Original Research Article

Effect of topical proparacaine 0.5% on tropicamide- induced mydriasis

Abstract:

PURPOSE: The topical anesthetic proparacaine (0.5%) before the instillation of a mydriatic tropicamide is recommended to enhance the rate and magnitude of pupillary dilatation. However there is a paucity of data supporting this. Therefore we conducted a study to analyze if preinstillation of topical proparacaine (0.5%) can potentiate the mydriatic efficacy of 0.8% tropicamide.

METHODS: The patients were divided into two groups for pupillary dilatation. The study group was given a drop 0.5% propracaine before instilling a drop of tropicamide while the control group was given the tropicamide alone. The pupillary size was measured and recorded before the instillation of tropicamide at 0 min, 15 min, 30 min. The end point was taken as 6 mm pupillary size (clinically effective diameter).

RESULTS: There was a small, statistically significant difference in rate of pupillary diameter between the control and the study group. The rate of pupillary dilatation at 15min and 30 min was reached and differ between the control and study group and was statistically significant.

CONCLUSION: Prior instillation of topical proparacine produced a statistically significant difference in rate of pupil dilatation at 30 min. Therefore, we recommend the use of a topical anesthetic before tropicamide induced mydriasis.

INTRODUCTION:

Dilation of pupils is an essential accompaniment to routine eye examinations and in many intraocular surgeries like small incision cataract surgery, phacoemulsification, and outpatient procedures like laser treatments. A recommended drug regime for a mydriatic fundus examination uses the cholinergic antagonist tropicamide.[5] The use of a topical anesthetic, namely proparacaine 0.5%, before the instillation of any mydriatic has also been recommended earlier.[5-11] Mechanism of action is still not known, the corneal epithelium gets disrupted when a topical anesthetic is used[11] and is thought to facilitate the absorption of the mydriatic agent through the cornea.[5,12,13] Apart from that, prior instillation of anesthetic agent reduces reflux tearing, because of which a higher amount of mydriatic is available for corneal penetration.[5,14] Advantages of using an anesthetic prior to instillation of a mydriatic consists of

increased magnitude and rate of pupillary dilation,[9,10,13] along with sustained pupillary dilation.[10] Patient compliance will also be improved if a local anesthetic is used due to a reduction in the discomfort.[5,14] In one of the study conducted by Ghose et al., it is reported that lignocaine has a significant increase in pupillary dilatation if it is used before instilling a drop of tropicamide indicating that prior instillation of a local anesthetic has a beneficial role to play in pupillary

dilation.[15]

METHODS

This experimental study was conducted in the department of ophthalmology, M.D.M Hospital, jodhpur in the outpatient clinic from October 2019 to December 2019 over a period of 3 months. Informed written consent was taken from the individual participants who had taken part in the study. Right eye was taken for the study while left eye served as control.

A total of 58 patients aged between 20 and 60 years were selected randomly by lot method attending outpatient clinic in our department. The subjects who were enrolled in the study underwent a thorough slit lamp examination with brief history taking. Subjects with pupillary abnormality, glaucoma, history of using any topical medication usage, trauma, pseudoexfoliation, uveitis, corneal scars, acute or chronic dacryocystitis, and any history of allergy to drugs were excluded from the study.

Undilated pupil measurements were taken from both eyes in a dark room using pupillary gauge.

Eye drops were instilled into the lower conjunctival fornix after asking the patient to look up toward the roof and lacrimal passage was occluded by pressing on the medial side of the medial canthus so that drainage was reduced. Eye drops containing proparacaine was instilled in the study group and normal saline in the control group. After 5mins tropicamide eye drops was instilled in both the groups. Pupillary measurements were taken after 15 mins and at the end of 30 mins using the same pupillary gauge and the recordings were noted by the examiner. Instillation of the drop was done by one investigator and measurement of pupillary size at the end of 15 mins and 30 mins was done by another investigator separately.

Student’s t-test was used to find the difference between two groups. For all practical purpose $p<0.05$ was considered as statistically significant.

RESULTS

This study included 58 subjects, among which 23 (39.65%) were males and 35 (60.34%) were females. Among the 58 subjects, mean age was 58.42±10.27 years. Right eye was the study eye and left eye was the control eye. Mean undilated pupil diameter (in mm) in a study group at 0min was 2.896±0.42 and in the control group was 2.885±0.443. There was not much difference in the pupillary diameter of both the study and the control group at 0 mins and it was not statistically significant. Six millimeter pupillary diameter (clinically effective diameter [CED]) is considered to be an adequate size for fundus evaluation, as reported from the previous study.[16] The mean pupillary diameter in the study group at 15 mins was 5.56±0.5 and in the control group was 5.24±0.45 ($p<0.001$) which was statistically significant. The pupillary diameter at the end of 30 mins in study group and control group was 7.96±0.43 and 7.83±0.43, respectively ($p<0.001$), which was statistically significant.

