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# Efficacy of Nor-Adrenaline Vs Phenylephrine for the management of Spinal Hypotension among patients undergoing Cesarean Section

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## Abstract

**Introduction:** Most of the Cesarean sections are conducted under regional anesthesia. Spinal anesthesia is the anesthesia of choice except where contraindications are encountered. Spinal anesthesia can lead to significant hypotension with relevant hemodynamic changes. Rescue medications frequently used to manage per-operatively include phenylephrine, ephedrine and noradrenaline. Phenylephrine is an α-agonist commonly used for the prevention and treatment of hypotension. The significant drawback is that it can cause bradycardia and reduced cardiac output. Recently, noradrenaline has been found as effective as phenylephrine to maintain blood pressure while also conferring a greater heart rate and cardiac output. The aim of our study was to compare the effects of intravenous boluses of conventional phenylephrine and noradrenaline for the management of spinal induced hypotension among patients undergoing cesarean sections in spinal anesthesia.

**Methods:** The study was conducted at Cantonment General Hospital, Rawalpindi from Jan 2020 to June 2020 over a period of 6 months. A total of 160 patients posted for elective cesarean section were recruited in the study. They were randomized into two groups of 80 each. The standard intravenous bolus dose of Phenylephrine and noradrenaline was defined as 100 microgram (mcg) and 8 microgram (mcg) respectively. Group A received Phenylephrine 100mcg and Group B received Noradrenaline 8mcg intravenously whenever systolic blood pressure was 20% lower than baseline with relevant tachycardia. Systolic blood pressures, diastolic blood pressure, heart rate and Apgar scores were compared between the two groups. SPSS version 17.0 was used to analyze the data.

**Results:** The incidence of hypotension in group A was comparable to group B (60% vs 65%) and was not statistically significant ($p>0.05$). The incidence of bradycardia in group A was significantly higher than in group B (35% vs 7.5%) and was statistically significant ($p <0.05$). There was no difference in Apgar scores between the two groups.

**Conclusion:** Noradrenaline bolus doses are effective in the management of spinal-induced hypotension during cesarean section. It has better effects on the hemodynamic stability of the patients in terms of heart rate and blood pressure stabilization. Phenylephrine, though, can manage the blood pressure effectively, but can cause significant bradycardia that can cause some deleterious conical effects. In conclusion, noradrenaline is an excellent choice to manage spinal induced hypotension.

**Keywords:** Spinal Anesthesia; Hypotension; Noradrenaline; Phenylephrine

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## 1. Introduction

Spinal anesthesia is often used for caesarean section all round the globe because of its safety and effectiveness. However, there are chances of more frequent hypotension that may lead to adverse outcomes like maternal nausea, vomiting, and cardiovascular instability along with decreased uteroplacental blood flow. Hypotension is described as a decrease in the absolute value of systolic arterial pressure (SAP; usual threshold between <80 and <100 mmHg), a decrease compared with a baseline value, or a combination. Spinal anesthesia results in sympathetic vasomotor blockade leading to decreased systemic vascular resistance and ultimate hypotension. Incidence of spinal hypotension may range from 7.4% to 74.1%. The additional causes of maternal hypotension after spinal anesthesia are due to blockade of sympathetic fibers resulting in reduced preload and reduced afterload along with aortocaval compression by gravid uterus. Common management to prevent and treat hypotension includes fluid preloading/co-loading, and vasopressors like phenylephrine, ephedrine and sometimes noradrenaline. Phenylephrine is an α-agonist commonly used for the prevention and treatment of hypotension. The significant drawback is that it can cause baroreceptor mediated bradycardia and reduced cardiac output. Additionally the use of phenylephrine in spinal-induced hypotension significantly raises vascular resistance, affecting uterine and placental vessels and resulting in fetal hypoxia. This reflex bradycardia is dose dependent and risk is higher as dose of phenylephrine increases. Recently, noradrenaline has been found as effective as phenylephrine to maintain blood pressure while also conferring a greater heart rate and cardiac output. The aim of our study was to compare the effects of intravenous boluses of conventional phenylephrine and noradrenaline for the management of spinal induced hypotension among patients undergoing cesarean sections in spinal anesthesia.

## 2. Methods

The study was conducted at Cantonment General Hospital, Rawalpindi from Jan 2020 to June 2020 over a period of 6 months. The departments of Anesthesia, Obstetrics and Gynecology and Statistics collaborated jointly to gather and process the data.After approval from hospital ethical committee, a total of 160 patients posted for elective cesarean section were recruited in the study. They were randomized into two groups of 80 each. The standard intravenous bolus dose of Phenylephrine and noradrenaline was defined as 100 microgram (mcg) and 8 microgram (mcg) respectively.

### 2.1. Inclusion criteria

- ASA – I (normal healthy patient).
- Routine cases booked from OPD based on History, clinical examination and relevant investigations.
- Elective surgery (Elective Cesarean Section)

### 2.2. Exclusion criteria

- Patient with concomitant co-morbid conditions like diabetes mellitus, hypertension, malignancy, pulmonary, hepatic or renal diseases.
- Patients having specific contraindications for spinal block like patient refusal, coagulopathy, bleeding disorders, valvular heart diseases, fever/pyrexia, backache, infection or spinal deformity.
- Contraindications for using Phenylephrine, Noradrenaline, Opioids or NSAIDS (Allergic reactions/hypersensitivity).
- Patients having autoimmune disorders like Rheumatoid Arthritis (RA), Multiple Sclerosis, Amyotrophic Lateral Sclerosis (AML) or Myasthenia Gravis, Chronic post-surgical pain (CPSP), Fibromyalgia, Polymyalgia rheumatic, Filed Back Surgery Syndrome (FBSS) or having red/yellow flags of pain.
- Patients either having Psychiatric/Movement disorders like Anxiety, Depression, Mania, Schizophrenia, Delirium, Parkinsonism, Epilepsy or taking on Antidepressants, anti-psychotics, anxiolytics or antiepileptic.
- Morbid Obesity (BMI > 35 with Co-Morbid or BMI>40), Obstructive Sleep Apnea or use of BiPAP/CPAP.
- Patient refusal for participation on the study

Baseline Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DSB), Mean arterial pressure (MAP) and heart rate (HR) were recorded in pre-delivery room. Group A received Phenylephrine 100mcg and Group B received Noradrenaline 8mcg intravenously whenever systolic blood pressure was 20% lower than baseline with relevant tachycardia.

