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Research Article

To evaluate effects of combination of topical 5% Phenylephrine and 0.8% Tropicamide on Pulse Rate and Blood Pressure

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ABSTRACT

Background: Dilation of pupil in Ophthalmic OPD is a routine procedure. Whether a sympathomimetic agent like phenylephrine should be used in hypertensive patients is still a question to be answered. This study tries to resolve the issue.

Objective: To evaluate cardiovascular effects of combination of topical 5% phenylephrine and 0.8% Tropicamide.

Method: Total 150 patients were subjected for this study (male and female) between 30-80 years of age. Combination of 5% phenylephrine and 0.8% tropicamide eye drops was instilled at an interval of 15 minutes thrice in the eyes of each patient. Any change in BP or HR was recorded

Result: The data was collected and subjected to appropriate statistical method using R software version 4.2.1. This study has shown no significant increase in Blood Pressure and Heart Rate after instillation of 5% Phenylephrine and 0.8% Tropicamide eye drops except in one case.

Conclusion: We conclude that combination of 5% Phenylephrine and 0.8% Tropicamide can be safely used in all patients who come for ocular examination but precautionary measures should be taken in hypertensive patients.

Keywords: Pulse rate; Blood pressure; Tropicamide; Phenylephrine

INTRODUCTION

Pupil dilatation is a routine procedure in outdoor patient department of any ophthalmic center. Dilated pupil gives us better access to examine structures of eyeball like crystalline lens and fundus thus helps achieve better diagnostic and curative outcomes. Pupil dilatation is also done before cataract surgery, insertion of Intra ocular lens and for breaking posterior synechiae in patients of uveitis.[1,2]

Phenylephrine hydrochloride is the levo-isomer of 3- hydroxyphenyl – ethanol - methylamine and a sympathomimetic drug. [1] It differs chemically from epinephrine by absence of hydroxyl group in the position 4 of benzene ring. It is also used as a decongestant. It causes mydriasis without cycloplegia as it has no effect on ciliary muscles[1].It acts mainly on the alpha-adrenergic receptors with minimal effects on the beta-receptors. Phenylephrine is a sympathetic agonist that has a direct effect on nerve receptors, mainly located on the pupillary dilator muscles. Its peripheral alpha effects result in peripheral vasoconstriction[3-6].

Phenylephrine stimulates the release of norepinephrine.[7,8,9] It is contraindicated in patients of acute pulmonary oedema, fatal subarachnoid hemorrhage, syncope, myocardial infarction, tachycardia, arrhythmia, hypertension and history of cardiovascular disease[1-4.] It must be used with caution in case of angle-closure glaucoma[5] and shallow AC as it can precipitate an acute attack. Its side effects also include allergic reactions, photophobia, headache, fainting, trembling and pallor[6,7]. Tropicamide is a muscarinic receptor antagonist and belongs to the class of anticholinergics. It is used to induce mydriasis with mild cycloplegia.[4]

Tropicamide is a muscarinic receptor antagonist and belongs to the class of anticholinergics. It is used to induce mydriasis with mild cycloplegia. It is contraindicated in patients with allergic reactions, narrow angle glaucoma, and shallow AC.[4,8]

Phenylephrine is a sympathetic agonist that has a direct effect on nerve receptors, mainly located on the pupillary dilator muscles. It mainly acts on alpha-1 receptors and there is no effect of phenylephrine on beta receptors.

In a study conducted by Ahmet et all, single puff of

1% tropicamide spray was used to compare its efficacy with 1% tropicamide eye drops. It was observed that instillation of tropicamide eye drops was easier in adults but difficult in children and elderly patients who have hand, tremors, neck rigidity and poor vision. The alternatives in form of tropicamide spray can be considered to avoid all these difficulties.

It is noticed that combination of Phenylephrine and tropicamide eye drops gives better mydriasis. Tropicamide is the safest parasympatholytic drug and Phenylephrine is commercially available sympathomimetic drug which is used to achieve pupil dilation for ROP screening.[10-16]

AIMS AND OBJECTIVES

To evaluate effects of combination of topical 5% Phenylephrine and 0.8% Tropicamide on Blood Pressure and Pulse Rate.

