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Safe mydriasis

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Routine examination of the fundus requires a dilated pupil. If a cycloplegic drug is used the three major disadvantages are: paralysis of accommodation, an increase in intraocular pressure produced by a mechanism not involving angle-closure (Schimek and Lieberman, 1961; Christensen and Pearce, 1963), and a frank attack of acute closed-angle glaucoma.

With a sympathomimetic drug only the last complication is of consequence. After the pupil has been dilated it can be either left as such, inviting potential disaster in an eye with a narrow angle, or a parasympathomimetic drug can be instilled, which, if successful in producing miosis, causes a tonic pupil and spasm of accommodation. Neither combination is therefore satisfactory.

The purpose of this paper is to describe a mydriatic – miotic combination in which the dangers and disadvantages are reduced to a minimum and to illustrate the properties of the miotic used.

Material and methods

One drop of thymoxamine (a sympathetic alpha inhibitor: Birmingham and Szolcsányi, 1965) was instilled into the right conjunctival sac of ten subjects. Photographs of both eyes were then taken at a fixed distance, at hourly intervals for 6 hours and again at 24 hours. Each subject received on separate occasions 0·1, 0·5, and 1·0 per cent. concentrations. Subsequently, the slides were projected and the horizontal pupil diameter of the eye receiving thymoxamine was expressed as a percentage of the opposite normal eye.

The same ten subjects subsequently had one drop of 10 per cent. phenylephrine instilled into the right eye and photographs were taken at 30-min. intervals for one hour. At this point 0·5 per cent. thymoxamine was instilled and photographs were taken at 15-min. intervals for 30 min., half an hour later, and again at 5 and 24 hours.

Results

Fig. 1 shows a plot of percentage pupil diameter against time after the instillation of thymoxamine. It can be seen that the miotic effect of a 0·1 per cent. solution had practically disappeared after 4 hours, but that with 0·5 and 1 per cent. solutions a significant miosis was present after 24 hours.

All subjects complained of a burning sensation after using the 1 per cent. solution (in one this was extreme); the burning was not much in evidence with the 0·5 per cent. solution and absent with 0·1 per cent.

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Fig. 2 is a similar graph showing the effect of thymoxamine on a phenylephrine mydriasis. It can be seen that after 24 hours the miosis is of the same order as that produced by thymoxamine alone (*cf.* Fig. 1). Eight of these subjects had a perceptible miosis after 36 hours.

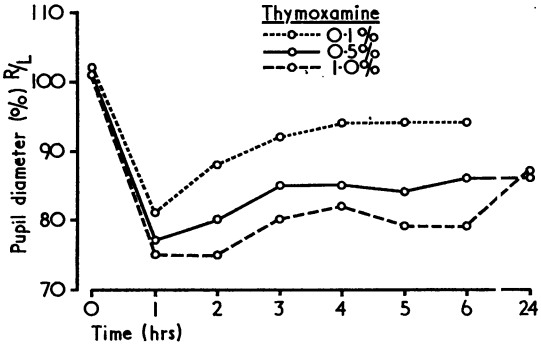

FIG. 1 *Effect of various concentrations of thymoxamine on pupil diameter when instilled into right eye*

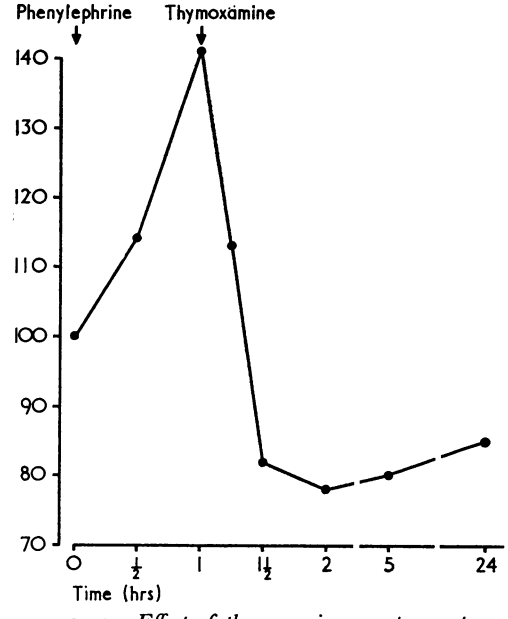

FIG. 2 *Effect of thymoxamine* 0·5 *per cent. on phenylephrine-induced mydriasis*

Discussion

Thymoxamine (Opilon) was first used in ophthalmology by Pau (1955), who investigated its effects in chronic simple glaucoma using a 5 per cent. solution. At this concentration a pharmacological Horner's syndrome is produced with marked chemosis. In the concentrations used above, ptosis was noted in one subject after using the 1 per cent. solution.

Figs 1 and 2 show that thymoxamine is both an effective miotic and an inhibitor of phenylephrine mydriasis (itself a specific alpha receptor stimulator). The advantages of this combination when used for fundus examination are:

(1) Minimal cycloplegia (phenylephrine reduces accommodation by about 0·6 D (Biggs, Alpern, and Bennett, 1959).

(2) Phenylephrine does not produce the raised intraocular pressure in eyes with open angles that can occur with cycloplegics (Becker, Gage, Kolker, and Gay, 1959).

(3) Phenylephrine – although capable of precipitating closed-angle attacks in minute concentrations (Weiss and Shaffer, 1962) – is rapidly reversed in action by thymoxamine and this miosis is well maintained after any effect of phenylephrine has disappeared.

(4) The pupil miosed by a sympathetic inhibitor has less force available for causing pupil block than either the normal pupil or one stimulated to miosis by pilocarpine (Mapstone, 1970).

(5) The pupil remains mobile.

Thymoxamine has now been used in over 100 patients—in some daily—for over one year and no untoward effects have been noted. It is concluded therefore that this mydriatic–miotic combination has advantages not possessed by others.

Summary

The effect of thymoxamine (an alpha sympathetic inhibitor) in producing a miosis and reversing a phenylephrine-induced mydriasis is illustrated and discussed.

Phenylephrine and thymoxamine is a safe combination to use for routine pupillary dilatation and subsequent miosis.

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