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Research article

DEGREE AND ONSET OF MYDRIASIS CAUSED BY MYDRIATIC AGENTS WITH SPECIAL REFERENCE TO TOBACCO ADDICTION

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ABSTRACT

Introduction: The quality of an intra-ocular examination depends on adequate pupil dilation (mydriasis). Magnitude of dilation depends on sphincter and dilator muscles of pupil. Most frequently used drugs in ophthalmology for mydriasis are parasympathetic antagonists (Tropicamide), sympathetic agonist (Phenylephrine) and combination of Phenylephrine + Tropicamide. This study was planned to evaluate and compare onset and degree of mydriasis achieved by the above drugs and to study changes in the same in tobacco addicts. **Aim:** To evaluate and compare the onset and degree of mydriasis achieved by Tropicamide (1%), Phenylephrine(10%), Tropicamide (0.8%) +Phenylephrine (5%) combination. To compare the changes in onset and degree of Mydriasis in tobacco addicts. **Materials & Methods:** This is a descriptive cross sectional study carried out in the ophthalmology department of PRH, Loni. Total of 52 patients were enrolled for the study and grouped according to the mydriatics used into Group 1 (n=25) Tropicamide (1%), Group 2(n=18) Phenylephrine (10%) Group 3(n=20) Tropicamide (0.8%) + Phenylephrine (5%) combination and each group were evaluated for onset and degree of dilatation. Each group was further divided into tobacco and non-tobacco addicts. **Results & Conclusion:** The combination of Tropicamide (0.8%) and Phenylephrine (5%) have the fastest onset of mydriasis, and achieved the highest dilation in 60 min. as compared to Tropicamide (1%) and Phenylephrine (10%) alone. Tobacco addicts in each group were observed to have lesser magnitude of dilation than non tobacco addicts.

Keywords: Mydriasis, Degree and onset of mydriatic agents; Tobacco addicts, Tropicamide, Phenylephrine

INTRODUCTION

Mydriasis is the dilation of the pupil, usually defined as when having a non-physiological cause, but sometimes defined as potentially being a physiological pupillary response.^{1,2} The excitation of the radial fibres of the iris which increases the pupillary aperture is referred to as mydriasis. More generally, mydriasis also refers to the natural dilation of pupils, for instance in low light conditions or under sympathetic stimulation.²

A mydriatic ocular examination may be necessary to detect some eye diseases as it allows better

visualization of all structures posterior to the pupil and is necessary for examination of the peripheral ocular fundus. It is also necessary for examination techniques such as binocular indirect ophthalmoscopy and scleral indentation.³

The ideal mydriatic agent should show a rapid onset of action, achieve adequate mydriasis, permit a quick recovery and not cause discomfort or side effects. The quality of an intra-ocular examination depends on adequate pupil dilation.⁴ Magnitude of dilation depends on the sphincter muscle of the pupil,

controlled by parasympathetic nerves and on the dilator muscle of the pupil, controlled by sympathetic nerves.⁵

The most commonly used drugs include the parasympathetic antagonists like Atropine, Homatropine, Cyclopentolate, Tropicamide and sympathetic agonists like Phenylephrine. The parasympathetic antagonists act by contracting the iris sphincter muscle (circular muscles of the iris) producing passive mydriasis whereas the sympathetic agonists act by stimulating the iris dilator muscle resulting in active mydriasis.^{6, 7, 8} Atropine, Homatropine and Cyclopentolate produce mydriasis along with cycloplegia and have duration of action of 1-2 weeks, 2-3 days, and 24 hours respectively.⁶ Therefore, they are not suitable for routine refraction purposes. Tropicamide produces mydriasis within 20-40 minutes of instillation and (weak) cycloplegia maximal within 30 minutes. Both effects usually last up to 6 hours. It is available in 0.5% and 1% concentrations.³

Phenylephrine stimulates post-synaptic alpha receptors which constrict the dilator muscles, hence causing mydriasis.⁹ It causes mydriasis by affecting the iris dilator muscle. Maximal mydriasis occurs in 10-90 minutes with recovery after 5-7 hours without cycloplegia. It is available as 2.5% and 10% concentrations.³

Commonly used drugs in ophthalmology practice for mydriasis are Tropicamide (1%), Phenylephrine (10%), Tropicamide (0.8%) either alone or in combinations.

