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ROLE OF INTRAMUSCULAR GLYCOPYRROLATE IN PREVENTING HYPOTENSION AFTER SUBARACHNOID BLOCK IN ELDERLY PATIENTS

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Abstract

Post-subarachnoid block (SAB) hypotension presents itself as a major challenge in the perioperative setting of elderly patients because there is an evolution in cardiovascular alterations and disorders related to age. Glycopyrrolate, a manmade medicine that has anticholinergic effects, may reduce the bradycardia and vasodilation caused by SAB because of its vagolytic actions, thereby possibly preventing hypotension. The study was a randomized, double-blind, placebo-controlled trial that also evaluated the effect of intramuscular glycopyrrolate in alleviating hypotension among patients 70 years old and up who underwent surgery in the lower limbs under SAB. Ninety patients between the ages of 65-85 years were randomly allocated to either receive glycopyrrolate 0.2 mg intramuscularly 15 minutes before SAB (Group G, n=45), or equivalent volume saline (Group S, n=45). The hemodynamics were noted at baseline; following the SAB introduction of 0.5% combined bupivacaine at L3-L4, blood pressure and the rate of heartbeat were observed. Hypotension was characterized by the decrease in MAP by >25 of baseline values or a systolic BP <90 mmHg. In the event of hypotension, mephentermine it was administered Group G experienced far fewer events of hypotension (13% vs. 42%, $p<0.01$), and less vasopressor (3 +/ -1 mg vs. 8 +/- 2 mg, $p<0.001$) was used and maintained better hemodynamics. There was no observed adverse anticholinergic effects The IM active glycopyrrolate seems to be safe and effective in the reduction of hypotension in the aged patients during SAB.

Keywords: Glycopyrrolate, hypotension, subarachnoid block, elderly, vasopressor

Introduction

Subarachnoid block (SAB) is a very frequently used regional technique of anaesthesia during lower-limb surgery. It offers the benefit of fast-acting, high densities of sensory and motor sensory block along with a low rate of postoperative complications as compared to general anesthesia, particularly when used in elderly patients (1,2). Nevertheless, SAB may cause severe hypotension because of the sympathetic blockade and peripheral vasodilation (3).

Post-SAB hypotension is especially threatening to elderly patients. This predisposition is attributed to age related loss in cardiovascular autonomic responsiveness, decreased baroreceptor sensitivity, and loss of myocardium compliance (4,5). Rates of hypotension in older patients undergoing SAB vary between 30 and 55 percent (6,7). In its lack of treatment, hypotension may result in significant complications, including heart ischemia, brain vascular anemia, and kidney hypoperfusion (8).

Preloading or coloading with crystalloids, elevation of legs, and prophylactic vasopressor (phenylephrine or ephedrine) are all traditional

preventive steps (9,10). These, however, have limitations, such as the risk of volume overload in a patient with poor cardiac reserve in the case of fluid loading, and arrhythmias, tachycardia, and rebound hypertension in the case of vasopressors (11).

Glycopyrrolate is one of the quaternary ammonium anticholinergics with little penetration of the central nervous system. It blocks muscarinic receptors and has vagolytic properties that increase the heart rate, and overcome parasympathetic overactivity (12,13). It has been proposed as a possible means of preventing SAB-induced hypotension and is commonly employed to treat bradycardia during an operation (14). Its long acting nature and good safety status makes it have the potential of being used in premedication of elderly patients.

Few studies have investigated the prophylactic intramuscular administration of glycopyrrolate to prevent SAB-induced hypotension, especially in the surgical elderly population. Available literature is mainly on intravenous use or prevention of bradycardia (15). The aim of the study is to investigate the possibility of intramuscular glycopyrrolate to lower the occurrence of hypotension and vasopressor requirements in this high-risk population.

Aim

To evaluate the efficacy of intramuscular glycopyrrolate in preventing hypotension following subarachnoid block in elderly patients.

Objectives

1. To compare the incidence of hypotension (MAP drop >25% or systolic BP <90 mmHg) post-SAB between glycopyrrolate and placebo groups.
2. To assess the requirement and total dose of vasopressor (mephentermine) rescue in both groups during the first 60 minutes post-SAB.

Methodology

Study Design and Place

This will be prospective, randomized, double-blind, placebo-controlled clinical trial, which will be done in Department of Anaesthesiology, tertiary care hospital,

Inclusion Criteria

Subjects Ages 65-85 years

ASA physical status I–III.