REVIEW OF LITERATURE

KW Chin et al conducted prospective double-blind study on 89 consecutive patients and concluded that both 2.5% and 10% phenylephrine solution can cause cardiovascular stimulation. Blood Pressure readings were significantly higher in normotensive patients as compared to hypertensive patients in response to 2.5% and 10% phenylephrine to the extent that 10.3% of the 10 % phenylephrine group and 3% of the 2.5% phenylephrine group needed intra operative hypotensive drugs to control blood pressure. This study concluded that 2.5% phenylephrine seems to be as capable of causing a rise in BP as 10% phenylephrine. [3]

A.K. Adediji et al conducted a study on 137 patients and concluded that diagnostic mydriasis has the ability to cause both ocular and systemic effects and 2.5% phenylephrine can safely be used for diagnostic mydriasis in normal patients and also in patients with well controlled hypertension. [2]

R. Malhotra et al included 54 patients in the study and concluded that there was no difference in systemic cardiovascular effects of either 2.5% or the 10% concentration of phenylephrine. In addition, there was no sustained changes in blood pressure after instillation of either concentration of phenylephrine. [8]

Bethany et al conducted a meta-analysis on 916 patients and concluded that 2.5% phenylephrine causes no clinically relevant changes in BP and HR whereas the changes seen in BP and HR with 10% phenylephrine were short lived. Thus, 2.5% phenylephrine was found to be safe in clinical practice. [4]

Jelena Škunca et al performed a prospective, randomized, double blind study on 49 patients, 27 males and 22 females and divided the patients in 2 groups (experimental and control). A combination of 1% tropicamide and 10% phenylephrine was used to dilate the pupil for cataract surgery. It was concluded that there was no statistically significant difference between the experimental and control group with respect to the drug on BP and HR. [6]

Jacob et al presented a case report in which a 76 years old man became confused and agitated after instillation of 10% phenylephrine and intra vascular hydralazine had to be used to bring the blood pressure down. [5]

Jagdish Bhatia et al conducted a study on 55 normotensive patients and 34 hypertensive patients and concluded that there was a mild to moderate rise in BP in very few patients, large percentage of patients from both groups showed no effect on Blood Pressure. There were no untoward side–effects observed by them in any of their patients. [1]

S Samantary et al performed a study on 60 patients and concluded that there was a definite rise in systolic and diastolic blood pressure after instillation of 10% phenylephrine in all of their cases. It was associated with fall in heart rate in all the patients. The rise in blood pressure was due to peripheral vasoconstriction and not due to myocardial stimulation. The fall in heart rate was due to reflex bradycardia. [7]

Jitendra et all performed a study on 30 patients and concluded that there was no significant change in blood pressure and heart rate in both the groups who were given single drop of 0.8% tropicamide and 5% phenylephrine eye drops in both the groups of single as well as multiple application of the same drop. [19]

Yosanan et all conducted a study on two groups of patient group 1 (293 patients) group 2 (271 patients). Patients in group 1 received 1% tropicamide and 10% phenylephrine whereas patients in group 2 received 1% tropicamide and 2.5 % phenylephrine. Blood pressure and heart rate was measured before and after instillation of eye drops and there were no significant changes in blood pressure and heart rate in both the groups. [17]

Adisak et all conducted a study on 40 patients aged between 35 to 75 years with ± SD OF 57.3 ±10.9 years. They included 58% female and 40% patients were diabetics. They concluded that there were no significant changes in blood pressure and pulse rate before and after instillation. [18]

Sikander et all conducted a study on 517 patients who were given 0.8% tropicamide and 5% phenylephrine before undergoing cataract surgery. They concluded that there were no untoward cardiovascular effects seen. The authors

have shown in the study that the difference between baseline and final readings of blood pressure and heart rate were statistically significant but not significant clinically. [13]

MATERIALS AND METHOD

It was a prospective and hospital-based study, carried out for a period of 6 months after the approval of Institutional and Ethics Committee of the Hospital. The study was conducted on 150 patients aged between 30-80 years (male and female) who came for detailed ocular examination in the hospital.

