Original Article

Anatomic pattern of arteriovenous crossings in branch retinal vein occlusion

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Abstract

Objective: To determine the relative position of the two vessels at the site of venous obstruction, as it facilitates Arteriovenous adventitial sheathotomy and to look for the associated diseases with branch retinal vein occlusion (BRVO) so as to create more awareness among the masses.

Methods: It was a case series carried out at the Ophthalmology out-patient department of Ziauddin University Hospital Karachi, Pakistan, from April 2005 to March 2006. The diagnosis of BRVO was made on the clinical basis. The fundus was photographed for confirmation and record purpose. The relative anatomic position of artery and vein at the site of occlusion, and the quadrant of occlusion were recorded. The associated diseases with BRVO were also identified.

Results: Seventy patients were enrolled in the study. Forty nine were males and twenty one were females. Mean age of the male group was 51.5+ 8 years Mean age of the female group was 49.4+ 8.5 years. In all, there were seventy-two eyes with branch retinal vein occlusion. In seven eyes the relevant position of the artery and vein could not be ascertained. In 63 eyes (96.9%) the artery was anterior to the vein, and in the remaining 2 eyes (3.1%) the vein was anterior to the artery. There was a greater number of superotemporal occlusions as compared to inferotemporal occlusions. Fifty seven (81.4%) cases had associated hypertension, two (2.85%) had diabetes, seven (10%) had diabetes and hypertension, and four (5.7%) had no associated diseases. Fellow eyes were compared with the vein occlusion sites and the vein occlusion eyes. The differences were statistically significant (p.001), with a greater prevalence of arterial over crossings in the affected eye.

Conclusions: The study shows that artery lies anterior to the vein in almost all cases of BRVO. The study shows that more hypertensives present with BRVO as compared with diabetics and diabetics cum hypertensives (JPMA 58:233;2008).

Introduction

The retina is a light sensitive layer that lines the inner wall of the eye ball. The retinal blood vessels enter the eye ball at the optic disc and branch in a complex pattern to serve the metabolic needs of the inner retina.[1] Small veins, within the retina (branch veins) drain blood from the retina to a large central vein which drains blood out of the eye. Occasionally an artery compresses the underlying vein making it difficult for blood to exit the eye. This blockage called retinal vein occlusion (RVO) causes the vein to dilate and leak fluid and blood.

Branch retinal vein occlusion (BRVO) is the second most common vascular disorder of the retina and usually leads to some degree of visual loss due to intra-retinal haemorrhage, macular oedema or secondary neovascularisation[2,3] BRVO occurs at an arteriovenous crossing where the artery passes anterior to the vein[4,5] and is predisposed by various systemic and local factors.[6,7] It was first described as a clinical entity by Leber in 1877 since then there has been no disagreement as to the ophthalmoscopic picture of patients with this disorder. A greater proportion of arterial over crossings were found in eyes with branch retinal vein occlusions (77.7%) compared to fellow eyes (70.6%) or control eyes (67.0%).[3] It was seen that crossings at which a vein crossed over an artery were not an uncommon finding (22.3% to 33.0% of crossings), but were rare at the crossings where branch retinal vein

occlusions were found (2.4%).[3] This data indicates that arterial over crossings are at relatively higher risk of branch retinal vein occlusion than venous over crossings, and that the risk of branch vein occlusion in an eye is proportional to the number of arterial over crossings in the eye. To the best of our knowledge, such studies are available in our country. Histological studies suggest that, at the site of a crossing, a common adventitia binds the artery and vein[8] the thickened and rigid arteriosclerotic arterial wall compresses the vein, resulting in turbulence of blood flow and endothelial cell damage, which could lead to thrombus formation and vein occlusion.[9] The adventitial sheath that surrounds the retinal venule and arteriole at the crossing site plays a crucial role in branch retinal vein occlusion. Cutting the common adventitial sheath[10] at arteriovenous crossings may relieve pressure exerted by the artery on the vein. This technique could be effective for improving the delay in perfusion in the affected venule. This delicate surgical dissection[11,12] is facilitated by the knowledge that the thicker walled artery is anteriorly situated or posteriorly placed at the site of occlusion. Hence the surgeon is less apt to damage the thicker walled artery during manipulation. Literature search has shown that hypertension is significantly more prevalent in cases of BRVO.[13]

Hence the objective of the study was to determine the relative position of the two vessels at the site of venous obstruction, as it facilitates Arteriovenous adventitial sheathotomy and to look for the associated diseases with BRVO so as to create more awareness among the masses.

