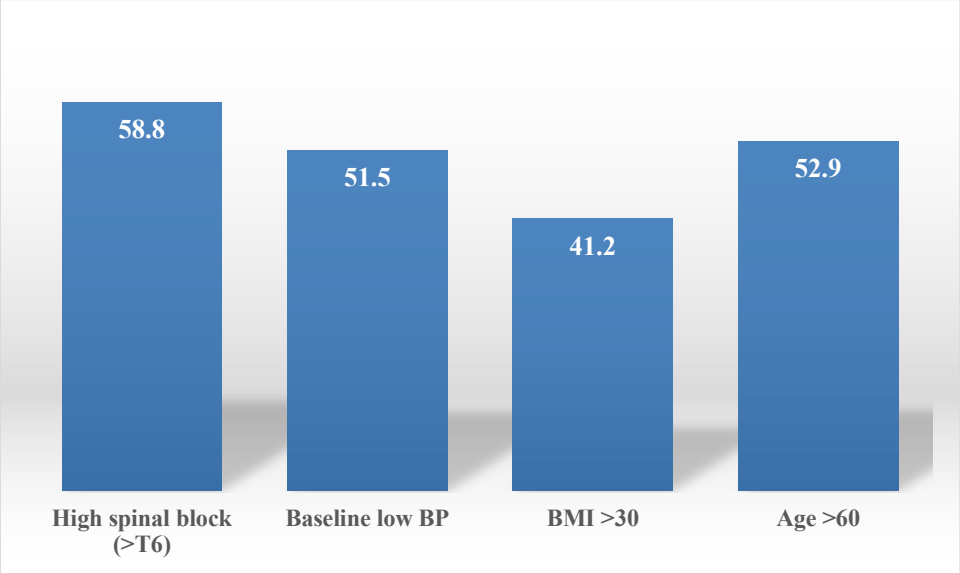

Figure 3: Visual Representation of Risk Factors Associated with Hypotension

The management strategies that are used in hypotension in the affected patients are shown in Table 5. The most common intervention was the administration of fluid bolus (73.5%), then vasopressor therapy (60.3%). Oxygen supplement was administered in 44.1% patients. The results of these studies mean that fluid resuscitation is the most common primary management method and vasopressors are often needed to regain and maintain hemodynamic stability in a large percentage of patients.

Table 5: Management of Hypotension		
Intervention	**Frequency (n)**	**Percentage (%)**
Fluid bolus	50	73.5
Vasopressors	41	60.3
Oxygen therapy	30	44.1

