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Original Research Paper

Prophylactic Ephedrine to Prevent Post Spinal Hypotension Following Spinal Anesthesia in Elective Caesarean Section

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ABSTRACT:
The use of spinal anaesthetic is prevalent in the context of caesarean births. Hypotension often occurs as a prevalent clinical issue after the administration of spinal anaesthetic for the purpose of caesarean birth. The present research was conducted at AL Zahra teaching hospital, which is affiliated with the Wasit Health Department in Kut, Iraq, spanning from the 2nd of January 2021 to the 20th of April 2021. A total of sixty participants were included in the present investigation. Participants were divided into two groups, each group consisting of thirty individuals. Patients were categorized into two groups: the prophylactic group (Group 1) and nonprophylactic (Group 2), according to the independent judgment of competent anesthetists. The individuals who received a preventive dosage of 6 mg of ephedrine during the initiation of spinal anesthesia were categorized as the prophylactic cohort, specifically referred to as Group 1. In this study, the nonprophylactic group was operationally defined as the specific group of patients who did not receive any prophylactic vasopressor during the administration of spinal anesthesia, specifically referred to as Group 2. The administration of spinal anesthesia is performed via aseptic method. The initial value for this study was established by computing the mean values of noninvasive blood pressure and heart rate at multiple time intervals: prior to induction, during induction, 5 minutes post-induction, 10 minutes post-induction, and 15 minutes post-induction. The collected samples underwent statistical analysis. The results showed that hypotension occurred more often in women who did not receive prophylactic ephedrine compared to those who did. Patients who were given ephedrine prophylactically had more consistent blood pressure readings than those who were not. The heart rates of those taking preventative measures also increased significantly.

Keywords: ephedrine, prophylaxis, spinal anesthesia, hypotension

INTRODUCTION:

Spinal anesthesia is widely used as a primary approach for central neuraxial anesthesia in both surgical procedures and obstetric care. These strategies are used across many age cohorts. Spinal anesthesia is often regarded as a very suitable anesthetic approach for surgical procedures that include lower limbs, pelvis, perineum, and lower abdominal region [1]. The use of spinal anesthesia obviates the need for the administration of a general anesthetic throughout the course of the treatment. This implies that you will be in a state of complete wakefulness and will be able to actively engage in the process of your baby's delivery, alongside your spouse, inside the confines of the operating theatre. During the process, it is expected that you will have a high degree of pain reduction, while maintaining a state of alertness. Moreover, the probability of experiencing discomfort is reduced compared to the administration of a general anesthetic. Regional cento-axial anesthesia, namely spinal block, is the favored anesthesia technique for elective caesarean section due to its lower risk profile for both the mother and the baby as compared to general anesthetic [2].

Hypotension resulting from sympatholytic effects is the most often seen adverse effect in relation to spinal block. The sympatholytic effects of spinal block result in vasodilation, leading to maternal hypotension. This decrease in blood pressure has the potential to negatively impact uterine blood flow and fetal circulation, ultimately resulting in fetal hypoxia, bradycardia, and acidosis. The identification of the optimal treatment approach for achieving

hemodynamic stability during spinal anesthesia for caesarean section remains a significant obstacle in the field of obstetric anesthesiology. Various strategies are employed in clinical settings to prevent and treat hypotension induced by spinal blocks. Compression stockings or bands can be applied to the lower extremities, inotropes and vasopressors can be given, and the patient can be placed in a left tilt position. Other measures include preloading and co-loading with crystalloid and/or colloid infusion and achieving an optimal spinal block level with local anesthetic. According to recent algorithms, it is recommended to provide a prophylactic vasopressor infusion [3]. As a result of the limited efficacy of fluid-loading techniques, vasopressors have become the preferred therapeutic strategy for managing hypotension induced by spinal procedures. After the administration of spinal anesthesia, there is an observable decline in mean arterial pressure and a substantial decrease in systemic vascular resistance, despite an elevation in cardiac output, heart rate, and stroke volume within the initial 15-minute period following the induction of spinal anesthesia. [4]. The use of vasopressors, such as phenylephrine, is considered the most effective approach for managing hypotension generated by spinal anesthesia [5]. The primary mechanism of action of ephedrine is its sympathomimetic activity. The mode of action refers to the specific mechanism through which a substance or agent produces its effects or achieves its intended outcome. Ephedrine exerts its pharmacological effects by both indirect mechanisms, including the release of noradrenaline from sympathetic nerve terminals, as well as direct mechanisms, involving the activation of alpha- and beta-adrenoceptors. When hypotension occurs after general, spinal, or epidural anesthesia, ephedrine is used to restore blood pressure [6]. Ephedrine has been widely regarded as the preferred vasopressor for use in obstetric patients. Nevertheless, the use of ephedrine is subject to some constraints. The medication has a rather gradual initiation of its effects, and frequent use may be linked to the development of tachyphylaxis [7].