Taking into consideration the varied use of mydriatic agents for various ophthalmological examination it was thought prudent to evaluate and compare the degree of mydriasis produced by Tropicamide, Phenylephrine and their combination at the ophthalmology OPD of PRH, Loni, in terms of onset and degree of mydriasis and to study changes in the same in tobacco addicts.

AIM:

1. To evaluate the degree of mydriasis achieved by Tropicamide (1%), Phenylephrine (10%), Tropicamide (0.8%) +Phenylephrine (5%) combination.
2. To find out the onset of action of the above drugs.
3. To compare the changes in onset and degree of Mydriasis in tobacco addicts .

MATERIALS & METHODS

Study design: This is a Descriptive cross sectional study carried out on individuals who came to the O.P.D for routine refraction in the ophthalmology department of PRH, Loni.

Ethical approval: Institutional Ethical Committee approval was obtained, written informed consent was taken from all the participants

All the patients satisfying the following inclusion exclusion criteria were enrolled for the study:

Inclusion Criteria: Any patient of age more than 18 years coming for any ophthalmological examination receiving mydriatic agent, patients with baseline pupil size 2 ± 0.5 mm and patients of either sex,

Exclusion Criteria: Patients with history of any ocular infections, patients with posterior synechiae, shallow anterior chamber, patients with history of liver and cardiac disorders, patients on any antihypertensive medications or any relevant drug history of symphathomimetics or cholinergic drugs, Patients with congenital ocular disorder, and any ocular trauma or undergone any ocular surgery

Grouping & sample size: Total of 63 patients (126 eyes) were enrolled for the study. Patients were randomly grouped according to the mydriatics used into 3 groups:

Group 1(n= 25): Tropicamide (1%)

Group 2(n= 18): Phenylephrine (10%)

Group 3(n= 20): Tropicamide (0.8%) +Phenylephrine (5%)

Each group was further divided into tobacco and non-tobacco addicts depending upon the personal history of tobacco addiction given by them.

Procedure:

After the enrolment of patients, the baseline pupil size was measured and according to the grouping schedule the patients were instilled the mydriatic agent (total three drops of drug) in the lower conjunctival fornix,each at the interval of 10min up to 30 min. Patients were directed to keep their eyes closed to prevent loss of medication through the punctum in the conjunctival sac. Measurement of pupil diameter was done using pupil gauge.¹⁰ Five repeated measurements were taken at an interval of 15 minutes (from 0min -60mins).

RESULT

A total of 63 patients were included in the study. Of these 36 (57.14%) were males and 27 (42.86%) were females.