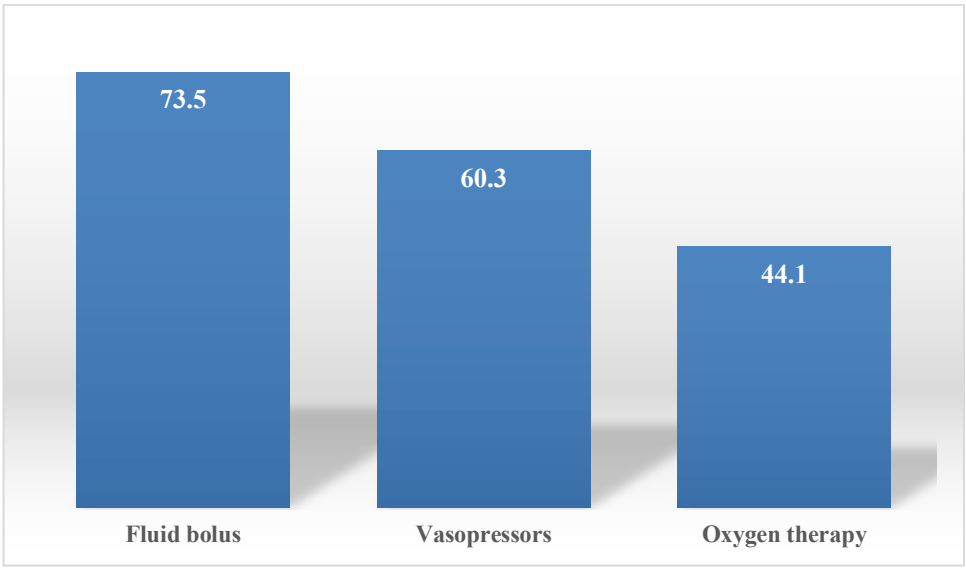

Figure 4: Visual Representation of Management of Hypotension

Discussion

This current retrospective study assessed the incidence and the determinants of hypotension in 170 patients that underwent spinal anesthesia. The total percentage of hypotension was 40% (68/170 patients, which is 2 out of 5 patients) meaning that almost two percent of patients had a serious decrease in their blood pressure during perioperative surgery. The implication of this finding is that hypotension is a common and clinically significant complication of spinal anesthesia. The incidence observed is within the range of incidence typically reported in the clinical setting and indicates the current lack of control in ensuring hemodynamic stability even with the current advancements in anesthetic methods (Rodseth et al., 2019) [16]. Differences in incidence among various studies could be explained by the differences in patient profile, type of surgery, type of anesthetic dosing and practice of perioperative monitoring.

Hypotension was more prevalent in the elderly patients with an age of over 60 years in the present study and 52.9% of the cases of hypotension were in the elderly. This implies that the age factor is an important risk factor, probably because of decreased cardiovascular reserve, dysfunction of the baroreceptor reflex and decreased autonomic compensatory mechanisms. The elderly patients might consequently be unable to effectively react to some immediate reductions in systemic vascular resistance caused by spinal anesthesia (Shehata et al., 2019) [17]. Also, there was hypotension, both in obstetric and non-obstetric patients with 47.1% of the cases in obstetric and 52.9% in non-obstetric patients. Though the difference is not that high, the phenomenon observed in obstetric patients is still of clinical significance, as they are more susceptible to hemodynamic instability because of physiological changes, including an increase in intra-abdominal pressure and a change in the vascular tone.

The current research determined some of the noteworthy risk factors that relate to hypotension. The most salient factor was a high spinal block level (>T6) and was found in 58.8% of hypotensive patients, which shows that degree of sympathetic blockade is a key factor influencing the degree of blood pressure decrease. Increased blockade also results in a greater extent of vasodilation and decreased venous return, thus, greatly affecting the cardiac output. Low blood pressure at baseline was observed in 51.5% of the cases, which indicates that patients with less initial hemodynamic status cannot better withstand additional blood pressure decreases (Singh et al., 2019) [18]. Moreover, 41.2% of hypotensive patients were found to be obese (BMI >30) and this can play a role by causing higher intra-abdominal pressure, change in vascular resistance and weakening of the venous return. The results suggest that physiological and procedural variables interact to affect chances of hypotension.

When it came to management, most of the patients with hypotension needed active management to regain the hemodynamic stability. The most common strategy was the administration of fluid bolus that was used in 73.5% of all cases, which reveals its importance as the first and necessary step in management. Nevertheless, a large percentage of patients (60.3%) needed vasopressor therapy, which proves that fluid therapy was not always sufficient to properly address hypotension (Sudfeld et al., 2017) [19]. This indicates the significance of pharmacological agents in keeping the vascular tone and assisting cardiac output in spinal anesthesia. In 44.1% of cases, oxygen supplementation was given as an adjunctive measure, to maintain sufficient levels of oxygen in tissues. These results highlight that management may need the integrated interventions based on the severity of hypotension.

Overall, the findings of this study indicate that hypotension in the post-spinal anesthesia is a multifactorial phenomenon, which is conditioned by a combination of patient-specific factors, including age, BMI, and, finally, the degree of spinal block and procedures, including the degree of spinal block (Susano et al., 2019) [20]. The interaction of these aspects shows the complexity of the issue of predicting and preventing hypotension in clinical practice. Hence, accurate preoperative evaluation, recognition of patients at risk, proper intraoperative monitoring and prompt intervention will help to reduce complications. Individualized management approach can help a great deal in enhancing patient safety and outcome of perioperative processes.

Conclusion

This retrospective study shows that hypotension is a frequent and clinically significant complication of spinal anesthesia, occurring in 40% of patients, and more frequently and more significantly in older patients, obese patients, and patients with increased amounts of spinal blockade. The results underline the importance of patient-related and procedural causes of hypotension development and the necessity to pay much attention to preoperative assessment to recognize vulnerable patients. It is important to monitor the condition intraoperatively continuously to be able to diagnose it early and administer fluid therapy and vasopressors to maintain hemodynamic stability. Overall, a combination of adequate preventive measures and individual anesthetic methods can allow to reduce the number of complications, enhance patient safety, and improve the overall perioperative outcomes.

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