HYPOTENSION:

The regulation of systemic blood pressure is influenced by two main factors: cardiac output and systemic vascular resistance (SVR). Among these factors, SVR plays a crucial role in the development of spinal hypotension. The regional administration of anesthetics leads to the inhibition of lumbar preganglionic sympathetic fibers, resulting in a reduction in systemic vascular resistance (SVR). This reduction in SVR causes the accumulation of blood in the peripheral regions, leading to a decrease in venous return and preload. A decrease in preload leads to a decrease in stroke volume and cardiac output, ultimately resulting in systemic hypotension [17].

The present study aims to elucidate the pathophysiological mechanisms behind hypotension that occurs during spinal anesthesia, as well as the potential repercussions associated with this condition. The primary factors leading to hypotension generated by spinal procedures are arterial dilation and a decrease in systemic vascular resistance.[18]. The incidence of nausea and vomiting is notably higher under spinal anesthesia for caesarean section in comparison to non-obstetric surgical procedures, with hypotension being the primary underlying reason. Acute hypotension has been seen to decrease cerebral perfusion, leading to the occurrence of temporary brainstem ischemia and the activation of vomiting centers [19]. This finding is consistent with previous research indicating that the administration of oxygen might potentially mitigate cerebral hypoxia and decrease the occurrence of nausea (Reference 20). The occurrence of vertigo and lowered level of awareness may be attributed to severe and protracted maternal hypotension, however prompt treatment of the blood pressure drop can reduce the frequency of these symptoms. According to a study by [21], studies have indicated that splanchnic blood flow decreases by around 20% after spinal anesthesia. When systemic hypotension is present, this impact becomes much more pronounced. More important than the severity of hypotension is its duration. A brief drop in pressure of at least 30% had no effect on the newborn's Apgar score, the prevalence of meconium-stained amniotic fluid, or the need for neonatal oxygen therapy. [22]. The impact of hypotension lasting less than 2 minutes on neurobehavioral outcomes is negligible, although maternal hypotension lasting more than 4 minutes has been associated with neurobehavioral abnormalities within the first 4 to 7 days after birth [23]. The selection of a vasopressor for the management of hypotension plays a crucial role in assessing the acid-base balance of a newborn. According to clinical research, it has been shown that phenylephrine is linked to a more advantageous acid-base state in neonates when compared to ephedrine [24].

EPHEDRINE:

The classification of its activities on the adrenoceptors into distinct alpha and beta effects represents a significant milestone in the field of autonomic pharmacology. The mechanism of action refers to the specific biochemical interactions and processes via which a drug or therapeutic agent produces its effects on the body. Ephedrine, which is a stereoisomer of the more well recognized pseudoephedrine, is classified as a sympathomimetic amine. Its distinct effects may be attributed to its indirect method of action, distinguishing it from other sympathomimetic drugs such as pseudoephedrine and phenylephrine [37]. Ephedrine acts as a direct agonist as well as an indirect agonist in the sympathetic nervous system. The

