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Original Research Article

A Study on Coadministration of Different Doses of Phenylephrine with Oxytocin Effect in Oxytocin-induced Hypotension in Caesarean Section Under Spinal Anaesthesia

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Abstract

Introduction: Postpartum hemorrhage (PPH) from uterine atony is a leading cause of maternal mortality. Oxytocin, while effective in reducing PPH, can cause hypotension during caesarean sections under spinal anesthesia. This study investigates the optimal dose of phenylephrine, an α1-adrenergic agonist, to counteract oxytocin-induced hypotension, enhancing maternal hemodynamic stability.

Methods: This prospective randomized study at Government Medical College, Rajamahendrawaram included parturients for caesarean sections. Patients were randomized to receive oxytocin with either 50 mcg or 75 mcg phenylephrine infusions. Baseline measurements, subarachnoid block, and postoperative monitoring were conducted. Uterine tone, neonatal APGAR scores, and adverse effects were recorded.

Results: Total 100 members were included, 50 each group. Statistically there was no significance difference between the groups in age, mean height, mean weight, duration of SC, baby extraction time. Whereas there was significant difference between groups in hypotension and mean blood parameters.

Conclusion: This study suggests that phenylephrine, when co-administered with oxytocin during caesarean sections, effectively stabilizes maternal hemodynamics, reducing hypotension without significant adverse effects. Optimal dosing of phenylephrine can enhance maternal safety by maintaining blood pressure and uterine tone, providing a valuable protocol for managing oxytocin-induced hypotension in obstetric anesthesia.

Keywords: Oxytocin-induced hypotension, Phenylephrine dosage, hemodynamics, caesarean section, anesthesia

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Introduction

Postpartum hemorrhage (PPH), often resulting from uterine atony, is a major contributor to maternal mortality worldwide. Uterotonic agents like oxytocin play a critical role in reducing PPH, with prophylactic use decreasing its incidence by up to 40%. However, oxytocin can induce hypotension and reflex tachycardia due to its effects on vascular and cardiac receptors. [1, 2] This hypotension is particularly concerning during caesarean sections under spinal anaesthesia (SA), which predisposes patients to further blood pressure drops. To counteract these effects, vasopressors such as phenylephrine, a short-acting α1-adrenergic agonist, are administered, as they provide rapid blood pressure control with fewer side effects compared to agents like ephedrine. [3]

Phenylephrine can be given as a bolus or infusion to offset the drop in systemic vascular resistance (SVR) and stabilize heart rate, thus mitigating the impact of oxytocin on cardiac output. [4] However, higher doses of phenylephrine may lead to reflex bradycardia and reduced cardiac output, underscoring the need for accurate dosing and careful monitoring. [4, 5] Despite phenylephrine's utility, there is limited guidance on the minimum effective dose to prevent oxytocin-induced hypotension without adverse effects.

This study aims to identify the optimal dose of phenylephrine that stabilizes hemodynamics during oxytocin administration in caesarean sections. By exploring different dosages, the research seeks to establish a dosing protocol that maintains maternal hemodynamic stability while minimizing risks, ultimately enhancing the safety of obstetric care.

Methods

It was a prospective randomized study conducted in the department of Anaesthesiology, Government Medical College, Rajamahendrawaram. Study was conducted over a period of 01 month, from 01 to 30 September 2024. The study protocol was approved by the institutional Ethics committee.

Inclusion Criteria: include parturient over 18 years with singleton pregnancy, BMI <30 kg/m², ASA grades I-II, Mallampati grades I-II, for elective or emergency caesareans.

Exclusion Criteria: include difficult airway, history of seizures, severe systemic diseases, allergies to anesthetics, high atony risk, short stature (<150 cm), and significant pre-infusion hypotension.

Patients were briefed in their own language about the study's purpose and methods, providing written informed consent. Detailed histories, physical exams, and investigations (hemoglobin, blood sugar, renal function, and ECG) were documented for each patient. Randomized via computer-generated numbers, patients were assigned to Group A or B. Group A patients received oxytocin 3U and phenylephrine 50 mcg diluted to 10cc with normal saline as an infusion over 5 min; while group B patients received oxytocin 3U and phenylephrine 75 mcg diluted to 10cc infusion over 5 min**.** All participants were kept nil orally for 8 hours pre-surgery and received IV metoclopramide and ranitidine on the morning of surgery. In the operating room, an 18-gauge cannula was secured, IV fluids initiated, and baseline measurements (HR, BP, and oxygen saturation) recorded.

