SLIT-LAMP STUDY OF THE AQUEOUS VEINS IN SIMPLE GLAUCOMA DURING THE AMYL NITRITE TEST*

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ATTENTION has already been directed to the fall in intra-ocular pressure usually occurring in chronic primary glaucoma during the inspiration of amyl nitrite and its presumable diagnostic and prognostic significance (Cristini and Pagliarani, 1953). It was suggested that this fall might be referred to the widening of the vascular bed and to the decrease of filtration pressure in the capillaries of the uvea.

The rapidity and transient character of the fall in tension proved that it could not possibly be caused by the removal of an anatomical obstacle; but the question remained unanswered whether the fall in ocular tension might be due to a variation in resistance to the drainage of the aqueous caused by functional changes in the aqueous veins, or to a diminution of pressure in the recipient episcleral veins.

As many authors consider these phenomena to be important for the appearance of hypertension in simple glaucoma, we thought it interesting to complete our previous investigations by the biomicroscopical study of the episcleral vessels and aqueous veins in glaucomatous subjects during the amyl nitrite test.

Material

About fifty cases of simple glaucoma were examined and eighteen of them—ten male and eight female patients ranging from 45 to 66 years of age—were selected because their aqueous veins were readily apparent. Seven normal eyes were used as controls. The ocular tension in the glaucomatous patients was about 35 mm. Hg (Schiotz); eyes with higher ocular tension were discarded owing to the impossibility of finding clear sizable aqueous veins in such conditions.

Technique

All the patients were hospitalized and tonometric readings were taken for some days in basic conditions and under the effect of miotics.

The amyl nitrite test was performed by making the patient, sitting at the slit lamp, inspire some drops of the drug from cotton wool, while the episcleral district containing the aqueous vessels was observed under good illumination by means of a medium magnification. Note was taken of the changes in the episcleral vessels, of the size and contents of the aqueous and laminated veins, and of the time taken by the aqueous veins to return to their initial state.

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Results

No substantial differences were observed during the amyl nitrite test between control eyes and glaucoma cases, and, in the latter group, between the effects observed in basic conditions and under the action of miotics. The most evident modification was a rather marked dilatation of the episcleral and conjunctival vessels, especially of those of minor size, and of the pre-capillaries and capillaries, so that new vessels became visible which had previously been neglected. The aqueous veins showed perhaps less evident dilatation and their clear fluid was constantly replaced by blood which was sometimes seen to advance towards the limbus from the equatorial region. This dilatation of the episcleral veins coincided chronologically with the greatest fall in ocular tension.

In three cases of glaucoma and in one control, some pulsations occurred in the aqueous vessels during the phase of greatest hyperaemia. The blood generally disappeared from the aqueous veins in 15-20 seconds, but occasionally it took longer than 2-3 minutes. The controls, however, showed no significant differences.

Discussion

The dilatation of the episcleral vessels, in particular of the veins and capillaries, and the appearance of blood flow in the aqueous veins coinciding with the phase of lower ocular tension, agree with the findings of Dobree (1953). It must be remarked that our series included no eyes with very high ocular tension and that in Dobree's investigation these behaved differently. It is known that in normal conditions there is a tendency for blood to appear in the aqueous veins with all vasodilatory drugs (Rio Cabanas and Cadenas Ugidos, 1954). Under the action of amyl nitrite this effect was constantly observed even in eyes with simple glaucoma, which, as our previous researches demonstrated, show a fall in ocular tension during this test. The duration of the blood phase showed no significant difference from that in the controls. All these facts seem to suggest that the fall in ocular tension induced in primary simple glaucoma by amyl nitrite does not depend on a temporary decrease of the resistance to the aqueous outflow. Indeed, if this were the case, one would expect to see an increase of the aqueous outflow and, therefore, of the clear fluid in the aqueous veins. This disagreement of our findings with the hypothesis that variations in ocular tension follow variations in the resistance to the aqueous outflow, finds a parallel in other clinical and experimental observations.

Changes in the size and contents of the aqueous veins not accompanied by variations of tension have been observed not only in normal eyes but also in glaucomatous eyes (Thomassen, Perkins, and Dobree, 1950), while, on the contrary, the fall in ocular tension may be accompanied either by an increase of the aqueous phase, as occurs for example under the action of pilocarpine or eserine (Ascher, 1954), or by an increase of the blood phase,
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in spontaneous variations (Dobree, 1953), or in those induced by drugs (e.g. amyl nitrite).

Similarly, Grant and Trotter (1954), referring to the relationship of the pressure in the episcleral recipient veins and intra-ocular pressure, state that:

A variation of the recipient venous pressure appears to be of little significance in the aetiology of glaucoma either from a theoretical or an experimental standpoint, except as it introduces uncertainty into the calculation of normal net rate of flow of aqueous humor.

Bain (1954) confirms the findings of Thomassen (1948) that variations of the tension in the episcleral veins preceded those of ocular tension, stating that these variations are very small and occur bilaterally, and are also seen without any noticeable changes in intra-ocular pressure. Changes in the episcleral recipient vessels must, therefore, be considered unlikely to cause rises in the ocular tension, although the possibility cannot be excluded that in particular cases a small cause might determine a great effect.

In conclusion, the changes in the episcleral veins associated with modifications of tension during the amyl nitrite test seem to be of negligible importance. These changes should be considered as a manifestation of vascular events occurring in the uveal tract and with quite insignificant effects on the changes in ocular tension.

If an analogy may be drawn between the variations observed in the amyl nitrite test and the spontaneous variations of tension occurring in glaucoma, it may legitimately be suggested that the latter also are due to vascular changes within the eye.

Summary

(1) The behaviour of the aqueous and episcleral veins after the inspiration of amyl nitrite was studied in glaucomatous eyes.

(2) It was found that total blood-filling of the aqueous veins and maximal dilatation of the episcleral vessels coincided with the greatest fall in ocular tension.

(3) It is suggested that a diminution in the outflow of aqueous humour and an increase of pressure in the episcleral venous vessels have only a negligible effect on the fall of ocular tension in the glaucomatous eye caused by the inhalation of amyl nitrite.

REFERENCES