chemical is capable of binding to both alpha and beta receptors in a direct fashion. However, its primary mechanism of action is mediated indirectly by the displacement of additional norepinephrine from storage vesicles and the suppression of neuronal norepinephrine reuptake [38]. Norepinephrine may bind to postsynaptic alpha and beta receptors because of this process, which allows it to remain in the synaptic cleft for a longer period of time [39]. Since norepinephrine may bind to both alpha and beta receptors, ephedrine works indirectly to increase heart rate by keeping it up for a longer period of time. Reflex bradycardia is triggered by direct sympathomimetics such phenylephrine. Although the direct vasoconstrictive action largely affects the veins, its indirect effect has a greater influence on arterial blood pressure. As a result, it works well to raise the patient's central venous pressure while they're having fluid issues [38]. Systolic and diastolic blood pressure are both raised when alpha-1-adrenergic receptors on smooth muscle cells in the blood arteries are stimulated. Direct activation of beta-1-receptors by ephedrine and norepinephrine increases their cardiac chronotropic and inotropic actions. Ephedrine causes bronchodilation by stimulating beta-2 adrenergic receptors in the respiratory system. The cardiovascular effects of ephedrine use are more serious, therefore it's important to keep that in mind [40].

Administration When given intravenously, boluses of the drug are often administered rather than a constant infusion. Current recommendations recommend a bolus dose of 5–10 mg for adults, with intramuscular dosages of 25–50 mg for a sustained impact [38]. The FDA has not confirmed the safety and effectiveness of the drug in children [28].

AIM OF STUDY:

The objective of this study is to investigate the impact of a 6 mg prophylactic intravenous bolus of ephedrine on the occurrence of hypotension in women undergoing elective cesarean section while under spinal anesthesia.

PATIENTS AND METHOD:

The present research was conducted at AL Zahra teaching hospital, which is under the jurisdiction of the Wasit Health Department in Kut, Iraq, spanning from the 2nd of January 2021 to the 20th of April 2021. The department of anaesthetic technologies at the College of Health and Medical Technology – Baghdad provides supervision for the aforementioned activities. A total of sixty participants were included in the present investigation. The patients were divided into two groups, with each group consisting of thirty individuals. The management of anesthesia, which encompasses the intraoperative treatment of hypotension, the selection of hydration regimes, and the administration of vasopressors. Using their professional discretion, the anesthesiologists separated the patients into two groups: those who would receive prophylactic antibiotics before surgery (Group 1) and those who would not (Group 2). The preventive group, or Group 1, consists of the patients who were given 6 mg of ephedrine prior to the onset of spinal anesthesia. Group 2 refers to the subgroup of patients who did not receive any prophylactic vasopressor during spinal anesthetic induction, and so represents the nonprophylactic group in this study. The participants were excluded from the research. The parturient who declines regional anesthesia, individuals with contraindications to spinal anesthesia, fetal anomalies, documented allergy to any of the drugs utilized in this investigation, pregnancy-induced hypertension or parturient with systolic blood pressure (BP) exceeding 140 mm Hg, history of diabetes mellitus, cardiovascular or cerebrovascular conditions, and any chronic illnesses.

The methodology and usual procedures before Cesarean Suction at the research location were as follows: The preoperative assessment was conducted in the morning before to the surgical procedure. Parameters such as vital signs, organ-function tests, history, physical exams, and total blood count are used in the determination of an anesthetic strategy. Prior to the scheduled operation, it is customary for all patients to observe a fasting period of 8-10 hours. Upon entering the operating room, bilateral arms are prepared with the placement of two 18- or 20-gauge IV cannula needles, as well as the insertion of a Foley catheter and attachment of a urine bag. Intravenous administration of metoclopramide at a dosage of 10 mg and ranitidine at a dosage of 50 mg was performed 10 minutes prior to the initiation of spinal anesthesia. Both intravenous lines were secured to provide Ringer's or normal saline solution as rapidly as feasible for co-loading. The lumbar puncture procedure was conducted with meticulous adherence to aseptic and antiseptic protocols. A midline approach was used, using a 25-gauge Quincke spinal needle at the L3-L4 intervertebral area. The patient assumed a seated posture throughout the procedure. Additionally, an intrathecal injection of 10 mg of 0.5% bupivacaine was delivered. The administration of ephedrine through intravenous injection at a dosage of 6 mg is performed promptly. Following intrathecal administration. The patients were placed in a supine posture with a modest elevation of the head using a pillow. They received 100% oxygen using a Venturi face mask at a flow rate of 3 L/min. Additionally, a dosage of 10 IU/ml of oxytocin was supplied after the birth of the baby, followed by an infusion of oxytocin at a concentration of 30 IU/ml. The researchers monitored many hemodynamic measures, including heart rate, systolic blood pressure (BP), percentage saturation of oxygen (SpO2), and electrocardiogram (ECG) readings.