A subarachnoid block (SAB) was administered at the L3-L4/L4-L5 space using a 25G needle, with 9 mg of 0.5% hyperbaric bupivacaine, followed by supine positioning with a left uterine tilt. Oxygen was given via a face mask at 4 L/min, and fluids infused at 200 mL/10 min. Patients in Group A received oxytocin 3U and phenylephrine 50 mcg (10 mL over 5 min), while Group B received 3U oxytocin and 75 mcg phenylephrine, using a syringe pump.

Uterine tone was assessed by obstetricians at closure; inadequate contractions were treated with methylergometrine or prostaglandin F2α. Hypotension was defined as a >20% MAP drop and treated with fluids or phenylephrine, with ephedrine as a backup. Neonatal APGAR scores, adverse effects, and postoperative monitoring were documented.

Statistical Analysis

The data were analysed using SPSS version 22, presented in mean +-SD, absolute numbers and percentage. Demographic variables were analysed using Chi square tests. Primary and secondary variables with ANOVA tests. $P<0.05$ is considered to be statistically significant.

Results

Total 100 members were included, 50 each group. Statistically there was no significance difference between the groups in age, mean height, mean weight, duration of SC, baby extraction time. Whereas there was significant difference between groups in hypotension and mean blood parameters.

Discussion

The study aimed to compare the efficacy of different doses of phenylephrine in controlling oxytocin-induced hypotension during cesarean sections under spinal anesthesia. A total of 100 participants, randomized into two groups, received either 50 mcg or 75 mcg phenylephrine alongside oxytocin. Both groups were statistically comparable regarding demographics such as age, height, weight, and surgical duration. Significant findings emerged in the incidence of hypotension and mean blood parameters, underscoring the impact of varying phenylephrine doses on hemodynamic stability.

Patient characteristics including age, height, and weight were comparable between the groups, which aligns with prior studies emphasizing the importance of matching baseline demographics to ensure the validity of intergroup comparisons. [6] The similarity in baby extraction times and the surgical duration between groups further suggests that any observed hemodynamic differences were likely due to the phenylephrine dosing rather than procedural variations. [7]

Hypotension is a well-known complication of spinal anesthesia during cesarean sections, exacerbated by oxytocin's vasodilatory effects. Phenylephrine, an alpha-adrenergic agonist, effectively mitigates hypotension by increasing vascular resistance. [7] This study demonstrated a significant reduction in the incidence of hypotension in the 75 mcg group compared to the 50 mcg group. This finding supports previous research indicating a dose-dependent response of phenylephrine in preventing hypotension during cesarean sections under spinal anesthesia. [8] A study by Cooper et al. [9] similarly found that higher doses of phenylephrine maintained systolic blood pressure more effectively during cesarean sections, though the risk of reflex bradycardia increased at higher doses.

The significant difference observed in mean blood parameters between the groups likely reflects the greater hemodynamic stability afforded by the 75-mcg dose of phenylephrine. This dose may have helped counteract the effects of oxytocin on systemic vascular resistance, resulting in more stable mean arterial pressure and heart rate. [10] Studies show that phenylephrine's effects on vascular resistance and heart rate are dose-

dependent, with higher doses potentially leading to reflex bradycardia due to rapid vascular constriction. [11] In the present study, while bradycardia incidence was not significantly different, the hemodynamic stability in the higher-dose group aligns with previous findings that phenylephrine at doses of 75 mcg and above can effectively maintain blood pressure without excessive adverse effects. [12]

These findings have important clinical implications, particularly for managing maternal hypotension without increasing the risk of adverse effects such as bradycardia or reduced uterine perfusion. The relatively low incidence of hypotension in the 75-mcg group suggests that a moderate increase in phenylephrine dosage can offer improved hemodynamic control in this context. However, previous research has also highlighted the risk of reflex bradycardia and reduced cardiac output at high doses. [13] It is crucial for clinicians to carefully titrate phenylephrine doses, particularly in patients with preexisting cardiovascular concerns, to avoid unintended hemodynamic responses.

This study's limitations include a relatively small sample size and the lack of long-term follow-up on maternal and fetal outcomes. Further research with larger cohorts and diverse populations is warranted to confirm these findings and explore the potential for personalized dosing strategies based on patient-specific factors such as baseline cardiovascular health and anesthesia response. [13, 14]. Additionally, studies examining alternative vasopressors or combination therapies could yield further insights into optimizing maternal hemodynamic stability during cesarean sections under spinal anesthesia.

The study highlights the importance of dosing in phenylephrine's effectiveness against oxytocin-induced hypotension during cesarean sections under spinal anesthesia. The 75 mcg dose offered superior hemodynamic stability without significant adverse effects, indicating that slightly higher doses of phenylephrine may be more effective in preventing hypotension compared to lower doses. This information can guide anesthesiologists in selecting appropriate vasopressor doses, ultimately enhancing maternal safety and improving surgical outcomes in cesarean deliveries.

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