CASE REPORTS

Understanding of the retinal circulation provided by an anomalous retinal vein

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In a study of a control population the blood velocities in the central retinal vein in the optic nerve have been found to have an unusual pulsatile pattern of flow which is in synchrony with the arterial pulse and which is not seen in other veins (unpublished data). This pattern of blood flow may occur because the intraocular venules are compressed by the fluctuations in pressure within the eye which occur with the systemic pulse. Alternatively, the reason may be the close approximation of the vein to the central retinal artery in the distal optic nerve where both vessels are enclosed within a common adventitial sheath. In this report, a colour Doppler examination from a patient with an unusual retinal venous anatomy has facilitated the identification of the source of the pulsatile velocities in the vein.

Case report
A 61-year-old man was noticed on fundoscopy to have a superior hemiretinal vein which directly entered the choroid adjacent to the upper edge of the optic disc (Fig 1). The inferior hemiretinal vein followed the usual path and entered into the central optic disc with the artery.

Colour Doppler imaging was used to detect the blood velocity signals from the continuation of the inferior hemiretinal vein within the optic nerve adjacent to the central retinal artery. Spectral analysis of these signals provided a pulsatile velocity waveform which was in synchrony with the pulsations in the central retinal artery, and which was similar to the waveforms from the central retinal vein of normal controls, with a maximum velocity of 8 cm/s and a minimum velocity of 5 cm/s. The Doppler signal attributable to the superior hemiretinal vein was detected in the perineural area at the level of lamina cribrosa and continued down the side of the optic nerve to join the inferior hemiretinal vein as it exited the nerve approximately 10 mm posterior to the globe (Fig 2). The waveform in this vessel exhibited a constant peak velocity of 7 cm/s and did not manifest the normal central retinal venous pulsatile waveform.

Comment
This case demonstrates that an extraneural retinal vein has a constant flow rate, while an intraneural retinal vein exhibits a pulsatile flow rate in phase with the cardiac cycle. If the fluctuations in the intraocular pressure were responsible for the pulsations in the vein both the intraneural vein and the extraneural vein would have been expected to possess pulsatile flow. Since only the intraneural vein had pulsatile flow this must have been induced by the anatomical location of the vein within the nerve. The central retinal artery and vein in the optic nerve share a space within a common adventitial sheath. This sheath, which has a relatively broad diameter and is collagenous, is relatively indistensible. The dilatation of the artery within this confined space during systole must result in compression of the vein. We speculate that this may have the effect of 'pumping' blood into the distensible distal vein as it leaves the optic nerve thereby resulting in the pulsatile blood flow rate which has been observed. It is of interest that the pulsations in the central retinal vein are reduced in patients with occlusion of the blood vessel (unpublished data) – for example, in a study of 80 patients with occlusion the venous pulsatility index (a measure

Figure 1 The retinal venous pattern is shown with the superior hemiretinal vein appearing to enter into the choroid adjacent to the optic nerve (arrow). The inferior hemiretinal vein enters into the central optic disc with the arteries.
Mechanism related to the lateral rectus muscle capable of retracting the outer canthus of the eye

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Relatively few anomalies of the extrinsic musculature of the human orbit have been identified. Whitnall believed that this was because 'dissecting room conditions do not favour their identification'. This probably remains true given that the most common teaching entry to the orbital cavity is via the thin supraorbital plates.

Case report
During detailed dissection of the contents of the orbital cavity, a distinct fibromembranous slip arising from the belly of the left lateral rectus muscle (Fig 1) was discovered in a male subject. The slip ran parallel with the muscle and was attached to the fascia deep to the lateral canthus. A pronounced elevation of the muscle belly was observed associated with the slip's muscular attachment. Muscle fibre arrangement in this elevation suggested that it could not be involved in movement of the eye but would have pulled instead, via the slip, on the outer canthus. There was no separate nerve supply to this elevation; thus, normal contraction of the lateral rectus in abduction of the gaze would have caused a simultaneous pull on the outer canthus. By pulling with forceps to simulate this action, an accompanying retraction of the lateral canthus was observed. This appeared to provide an apparently purposeful, additional action for the lateral rectus in that, while abducting the gaze, it also helped draw the lateral canthus posteriorly, reducing restriction of vision laterally. Although similar fibrous structures were evident contralaterally, as distinct a slip was not found beside the right lateral rectus muscle.

In the absence of material for further detailed dissection, a short study of outer canthus retraction was performed in living subjects asked to follow a pointer moved laterally in the interpupillary plane. Analysis of the findings (Table 1) suggested no sex difference but that right side retraction was more prevalent (males, p=0.019; females, p=0.005).

Table 1

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Figure 2  The colour Doppler image of the right orbit showing the superior hemiretinal vein (extraneural) and the spectral analysis of the blood velocities in this vessel which demonstrates a non-pulsatile waveform.