Patients with severe hypertension (180/120 mm of Hg) and known history of cardiovascular disease (myocardial infarction, aortic aneurysm, stroke, acute pulmonary edema, subarachnoid hemorrhage) were excluded from the study. Patients giving any history of allergic reaction to Tropicamide or Phenylephrine were also not considered for the study.

Procedure

- All patients who visited Outdoor Patient Department of Ophthalmology of the Hospital due to any ocular symptoms, underwent preliminary examination by Optometrist followed by expert opinion of an Ophthalmologist. Patients who were advised dilatation of pupil for one or the other reason were made aware of the study and those who were willing to participate, were requested to sign the consent form and included in the study keeping in mind the inclusion and exclusion criteria.
- Patient was asked to sit comfortably on chair for 15 minutes so that the Cardiovascular Parameters came to baseline. Patient's Blood Pressure and Pulse Rate (Heart Rate) was measured with Medi Vision BP Apparatus and pulse oximeter was applied on middle finger on left hand. The Parameters were recorded.
- Combination of 5% Phenylephrine and 0.8% Tropicamide eye drops were instilled in both the eyes the of patient three times at an interval of 15 minutes. BP and HR were recorded 15 minutes after putting the eye drops for the third time. These post mydriasis parameters were compared with pre mydriasis parameters.

STATISTICAL ANALYSIS

Table 1: Distribution of study participants according to their demographic variables.

Gender	No	Percentage
Male	60	40.0%
Female	90	60.0%
Age Group		
30-50 Years	53	35.0%
50-70 Years	69	46.0%
More than 70 Years	28	19.0%
Age (Mean ± SD)	54.55 ± 14.71	

In the present study, table 1 shows the distribution of demographic variable having the ratio of men and women of 2:3 in which 60% were female and 40% were male. According to the age group 30-50 years covers 53 patients, 69 patients under the category of 50-70 years and equal and more than 70 years had the least number of patients. The mean age was found to be 54.55 years with 14.71 years of standard deviation.