In 10-ml syringe either phenylephrine with concentration of 100mcg/ml or noradrenaline of concentration 8 mcg/ml was prepared. Co-loading of Ringer's lactate at the rate of 10ml/kg over 10 minutes, up to 1L maximum was done and

then reduced to 1ml/kg/hr. Under strict asepsis, lumbar puncture was performed in the sitting position with a 25-gauge Quinckes spinal needle, Injection 0.5% hyperbaric bupivacaine 2.3 ml (Heavy Marcaine) was given over 15 seconds after confirmation of needle placement. Patients were positioned to supine with wedge under right hip and the time was recorded as "time-zero". SBP, DBP, MAP, HR, and pulse oximetry were assessed every 2-minute for 20 minutes and thereafter every 5 minutes till the end of surgery. Upper sensory level was assessed by loss of pinprick sensation every 5 minutes till 20 minutes. Surgery was allowed as soon as upper sensory level reaches T4. Motor block was assessed according to Modified Bromage Scale. Hypotension was defined as decrease in SBP by 20% from baseline value. Phenylephrine or noradrenaline bolus 1ml was administered manually according to the group allocation by the anesthesiologist every time the SBP was 20% lower than baseline with relevant tachycardia. Inj. Ephedrine 10 mg was given IV if SBP remained 20% lower than baseline for 2 consecutive readings taken 2 minutes apart despite use of the study drugs, irrespective of the heart rate. Bradycardia was defined as an HR <50/min and was treated with inj. atropine 0.6mg. Following delivery of the baby, 5 international units (IU) of oxytocin was administered over 15 seconds. APGAR score of the neonate was noted at 1 minute and 5 minutes. SPSS version 17.0 was used to analyze the data.

## 3. Results

The incidence of hypotension in group A was comparable to group B and was not statistically significant ($p>0.05$). The incidence of bradycardia, atropine and Ephedrine use in group A was significantly higher than in group B and was statistically significant ($p <0.05$). There was no difference in APGAR scores between the two groups.

**Table 1** Baseline parameters of all study participants

| Parameter | Group A (Phenylephrine) | Group B (Noradrenaline) |
|---|---|---|
| Age | 27.4± 4.3 Years | 26.8± 5.5 Years |
| Weight | 67.2± 10.5 KG | 70.1± 8.3 KG |
| Height | 1.55± 0.11 Met | 1.54± 0.20 Met |
| BMI | 28.3± 3.4 Kg/m2 | 27.2± 4.1 Kg/m2 |
| Duration of Surgery | 53.3± 5.5 Min | 50.8± 7.1 Min |

**Table 2** Comparison of the two groups

| Parameters | Group A (Phenylephrine) | Group B (Noradrenaline) | P-Value |
|---|---|---|---|
| Hypotension % | 66.25% (53/80) | 68.75% (55/80) | NS |
| Bradycardia % | 41.2% (33/80) | 6.25% (5/80) | S |
| Atropine (Requirement)% | 18.75% (15/80) | 2.5% (2/80) | S |
| Ephedrine (Requirement)% | 23.75% (19/80) | 3.75% (3/80) | S |
| APGAR @ 1 Minute | 8.2 | 8.4 | NS |

NS- Non Significant, S- Significant

## 4. Discussion

The incidence of hypotension and the two vasoactive agents we used were comparable. We found that compared with noradrenaline, phenylephrine had a greater probability of causing maternal bradycardia. This phenomenon was mainly due to the α-adrenergic activity of phenylephrine, which may produce reflex maternal bradycardia. Noradrenaline has β receptor agonist activity that counteracts the negative effect of α-receptor activation on heart rate.

There have been many studies on the effects of vasopressors on fetuses and neonates, most of which have focused on changes in the pH of umbilical arterial blood. A randomized controlled study conducted by Mohta et al. confirmed that there was no statistically significant difference in the primary outcome measure of umbilical artery pH following the administration of either phenylephrine or noradrenaline for the treatment of spinal anesthesia-induced hypotension at caesarean section. Although many hospitals use ephedrine as rescue medication for spinal induced hypotension,

however, ephedrine is not the preferred recommendation for use before fetal delivery due to its potential to cause fetal acidosis. Our study focuses on the effects of phenylephrine or noradrenaline, which are now commonly used in clinical practice, on fetal circulation.

Comparable doses of phenylephrine or noradrenaline has similar effects on fetal heart rate and cardiac output changes after spinal anesthesia. Neither phenylephrine nor noradrenaline has meaningful detrimental effects on fetal circulation or neonatal outcomes.

## 5. Conclusion

Intermittent boluses of noradrenaline are effective in the management of spinal-induced hypotension during cesarean delivery. Intermittent IV bolus of noradrenaline results in reduced incidence of bradycardia as compared to intermittent IV bolus of phenylephrine while treating spinal-induced hypotension during cesarean delivery.

## Compliance with ethical standards

### *Disclosure of conflict of interest*

There is no conflict of interests and there is nothing to declare.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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