# INJECTION OF THE RETINAL VASCULAR SYSTEM IN THE ENUCLEATED EYE IN DIABETIC RETINOPATHY*

BY

NORMAN ASHTON

*From the Department of Pathology, Institute of Ophthalmology, London*

IN the course of our studies in diabetic retinopathy, a preliminary report of which was recently issued in this Journal (Ashton, 1949), many methods of demonstrating the retinal vasculature have been tried, among which injection of the retinal capillaries in the excised eye with a variety of dyes and plastic materials has been attempted and is still being investigated. So far the use of Indian Ink has been found extremely effective and during the course of our work Michaelson and Steedman (1949) published a similar method for injecting the freshly enucleated eye and they have indicated the potentialities of this technique in anatomical and pathological studies. It is thought, therefore, that the publication of photographs of the injected retina from a case of advanced diabetic retinopathy would be of timely interest. Our method varies in detail from that of Michaelson and Steedman.

## METHOD

The technique may be applied to either fresh or *post mortem* material. In order to prevent the fixation of blood in the capillaries the whole eye was not placed in formol saline as advocated by Michaelson and Steedman. The free end of the optic nerve is dipped in 10 per cent. formol saline for a few minutes and is then cut transversely with a sharp scalpel to give a clean flat surface. The globe is held inverted in an iris diaphragm and placed under a stereoscopic dissecting microscope. The cut surface of the nerve is illuminated with a point source of light and the pouting central vessels may be clearly seen in the majority of cases. A fine glass capillary canula, bent at an angle of about 120°, is drawn from a glass tube of 5 mm. internal bore and 3½—4 in. in length. The capillary canula, bent at an angle of about 120°, is drawn from a and cut to approximate to the required size. The canula is now attached to the suction tap of an electric pump (Edward's Rotary Vacuum Pump and Compressor) and distilled water is sucked into the tube which holds about 2 ccs. This method of filling

* Received for publication, September 27, 1949.

ensures that no particles enter the tube and block the capillary at the time of injection. The canula is now attached to the pressure tap of the same pump, adjusted to give a pressure of about 10 lbs. and the capillary tube is inserted into the vein or artery. An assistant works the motor switch, thus the operator has only to hold the canula in position. The irrigation of vessels with water lyses the red cells and opens up channels which might otherwise remain blocked. The water is allowed to remain in the vessels for 5-10 minutes for maximum haemolysation to take place and then more distilled water is run through. The vessels are then irrigated with 10 per cent. formol saline to fix them in the distended position. The canula is now charged with Indian Ink as above, and the final injection made. The injected eye is placed in 10 per cent. formol saline for 12 hours. The retina is then removed and mounted in a glass sphere, as described in our preliminary report, except that the optic nerve head is now included with the retina by cutting posteriorly with a sharp spoon, and examined under the microscope and photographed for record purposes.

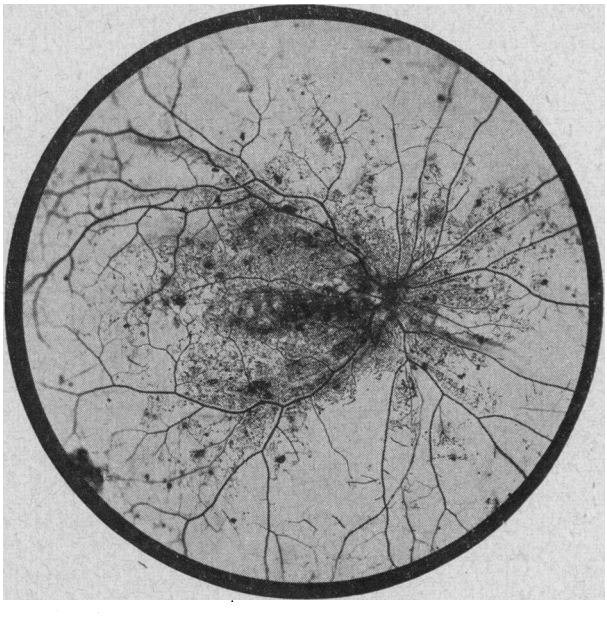

FIG. 1.

Left retina mounted in a glass sphere after injection of the vessels with Indian ink. Shows a Stage III diabetic retinopathy. Scattered haemorrhages and many thousands of micro-aneurysms can be seen. ×4·5.