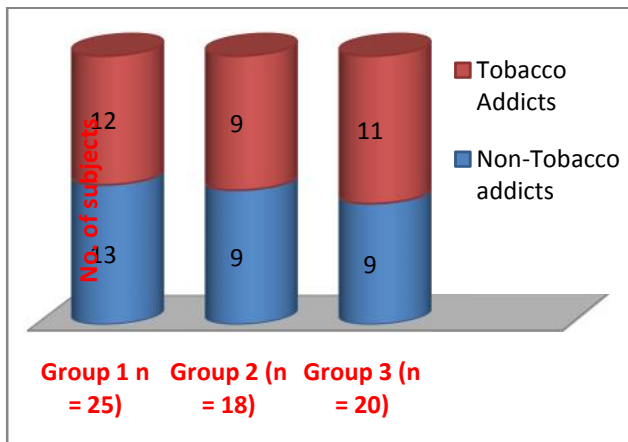


Fig 1: Distribution of Tobacco and Non-Tobacco Addicts

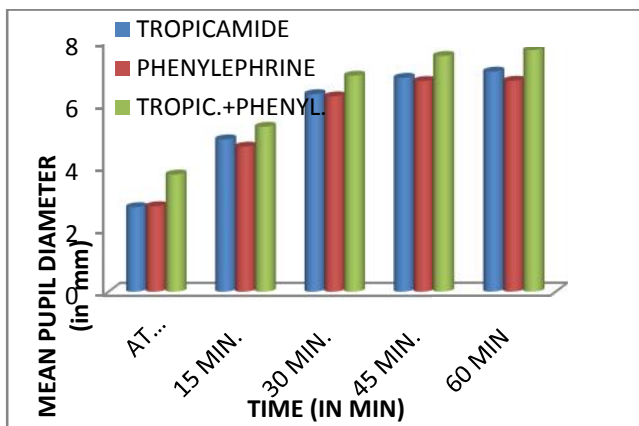


Fig 2: Comparison of Mydriasis Achieved At Every 15 Min. Interval

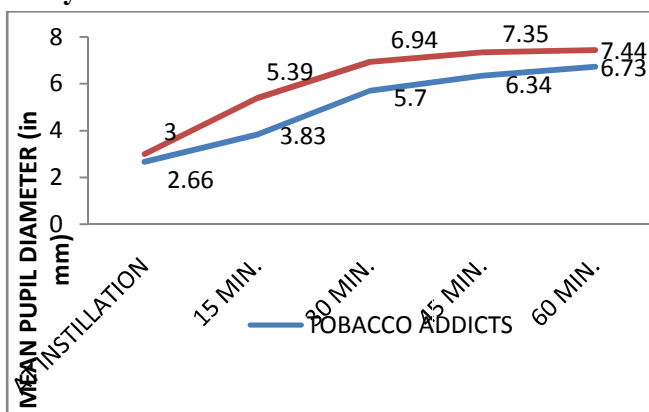


Fig 3: Pupil Diameter with Group 1-Tropicamide (1%)

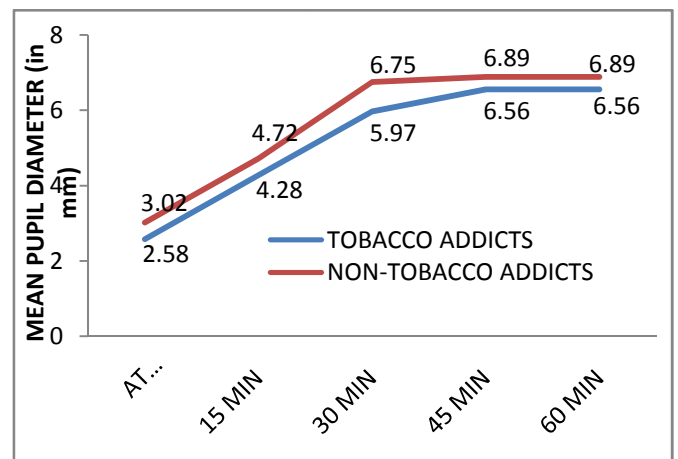


Fig 4: Pupil Diameter with Group 2-Phenylephrine (10%)

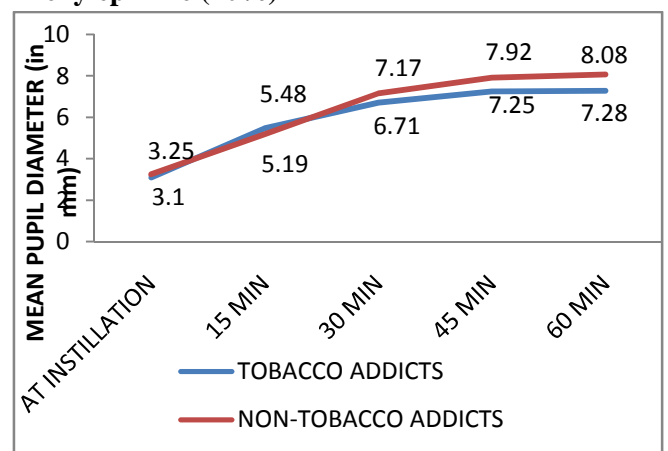


Fig 5: Pupil Diameter Group 3 (n= 20): Tropicamide (0.8%) +Phenylephrine (5%)