Lower-limb surgery that is purely elective by SAB

Exclusion Criteria

Allergy to glycopyrrolate/ bupivacaine

Uncontrolled hypertension, exciting arrhythmia or advanced cardiac disease

Autonomic neuropathy

Use of anticholinergics(Current)

Cognitive incapacity or incompetence to consent

Blinding and randomization

By use of computer-generated random numbers patients were randomized into two groups as follows: (Group G; glycopyrrolate 0.2 mg IM) and (Group S; normal saline IM) injected 15 minutes prior to SAB. The observer and the anaesthesiologist who conducted the SAB were blinded with regard to the group allocation.

Procedure

SAB was made with 0.5 percent hyperbaric bupivacaine 2.5 mL at L3-L4. Sensory blockage had been established at T10. Baseline and every 2 minutes during the first 20 minutes and every 5 minutes during 60 minutes, hemodynamic parameters were obtained. Hypotension was considered as the decrease in MAP >25 percent or SBP <90 mmHg and treated with IV mephentermine 6 mg.

Statistical Analysis

The data analyzed were done through SPSS v25 Chi-square and t-tests were used where appropriate. $p<0.05$ was set as statistically significant.

Results

Table 1: Incidence of Hypotension and Vasopressor Use

Outcome	Group G (n=45)	Group S (n=45)	p-value
Hypotension incidence (%)	13%	42%	<0.01
Vasopressor use (%)	13%	42%	<0.01

Table 2: Mean Mephentermine Dose Used

Outcome	Group G (n=6)	Group S (n=19)	p-value
Mephentermine dose (mg ± SD)	3 ± 1	8 ± 2	<0.001

Group G experienced significantly fewer hypotensive episodes and lower vasopressor use. Only 6 patients in Group G required mephentermine compared to 19 in Group S. The mean dose required was significantly lower in the glycopyrrolate group, confirming its hemodynamic benefit.

Discussion

This research proves the effectiveness of glycopyrrolate as intramuscular use in the reduction of hypotension following SAB in the elderly population. Fewer patients in Group G had hypotension and required less use of vasopressors as predicted by the fact that glycopyrrolate stabilizes hemodynamics through vagal blockade (12,13).

Pathophysiology of the SAB-induced hypotension begins with a sympathetic blockade and causes vasodilation and venous pooling (3). These tendencies are even more marked in elderly patients as a result of the lowered vascular tone and baroreceptor sensitivity (4,5). Glycopyrrolate decreases para sympathetic tone and in turn, simulates the heart rate and cardiac output in countering the hypotension.

Our results correlate with those of previously published articles which noted a reduction in the use of bradycardia and hypotension with intravenous administration of glycopyrrolate prior to spinal anesthetic administration (14,15). Nevertheless, intramuscular route has a slower onset and less hectic hemodynamics, which are used prior to SAB administration (13).

The extreme decrease of hypotention (42% to 13%) points at a good prophylactic effect. There was also less need of mephentermine with a lower dosage on those who needed it further supporting the stabilization process with a vascular tone by glycopyrrolate.

Vasopressors, such as phenylephrine and ephedrine, are effective but their use may trigger reflex bradycardia or tachycardia, which is potentially undesirable in an elderly patient with only limited cardiac reserve (10,11). Glycopyrrolate has negligible CNS-penetration and long duration of action offering a safe alternative with the twofold advantage of preventing bradycardia and attenuating hypotension (12).

Of comfort in our study was the safety profile. None of the patients experienced excessive tachycardia (>120 bpm), xerostomia, urinary retention, or blurred or altering vision, which are possible side effects of anticholinergics (13).

Weaknesses are the single-centric study design and the small sample size. Although relevant differences were detected, a multicertain trial of greater magnitude would provide more power. We also assumed an observation time of 60 minutes after SAB; more time might be warranted to capture a delayed hemodynamic event. The potential of glycopyrrolate in preventing post-surgery complications such as delirium (associated with hypotension) is also to be investigated. In conclusion, intramuscular glycopyrrolate offers a low-risk, effective strategy to prevent SAB-induced hypotension in elderly patients undergoing lower-limb surgery. It may be especially valuable where fluid preloading is limited or vasopressors are contraindicated.

Conclusion

Intramuscular glycopyrrolate (0.2 mg) administered 15 minutes before spinal anesthesia significantly reduced the incidence of

hypotension and vasopressor use in elderly patients undergoing lower-limb surgery. It provided hemodynamic stability without notable side effects, making it a practical and effective strategy for perioperative management. Future research should expand on these findings in larger, multicenter trials to validate optimal dosing and long-term outcomes.

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