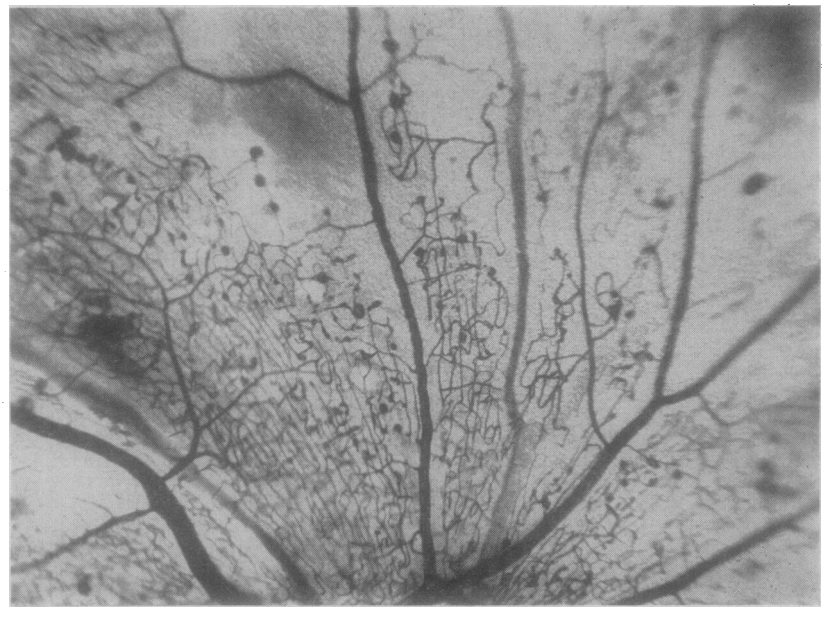

FIG. 2.

Higher magnification of retina shown in Fig. 1. Note the large number of aneurysms. ×27·5.

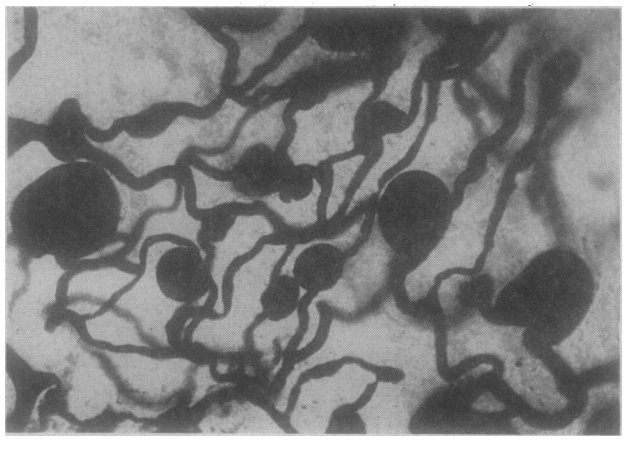

FIG. 3.

Injected retina showing many aneurysms, beading, looping and irregularity of the capillaries. ×200.

The case here shown is the retina from an injected right eye taken at *post mortem* from a female aged 71 who had suffered from diabetes for twenty-six years. There is a Stage III diabetic retinopathy with micro-aneurysms, irregular haemorrhages, macular and punctate exudates. Although the injection is not as complete as we have obtained in freshly excised eyes, it is satisfactory for a *post mortem* specimen and the picture clearly shows some thousands of micro-aneurysms. Beading, localised dilatations and looping of the vessels and multiple haemorrhages can be seen. It is believed that it has not previously been realised how surprisingly numerous micro-aneurysms are and the picture is a depressing one for one wonders how it can ever be possible to reverse such a gross and widespread process by the administration of drugs or the control of diet. At best we can only hope to prevent the development of such lesions or, once the condition is established, to attempt to control the haemorrhages.

I am indebted to Dr. Peter Hansell for the photographs.

**REFERENCES**

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# CONVERGENCE DEFICIENCY*

## An investigation into the results of treatment

BY

A. MELLICK

GLASGOW

OVER the period of twelve months which covered the present investigation, 88 patients attending the out-patient department of the Glasgow Eye Infirmary manifested the subjective and objective features of convergence deficiency. Their ages ranged from 14 to 50 years, 32 being below 20 years of age, 37 in the third decade, 15 in the fourth decade, and 4 in the fifth decade. Of the 88 patients, 51 were females, and 37 males. Thirty-seven cases were emmetropic; in 43 hypermetropia or hypermetropic astigmatism was present, and in 8 myopia or myopic astigmatism.

Fifteen of the 88 cases were considered unsuitable for orthoptic treatment. Of these, 12 suffered from so pronounced a degree of neurosis, that the immediate consideration was the treatment of

* Received for publication, July 14, 1949.