Retinal branch vein occlusion

Changes at the site of obstruction

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Obstruction in retinal branch veins usually occurs in relation to arterio-venous crossings (Moore, 1924; Jensen, 1936), and intramural thrombosis has been postulated as a frequent cause (Moore, 1924; Koyanagi, 1928; Jensen, 1936). Histological studies have failed, however, to show thrombosis but have demonstrated focal venous obstruction (Seitz, 1964; Rabinowicz, Litman, and Michaelson, 1968).

Fluorescein angiography has now revealed that the clinical appearance of branch vein occlusion can be seen both with focal obstruction (Gass, 1968) or without (Paton, Rubinstein, and Smith, 1964). The occurrence of segmental arterial changes led some authors to conclude that the appearances of branch vein occlusion were due to primary arterial insufficiency rather than venous obstruction (Paton and others, 1964), but this has been disputed (Gass, 1968).

The present report describes the changes seen on fluorescein angiography and their frequency in a series of 65 cases of branch vein occlusion.

Material

In the 65 patients included, the interval between the onset of symptoms and the initial examination was less than 6 months, and the relevant arterio-venous crossing was not obscured by haemorrhage. Retinal hemisphere vein occlusions were not included as the site of obstruction was often on the optic disc and unsuitable for analysis. Each patient had a clinical examination, colour fundus photography, and retinal fluorescein angiography at the first examination, and at each subsequent visit.

The interval between the presumed onset of the occlusion (onset of symptoms) and the initial fluorescein angiograms varied from 2 days to 6 months (mean 10 weeks). Fluorescein angiograms of each patient were analysed for evidence of venous and arterial obstruction at the apex of the involved retinal segment.

Findings

(1) *Focal vascular obstruction*

(A) VENOUS OBSTRUCTION

In 62 cases venous obstruction occurred at an arterio-venous crossing. Delayed filling or emptying of the peripheral portion of the obstructed vein occurred in all of them. 23 (37 per cent.) showed complete focal venous obstruction (Fig. 8, see p. 552) and 39 (63 per cent.) showed significant narrowing of the fluorescein column at the crossing (Figs 1, 2, 3, and 5).

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In the three remaining patients the occlusion occurred where the artery and vein were adjacent and in two of these venous obstruction was incomplete.

(B) ARTERIAL OBSTRUCTION

Three patients showed slight focal narrowing of the arterial fluorescein column at the arteriovenous crossing (Fig. 8). Arteriolar filling was not delayed in the involved retinal sectors compared to the uninvolved sectors. In two the venous occlusion was complete and the third showed a partial occlusion.

(2) Focal fluorescein leakage

This was recorded at, or adjacent to, the site of venous obstruction in ten of the 65 patients (table), but the obstruction was complete in only one of them.

Leakage was seen only in cases of recent onset. Of 22 patients who were seen within 6 weeks of the onset of symptoms nine had focal dye leakage. Leakage was observed as early as 2 days, and as late as 8 weeks after the onset of symptoms (Table), and resolution occurred as early as 6 weeks from the onset (Fig. 3, Case 2).

Table Summary of findings in ten patients with focal venous fluorescein leakage

Case no.	Age (yrs)	Type of obstruction	Site of focal fluorescein leakage	Interval from onset to focal leak (days)	Interval from onset to observed resolution (wks)
2	47	R Incomplete inferior macular	Proximal to A/V crossing in occluded vein	7	6
19	58	R Incomplete inferior peripheral	Proximal to A/V crossing overlying main vein	8	16
31	60	R Complete inferior temporal	Distal to crossing in occluded vein	2	14
46	65	L Incomplete superior temporal	At A/V crossing in occluded vein	4	6½
50	59	R Incomplete superior temporal	At A/V crossing in occluded vein	21; 49	16
60	45	R Incomplete superior temporal	At A/V crossing in occluded vein	12	8
73	68	R Incomplete superior temporal	At A/V crossing in occluded vein	3	20
105	54	R Incomplete inferior temporal	At A/V crossing in occluded vein	20	9
131	65	L Incomplete inferior temporal	Proximal to A/V crossing in occluded vein	25	7
136	56	R Incomplete superior temporal	At A/V crossing in occluded vein	7	13

A/V = arterio-venous

The patterns of leakage varied with the positions of artery and vein at the crossing. Six patients showed focal hyperfluorescence at the crossing (Figs 6, 7), in three leakage was proximal (Figs 1, 2) and in one distal to the crossing and the site of obstruction.

Focal leakage was recorded during the venous phase of the angiograms and persisted, fluorescing brightly, as the concentration of dye faded.

Colour photographs, taken at the initial examination showed a small area of perivenous pallor corresponding to the hyperfluorescence seen on angiography.

The following cases illustrate some of the angiographic characteristics of the focal leakage:

Case 2, a 47-year-old hypertensive woman, had a 7-day history of blurred vision affecting the right eye.

Examination

There was an inferior macular branch vein occlusion with retinal haemorrhages and oedema in the drainage area of the occluded vein. On the proximal side of the arterio-venous crossing there was a focal spot of retinal pallor. Focal dye leakage corresponded exactly to the focal retinal pallor (Figs 1, 2).

FIG. 1 Case 2. 7 days after onset of occlusion. Venous phase. Arrow indicates focal venous fluorescein leakage proximal to arterio-venous crossing.

FIG. 2 Case 2. (2 minute frame). Intensified focal hyperfluorescence (Cf. Fig. 1).