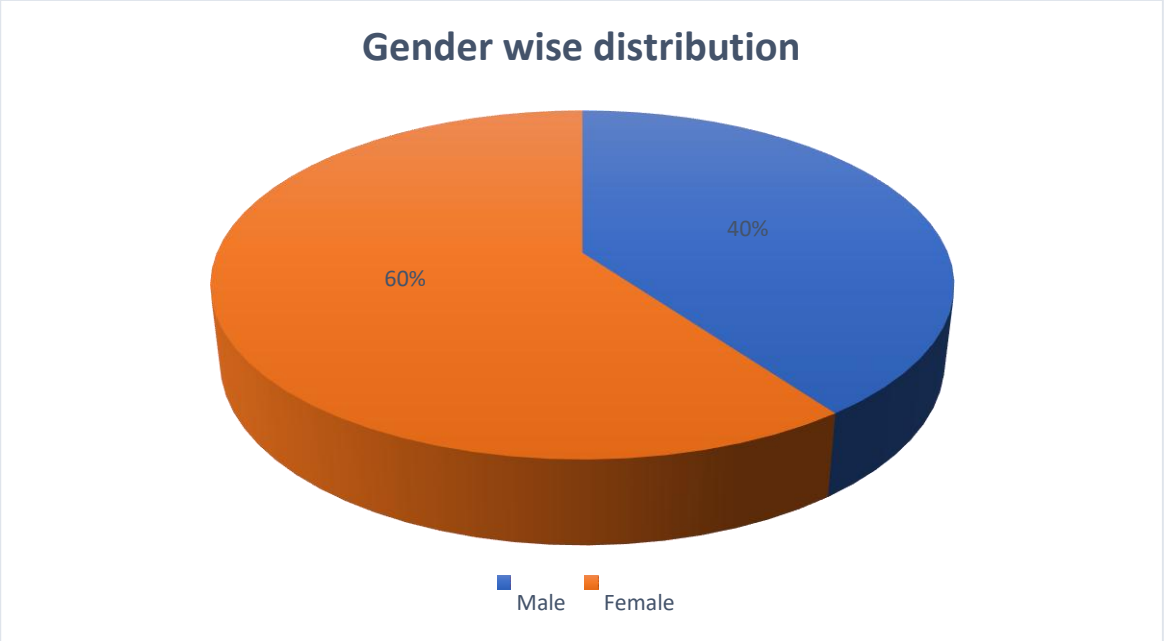

Fig.1: Gender wise distribution

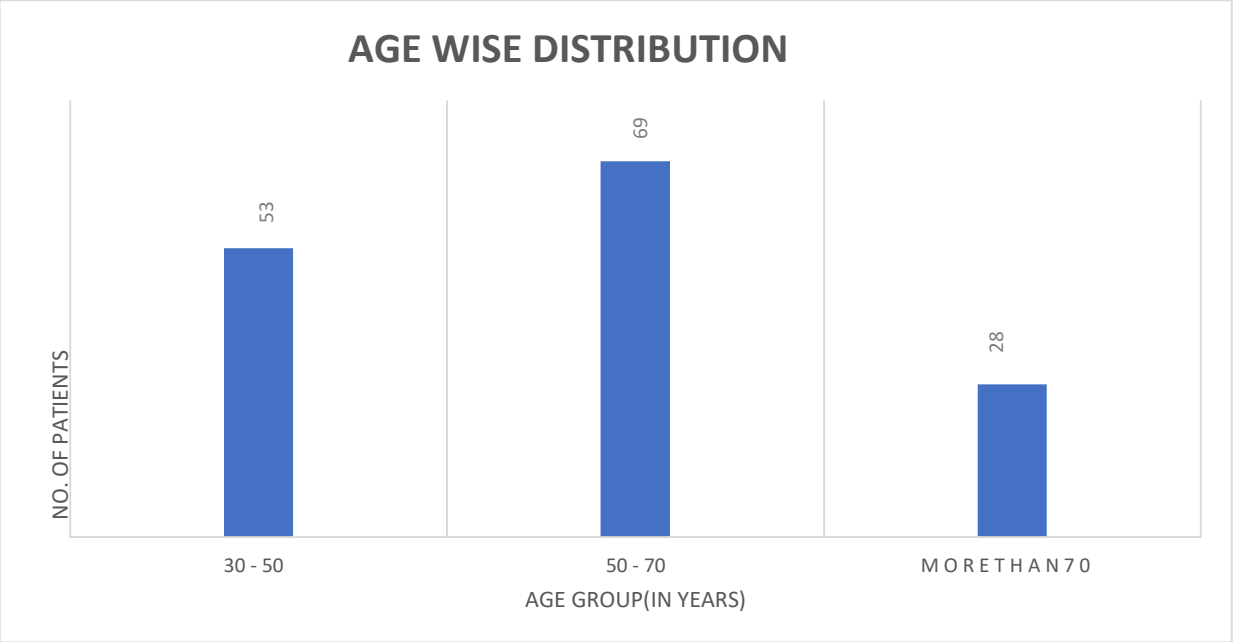

Fig.2: Age wise distribution

Table 2: Distribution of study subjects according to their blood pressure.

Blood Pressure	Mean	Std. Deviation	t-value	p-value
SBP Pre	124.07	11.42	0.657	0.512^{NS}
SBP Post	124.53	11.33		
DBP Pre	79.70	9.24		
DBP Post	79.86	9.04	0.297	0.767^{NS}

In our study, table 2 describes the blood pressure of the study subjects having pre and post intervention.

According to the systolic blood pressure, the pre mean value was 124.07 with 11.42 SD, similarly for post-test it was found to be 124.53 with 11.33 SD. There was no significant change in systolic blood pressure (p value 0.512)

For diastolic blood pressure, the pre & post-test mean value was 79.70 and 79.86 respectively. Student's t-test (Paired) was applied for comparison of pre-post-test and the results were insignificant at 0.05 level of significance. (p value 0.767)