During the intraoperative time, a monitoring equipment manufactured by Saadat firm, namely the Alborz B9 type, is used. The baseline value for this research is determined by calculating the average at several time points: before to induction, during induction, 5 minutes post-induction, 10 minutes post-induction, and 15 minutes post-induction.

RESULTS:

This chapter presents the result of analysis in a systematically driven presentation. A logical interpretation to each was provided to show the significant finding.

Table (1) Distribution of groups study by mean and stander deviation of systolic, diastolic and heart rate for each period of time

		Parameters	N	Ran	Min	Max	Mean	SD
non prophylaxis	DYS	before ind	30	30	60	90	76.37	8.915
		during ind	30	45	50	95	66.67	12.549
		after 5	30	45	40	85	54.83	10.212
		after 10	30	40	40	80	54.77	9.573
		after 15	30	50	40	90	61.17	11.721
	HR	After ind	30	50	85	135	103.17	12.309
		during ind	30	49	75	124	98.9	13.155
		after 5	30	45	75	120	95.53	11.512
		after 10	30	50	60	110	91.6	11.646
		after 15	30	58	70	128	90.23	10.546
	SYS	before ind	30	25	110	135	122.83	6.783
		during ind	30	40	85	125	108.83	9.255
		after 5	30	35	75	110	96.83	10.042
		after 10	30	45	70	115	96.83	10.379
		after 15	30	40	75	115	104	10.78
Prophylaxis	DYS	Before ind	30	35	60	95	78.57	8.744
		during ind	30	35	55	90	76.2	7.388
		after 5	30	50	40	90	63.5	11.383
		after 10	30	33	50	83	60.27	8.513
		after 15	30	40	50	90	63.23	9.835
	HR	before ind	30	43	82	125	103.9	13.54
		during ind	30	63	72	135	101.87	14.063
		after 5	30	62	60	122	100.63	13.895
		after 10	30	43	72	115	97.33	10.07
		After 15	30	39	76	115	97.17	8.69
	SYS	before ind	30	35	110	145	128.5	7.445
		during ind	30	35	105	140	125.5	7.352
		after 5	30	45	80	125	109.17	12.112
		after 10	30	45	80	125	104.67	11.366
		after 15	30	30	100	130	110.5	6.74

Table (2) showed high significant in systolic, diastolic in before and during induction, after 5 min 10 and 15min.the heart rate significant in before and during and high significant after 5min ,10 min and 15 min in nonprophylactic group.

Group	Parameters		P. Value	C.S
non prophylaxis	DYS	before indc - during ind	P < 0.01	HS
		before indc - after 5	P < 0.01	HS
		before indc - after 10	P < 0.01	HS
		before indc - after 15	P < 0.01	HS
	HR	before indc - during ind	P < 0.05	S
		before indc - after 5	P < 0.01	HS
		before indc - after 10	P < 0.01	HS
		before indc after 15	P < 0.01	HS
	SYS	before indc - during ind	P < 0.01	HS
		before indc after 5	P < 0.01	HS
		before indc - after 10	P < 0.01	HS
		before indc - after 15	P < 0.01	HS

Table (3) showed in prophylactic group non-significant systolic, diastolic before induction - during induction , high significant after 5min ,10 min and 15 min. nonsignificant in heart rate before induction - during induction, after5 min ,10 min and significant in 15 min .