The pupillary size measurement done during the study was tabulated as follows.

The mean pupillary diameter in the right eye that is proparacaine treated eye increased from a mean pupillary diameter of 2.89±0.42 at 0 min to 7.96±0.43 at the end of 30 mins. On the other hand, mean pupillary diameter in the left eye that is placebo-treated eye increased from 2.88±0.443 at 0 min to 7.83±0.43 at the end of 30 mins. The difference in the mean pupillary diameter between the study eye and the control eye was statistically significant at 15 mins as well as 30 mins (Table 1).Table 2 shows that 21 (36.2%) cases reached CED at the end of 15 mins and 37 (63.7%) cases did not reach CED in proparacaine treated eyes. In placebo-treated eye only 7 (12.06%) cases reached the CED and 51 (87.9%) cases did not reach CED at the end of 15 min.

TABLE 1: Pupillary size in study eye (RE) and control eye (LE)

	Mean pupillary dilatation (in mm)	SD	T value	P value
RE 0 min	2.896	0.4199	0.44	0.65
LE 0 min	2.885	0.4433		
RE 15 mins	5.562	0.5007	8.13	<0.001
LE 15 mins	5.246	0.4544		
RE 30 mins	7.966	0.4317	4.115	<0.001
LE 30 mins	7.834	0.4365		

SD: Standard deviation, RE: Right eye, LE: Left eye

TABLE 2: Proportion of study and control eyes reaching CED

	CNED (%)	CED (%)
RE	37 (63.7)	21 (36.2)
LE	51(87.9)	7(12.06)
Total	88	28

CNED: Clinically non effective diameter, CED: Clinically effective diameter

DISCUSSION

Instillation of one drop of proparacaine before the instillation of tropicamide for pupillary dilation resulted in a significant increase in pupillary diameter as compared to using tropicamide alone. Ghose et al. studying the potentiating effect of 4% lignocaine on tropicamide-induced mydriasis obtained a mean maximum pupil size of 6.75±0.80 mm in the intervention eye and 6.08±0.97 mm in the control eye.[15] This is much smaller than the pupil sizes of 7.96±0.43 mm and 7.83±0.43mm, obtained for proparacaine-treated study eyes and control eyes, respectively in the present study. The difference recorded in maximum pupil size, between both studies, was about 1.88 mm in the drug-treated eye and 1.75 mm in the control eye. The much larger difference in the drug-treated eye suggests that proparacaine may have a higher potentiating effect on tropicamide than eyes treated with lignocaine. It may be because of the lesser penetration and hence lesser availability of lignocaine as compared to proparacaine.

The mean pupillary diameter at the end of the study conducted by Ogun et al. was 6.01 ± 0.54 mm which is much less compared to the pupillary diameter in the proparacaine treated eye in our study which is 7.96 ± 0.43 at the end of our study. Atypical Nigerian patient is dark skinned with densely pigmented iris. The difference in the pupillary diameter may be because of the increased pigmentation in a Nigerian subject as compared to ours.[17] Same theory was suggested by Emiru, who states that iris pigmentation and not the race that is more likely to be responsible for the poorer pupil dilatation. Emiru noted that the dark-skinned African did not achieve the large pupil diameters even after 60 mins of dilatation.[18] His reported mean pupillary diameter at 60 mins was 6.21 mm, which is much lesser to the mean diameter of 7.96 ± 0.43 mm obtained at 30 mins in proparacaine treated eye in this study, which supports the theory of the higher pigmentation rate in African people as compared to Indian population here. Chen and Poth also could explain the reduced mydriatic effect

due to decreased absorption in iris crypts because of obstruction by pigments within the chromophores.[19]

Topical anesthetics inhibit the rate of corneal epithelial cell migration by disrupting the cytoplasmic action in filaments and destroy superficial corneal epithelial microvilli.[20] The mechanism of action of potentiating effect of proparacaine on tropicamide-induced pupillary dilation may be because of an increased intraocular penetration of tropicamide which is because of greater availability of the drug due to increased absorption through the microscopic disruptions in the corneal epithelium and reduced tearing because of which more time of contact and hence increased bioavailability might have been achieved.[9,13,16,21]

CONCLUSIONS

It can be concluded that instilling proparacaine before tropicamide gives faster pupillary dilation. Hence, we do recommend the use of proparacaine before instilling tropicamide for faster pupillary dilation.

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