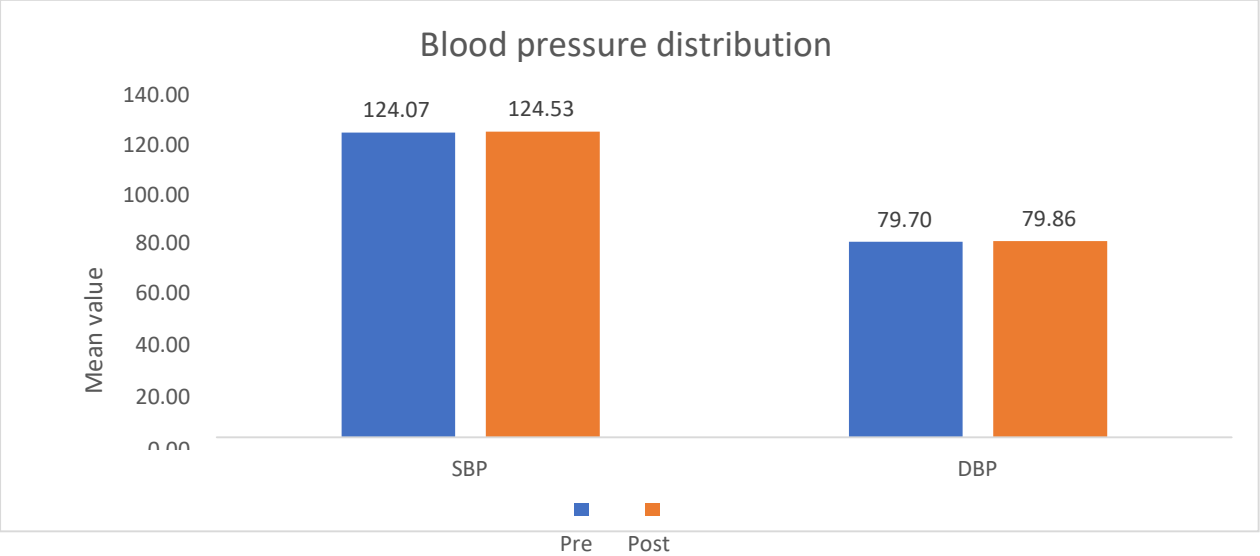

Fig.3: Distribution of study subjects according to their blood pressure

Table 3: Distribution of study subjects according to their heart rate.

Heart rate	Mean	Std. Deviation	t-value	p-value
Pre	82.92	11.23	0.812	0.418^{NS}
Post	83.59	10.38		

According to the table.3. it shows comparison of heart rate by pre and post-test, the pre mean value of heart rate was 82.92 with 11.23 standard deviation, similarly for post-test the mean heart rate was 83.59 with 10.38 standard deviation. Student's t-test (Paired) was applied and the t-value 0.812 was insignificant at 0.05 level of significance.