Result

After 5 weeks the focal dye leakage had resolved though narrowing of the venous fluorescein column persisted at the crossing (Fig. 3).

Case 19, a 58-year-old woman, had an 8-week history of blurred vision affecting the right eye.

Examination

There was an inferior temporal branch vein occlusion, with focal hyperfluorescence overlying the main inferior temporal trunk vein (Fig. 4).

FIG. 3 Case 2. 6 weeks after onset of occlusion. (2 minute frame). Focal leakage has resolved (Cf. Fig. 2).

Result

After 8 weeks the leakage had resolved and it could be seen that it had come from the short proximal stump of the occluded vessel which entered the superficial surface of the trunk vein after overlying it (Fig. 5).

FIG. 4 Case 19. 8 weeks after onset of occlusion. Focal venous fluorescein leakage overlies main vein.

FIG. 5 Case 19. 16 weeks after onset of occlusion. Late venous phase. Proximal stump of obstructed branch vein overlies main vein. Focal venous leakage has resolved.

Case 46, a 46-year-old hypertensive man, had a 4-day history of blurred vision affecting the left eye.

Examination

There was an incomplete superior temporal retinal branch vein occlusion. At the site of venous obstruction the superior temporal artery overlay the vein. Focal fluorescein leakage occurred from the vein on either side of the crossing (Fig. 6).

Case 50, a 50-year-old woman, experienced sudden blurring of the vision of the right eye 3 weeks before.

FIG. 6 Case 46. 4 days after occlusion. Late venous phase. Arrow indicates two foci of hyperfluorescence where artery overlies obstructed vein.

Examination

There was an incomplete superior temporal retinal branch vein occlusion in the right eye. Retinal fluorescein angiography showed a bright focus of hyperfluorescence at the arterio-venous crossing where the obstructed vein overlay the artery. Venous narrowing was not a prominent feature in this case but the distal vein was engorged and there were numerous dilated fine preferential channels to the right of the crossing (Fig. 7).

FIG. 7 Case 50. 3 weeks after occlusion. Late venous phase. Arrow indicates focal hyperfluorescence where obstructed vein lies superficial to artery.

FIG. 8 Case 90. Complete branch vein occlusion 9 days after onset. Late venous phase. Arrow indicates complete venous obstruction with slight focal arteriolar narrowing. Slow granular flow is maintained in distal part of occluded vein by numerous fine preferential channels above occlusion.

Discussion

The frequency of complete obstruction (in 23 of the 65 patients in this series) differs from the findings of other workers. Paton and others (1964) showed prompt passage of the fluorescein dye through recent branch vein occlusions. Witmer (1971) also reported that the vein in such cases is rarely completely blocked, so that a good but slow circulation

persists in the vein. The histological evidence of Rabinowicz and others (1968), however, agrees with our findings.

The phenomenon of focal fluorescein leakage may be due to morphological changes in the vein wall similar to those reported in patients with very recent occlusions by Seitz (1964), who had the opportunity to examine clinically, and within a few hours histologically, two cases of "prethrombosis" and one recent branch vein occlusion.

Prethrombosis (Bonnet, 1951) probably represents the earliest changes in the evolution of branch vein occlusion.

The correlation between the focal venous leakage found in the present study and the histological evidence of Seitz (1964) suggests that the venous obstruction may be initiated by focal swelling of the endothelium and tissues of the deep vein wall, rather than by thrombosis as suggested by Moore (1924), Koyanagi (1928), and Jensen (1936).

It is interesting that the endothelial changes leading to obstruction of the central retinal vein described by Klien (1953) and Klien and Olwin (1956) show similarities to those in branch vein occlusion. They commented on the prevalence of intimal changes causing venous obstruction in contrast to other less common pathogenetic mechanisms, *i.e.* periphlebitis, stagnation thrombosis, and pressure from without.

In the present series there was no evidence of cells in the vitreous at the site of focal fluorescein leakage. It therefore seems unlikely that periphlebitis was a significant cause of venous obstruction in this group of branch vein occlusions. Decreased arterial perfusion, perhaps even of a transient nature, cannot be entirely excluded as a factor contributing to the onset of venous obstruction. In the three patients showing focal arteriolar narrowing, no significant delay of arteriolar filling in the involved quadrants was seen. Gass (1968) has made similar observations. Delays in arterial perfusion of less than 1 second would not necessarily be recorded on the fluorescein angiograms in this study. The significance of segmental arterial changes will be the subject of a separate report.

The role of the arterio-venous crossing in the evolution of branch vein occlusion has been the subject of much discussion (Gunn, 1892; Raehlmann, 1902; Koyanagi, 1936; Ennema and Zeeman, 1953; Seitz, 1964). Certainly venous obstruction commonly occurs at arterio-venous crossings as shown in the present study. Direct venous compression by the artery at the crossing was not observed histologically (Seitz, 1964) but may conceivably occur during life, if alterations of arterial calibre take place within the shared indistensible perivascular sheath.

Summary

This report describes structural and functional vascular changes at the site of obstruction in 65 patients with retinal branch vein occlusion. Complete venous obstruction was recorded by retinal fluorescein angiography in 23 of the 65 patients, and the remaining 42 showed definite but incomplete venous obstruction. Arteriolar changes at the site of venous obstruction were relatively insignificant. Focal leakage from the vein at the site of obstruction was observed in ten early cases. This leakage may be due to focal loosening of the deep vein wall. The role of the factors contributing to the venous obstruction are discussed.

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