DISCUSSION

The baseline pupil diameter was average 2 ± 0.5 mm before the instillation of the mydriatic agent. On instillation of mydriatic agent in the patients of group 1 [Tropicamide(1%) n=25] the mean pupillary diameter was 2.69 mm and pupil dilated upto 7 mm at the end of 60 mins, whereas those in group 2 [Phenylephrine (10%) n=18] achieved a mean pupillary diameter of 2.72 mm at instillation and dilatation was 6.71 mm at the end of 60 min and in group 3 [Tropicamide(0.8%)+Phenylephrine(5%) n=20] achieved a significantly higher mean pupillary diameter of 3.73 mm at instillation and dilated upto 7.69 mm at the end of 60 min. Thus the combination of Tropicamide (0.8%) +Phenylephrine (5%) (group 3) had a faster onset and maximum degree of dilation. On comparing the drugs in term of rapidity of action it was seen that the adequate diameter of around 6.5 mm which is required for ophthalmologic testing, was achieved at 30 min with the combination, whilst it

was achieved at the end of 45 min in patients of group 1 [Tropicamide(1%) n=25] and 2 [Phenylephrine (10%) n=18].

Further, on comparing the degree of mydriasis achieved between tobacco and non-tobacco addicts, amongst each group, a mean pupillary diameter at instillation, was 3 mm, 2.66 mm and 3.1 mm in **tobacco addicts** of groups 1, 2, and 3 respectively, while an average diameter of 3 mm, 3.02 mm and 3.25 mm respectively in **non tobacco addicts**.

At the end of 60 min, the degree of mydriasis of tobacco addicts in group 1, 2, 3 were 6.73 mm, 6.56 mm, 7.28 mm respectively thus indicating a slower and lesser degree of dilation than non tobacco addicts who showed dilation of 7.44 mm, 6.89 mm and 8.08 mm respectively.

Another similar study by O Majid et al concluded that by using 0.75% Tropicamide and 2.5% Phenylephrine pupil successfully dilated to 7 mm within 40 minutes after initial eye drop application in 77% of patients enrolled in the study.¹⁰ Our study was comparable with a research that suggested that the use of a mixture of 0.75% Tropicamide and 2.5% Phenylephrine is a superior dilating mixture compared to the application of Tropicamide (1%) and Phenylephrine (10%) alone.¹¹ A study by Keimyung university showed that the combination of 1% Tropicamide and 2.5 % Phenylephrine was better than 1% Tropicamide and 2.5% Phenylephrine eye drops alone.⁵

The pupil is under the control of the autonomic nervous system. Parasympatholytic as well as sympathomimetic drugs have been used to dilate the pupil. The parasympathetic regulation dominates over the sympathetic effect in the control of the pupil.¹² Therefore application of only the sympathomimetic drug is usually inadequate to sustain the pupil dilation in bright light during indirect ophthalmoscopy. However, Parasympatholytic agents alone may not provide sufficient dilation. Combination of both drugs offers better pupil dilation than single drug use.¹³ Also; the combination has a lower concentration of each drug, thereby reducing the risk of cardiovascular side effects of Phenylephrine.

In a rural setup, where tobacco consumption is largely prevalent, suboptimal dilation was recorded in tobacco addicts on comparison with non-addicts in all three groups. Tobacco addicts in each group were observed to have lesser magnitude of dilation as

compared to non-tobacco addicts of the same group at the end of 60 minutes. However, tobacco addicts in group 3 [Tropicamide(0.8%)+Phenylephrine(5%) n=20] achieved maximum mydriasis compared to tobacco addicts of group 1 [Tropicamide(1%) n=25] and group 2 [Phenylephrine (10%) n=18] .

Widespread tobacco addiction is mainly caused by nicotine which is the only active pharmacological agent in tobacco. The effects of nicotine are initiated by binding to nicotinic cholinergic receptors in autonomic ganglia, adrenal medulla, and neuromuscular junctions as well as in the central nervous system. Binding of nicotine to cholinergic receptors causes the release of a number of vasoactive catecholamines and neuroactive peptides.¹⁴ Parasympathetic activity thus decreases the parasympatholytic effects of the mydriatic agents and hence achieving less magnitude of dilation of pupil.

The limitations of our study include the crude methods of pupil size measurement and the lack of regular monitoring of pulse and blood pressure in patients who were administered Phenylephrine only.

CONCLUSION

The combination of Tropicamide (0.8%) and Phenylephrine (5%) have the fastest onset of mydriasis, and achieved the highest dilation in 60 min. as compared to Tropicamide (1%) and Phenylephrine (10%) alone. Tobacco addicts in each group were observed to have lesser magnitude of dilation than non tobacco addicts.

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