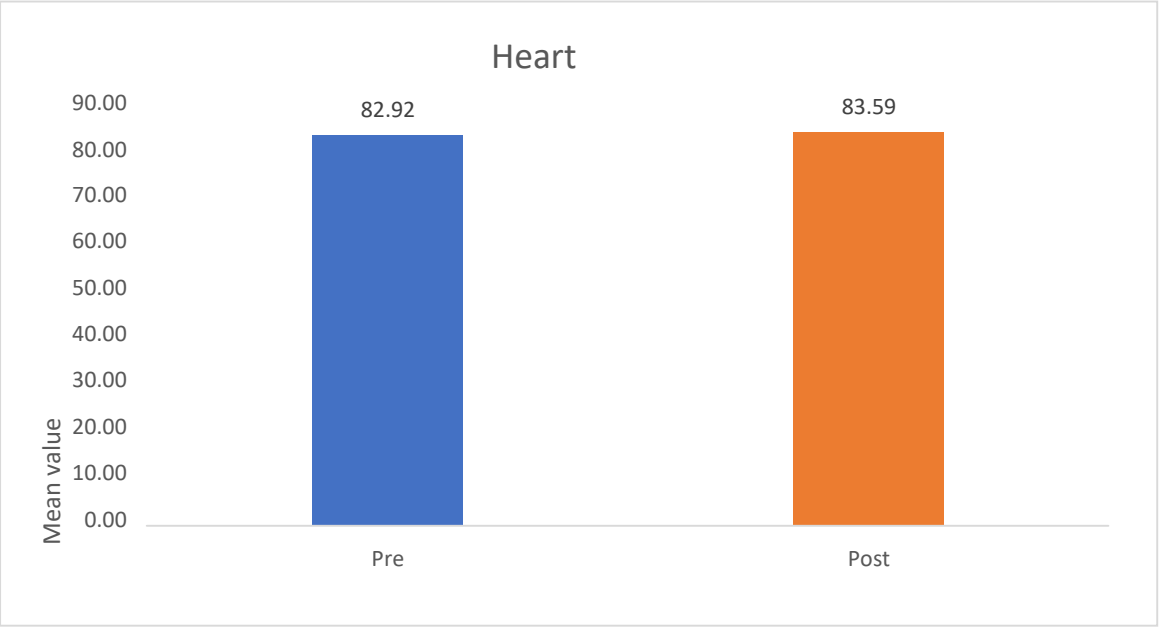

Fig.4: Distribution of study subjects according to their heart rate.

Table 4

SBP	Pre	Post	p-value
100-120 (Normotensive)	31	24	0.502^{NS}
120-140 (Normotensive)	95	104	
140 and above (Hypertensive)	24	22	

DBP	Pre	Post	p-value
60-80 (Normotensive)	41	41	0.607^{NS}
80-90 (Normotensive)	68	75	
90 & above (Hypertensive)	41	34	

RESULTS AND DISCUSSION

Total 150 patients, 90 female and 60 males in the age group of 30-80 years were subjected for the study with mean age of 54.55± 14.71 years. This study has shown no significant increase in Blood Pressure and Heart Rate after instillation of 5% phenylephrine and 0.8% tropicamide eye drops except in one case where blood pressure showed an increase from 160/110 mm of Hg to 180/110 mm of Hg. This is in accordance with many of the previous studies conducted by Jagdish et all [1], S Samantary et all[7], KW Chin et all [3]and R Malhotra et all [8]

Although phenylephrine is a sympathomimetic drug that causes rise in blood pressure and heart rate after parentral administration. But the amount of drug used in eye drops is very minimal and its systemic absorption is not enough to produce a significant rise in blood pressure or heart rate. This might be a reason for no significant change in BP and HR in our study.

In one patient where blood pressure had shown a rise from 160/110 mm of Hg to 180/110 mm of Hg can be explained either by sensitivity of the cardiovascular system of that patient towards phenylephrine or it might be an idiosyncratic reaction. This finding is in accordance with studies conducted by Jagdish et all [1]and S Samantary et all. [7]

We did not notice any fall in blood pressure and heart rate in any of our patients. This is contrary to studies conducted by AK Adediji [2], Jelena Skunca et all [6]

Side effects like occipital headache, palpitation, arrythmias or ischemic changes, trembling and excessive perspiration and chest discomfort were not noticed in any of our patients. This is in accordance with the findings reported by KW Chin et all [3]

Our observation supports studies conducted by R Malhotra et all [8] who reported that there was no significant change in blood pressure and heart rate after topical instillation of 5% phenylephrine and 0.8% tropicamide. Hence this drug can be safely administered in normotensive patients through topical route. However, in hypertensive patients the drug absorbed through conjunctival sac, anterior segment of eyeball (episcleral vessels and blood circulation of Iris) nasal and oral mucosa can cause some amount of rise in blood pressure and heart rate, hence should be used with caution.

We recommend that while using 5% phenylephrine with 0.8% tropicamide eye drops in hypertensive patients, the patients should be advised to keep his eyes closed and not to blink and should press the puncta of both eyes with the tip of his finger so that the drainage of drug into the nasal cavity becomes minimal and helps reduce the incidence of rise in blood pressure or heart rate.

CONCLUSION

It was concluded that there was no significant change in blood pressure or heart rate in 149 out of 150 patients. No untoward side effects were observed except for blurring of vision and photophobia. There was significant rise in blood pressure in one patient which might be due to over sensitivity of the patient towards drug or idiosyncratic reaction.

Thus, we conclude that combination of 5% phenylephrine and 0.8% tropicamide can be safely used in all patients who come for ocular examination but precautionary measures should be taken in hypertensive patients like occlusion of puncta for some time and asking the patient to keep the eyes closed.

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