Group	Parameters		P. Value	C.S
Prophylaxis	DYS	before ind - during ind	P > 0.05	NS
		before ind - after 5	P < 0.01	HS
		before ind - after 10	P < 0.01	HS
		before ind - after 15	P < 0.01	HS
	HR	before ind during ind	P > 0.05	NS
		before ind after 5	P > 0.05	NS
		before ind after 10	P > 0.05	NS
		before ind - after 15	P < 0.05	S
	SYS	before indc - during ind	P > 0.05	NS
		before ind - after 5	P < 0.01	HS
		before ind - after 10	P < 0.01	HS
		before ind after 15	P < 0.01	HS

DISCUSSION:

Regional anaesthetic is often used as the primary approach for doing caesarean births [57]. Hypotension is a common clinical issue encountered by patients undergoing spinal anesthesia, and in cases of severity, it may result in adverse health outcomes for both the mother and fetus [58]. In our research, the patients were categorized into two groups: the prophylactic group and the nonprophylactic group.

The baseline value for our research was determined by calculating the average of noninvasive blood pressure measurements and pulse rate readings collected before induction, during induction, 5 minutes after induction, 10 minutes after induction, and 15 minutes after induction using a pulse oximeter. Based on the findings of our research, it can be seen that the occurrence of hypotension was more prevalent among those who did not get prophylactic ephedrine compared to those who did receive prophylactic ephedrine. The results of the study indicate that patients who were administered prophylactic ephedrine exhibited enhanced stability in blood pressure when compared to the nonprophylactic group. Additionally, it was seen that the prophylactic group saw a considerable rise in heart rate. The nonprophylactic group had a statistically significant decrease in intraoperative blood pressure (both systolic and diastolic) from 5 minutes following the introduction of spinal anesthesia to the 15-minute mark. This finding shown concurrence with previous research conducted by Shireman, T., Aregawi, et al. (59), which also indicated similar results. The nonprophylactic group exhibited a statistically significant decrease in intraoperative blood pressure (both systolic and diastolic) from 5 minutes after the initiation of spinal anesthesia until the 20th minute. Shahzadi, I., Hanif, S., and colleagues [60]. There is a statistically significant difference in systolic blood pressure (SBP) between the groups observed from the 6th to the 20th minute. In their study, Hegde and Bhat (61) conducted a comparison between crystalloid preloading and the administration of ephedrine bolus and ephedrine

infusion for caesarean section procedures performed under spinal anesthesia. The findings of their study indicated that the administration of a 6 mg ephedrine bolus at the start of the spinal block, followed by a subsequent infusion of 24 mg ephedrine, was more effective in avoiding hypotension compared to the administration of crystalloid alone. The findings in our research are consistent with the results published by Chan et al and Desal et al [62], where they noticed a higher occurrence of hypotension in the preload group compared to the ephedrine group. Hypertension did not manifest in any of the patients belonging to any of the groups under investigation in our research. The potential influence of the little dosage of ephedrine used in this investigation on the observed outcome cannot be disregarded. In a similar vein, it is noteworthy that none of the patients in the preventive group had bradycardia. This observation might perhaps be attributed to the chronotropic impact of ephedrine. In our research, we observed a significant difference in intraoperative heart rate between the two groups. Specifically, the prophylactic group exhibited an increase in heart rate. This finding aligns with the results published by Shahzadi, I., Hanif, S et al [60], who also observed a substantial rise in heart rate within the prophylactic group.

The phenomenon described may be characterized as an elevation in heart rate in hypotensive individuals, which is attributed to the baroreceptor-mediated reflex. Research findings have shown that ephedrine exerts its influence on cardiac beta receptors in an indirect manner, resulting in the activation of the sinus node and subsequently inhibiting a reduction in heart rate subsequent to spinal anesthesia.

CONCLUSION:

Based on the findings of the current research, it can be concluded that the use of a mixture of crystalloid fluids together with a prophylactic intravenous bolus of 6 mg ephedrine resulted in a reduction in the incidence of hypotension subsequent to spinal anesthesia in parturient individuals having elective Cesarean Section.

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