Patients and Methods

It was a case series conducted at the ophthalmology out-patient department of Ziauddin University Hospital from April 2005 to March 2006.Patients above 40 years of age with branch retinal vein occlusion were recruited in the study. The diagnosis of branch retinal vein occlusion was established on the basis of clinical presentation and fundus appearance. Patients were excluded if the crossing site of occlusion could not be visualized because of extensive haemorrhage, poor quality photographs, multiple crossings of vessels in the region of occluded crossing, intermediate or posterior inflammatory disease, occlusion with extensive neovascularization or collateral vessels and retinal haemorrhage due to vasculitis.

Patients who consented to participate in the study were included. All the photographs of the cases included were studied for arteriovenous crossings within three disc diameter of the edge of the optic disc.

Following Parameters were measured:

Total number of the crossings (vein anterior and vein posterior) in right and left eyes, relative position of crossing artery and vein at each crossing of occlusion site, the quadrant of occlusion and any associated disease.

Fluorescein angiograms were used only in those cases where ophthalmoscopy was not conclusive and decision regarding application of laser was controversial. The FFA helped in reading A-V crossings. Analysis of data was done by MS Excel and Statistical Package for Social Sciences, version 10. The study was approved by the ethical committee of Ziauddin University.

Results

Seventy patients completed the study. Of them forty-nine were males twenty-one were females. Mean age of the male group was 51.5 ± 8.1 years. Mean age of the female group was 49.4 ± 8.5 years. In forty four (62.8%) cases, the right eye was involved, and twenty four (34.2%) cases had left eye involvement (Table1). The greater incidence of right eye involvement in our study could not be explained. Two (2.9%) cases had both eyes affected (Table1). Forty two cases had Superotemporal BRVO, and twenty eight cases had inferotemporal BRVO. Superonasal and inferonasal occlusions were not observed. (Table I). There were a greater number of Superotemporal occlusions as compared to inferotemporal occlusions.

In all, there were seventy-two eyes with branch retinal vein occlusion. Two branch retinal vein occlusion eyes had the vein anterior at the site of occlusion. In seven eyes the position of the vein could not be determined. In sixty three eyes the vein was posteriorly placed. It was observed that there was a greater placement of the vein at posterior position at the site of occlusion.

Table 1. Characteristics of patients with branch retinal vein occlusion (n=70).

Characteristics	N (%)
Unilateral	68 (97%)
Right	44 (62.8%)
Left	24 (34.2%)
Bilateral	2 (2.85%)
Gender	
Male	49 (70%)
Female	21 (30%)
Age (years)	
40-49	25 (35.7%)
50-59	33 (47.1%)
60 & above	12 (17.1%)
Location of BRVO	
Superotemporal	44 (60%)
Inferotemporal	28 (40%)

N = Number of subjects

Table 2. Position of the vein in relation to the artery in affected and fellow eye.

	Number of eyes	Affected Eye		Fellow Eye	
		Vein Anterior	Vein Posterior	Vein Anterior	Vein Posterior
		No of crossings	No of crossings	No of crossings	No of crossings
Right	44	53	127	72	107
Left	24	33	70	35	57

Vein anterior fellow left eye v/s affected right eye = $p < 0.37$
Vein anterior fellow right eye v/s affected left eye = $p < 0.13$
Vein posterior affected left eye v/s fellow right eye = $p < 0.014$*
Vein posterior affected right eye v/s fellow left eye = $p < 0.5$

Table 3. Comparison of features of arteriovenous crossings.

	Eyes	Determinable Crossings	Arterial Overcrossings	Venous Overcrossings
			N (%)	N (%)
BRVO Sites	72	65	63 (96.1%)	2 (3.1%)
BRVO Eyes	72	283	197 (69.6%)	86 (30.4%)
FELLOW Eyes	68	271	164 (60.5%)	107 (39.4%)

BRVO sites v/s fellow eyes ($p<0.05$)
BRVO eyes v/s fellow eyes ($p<0.05$)

Number of crossings in the right affected eyes was 180, out of which in 127 cases the vein was posterior and in 53 cases it was anterior. Fellow unaffected left eye had 179 crossings, out of which in 107 cases the vein was posterior and in 72 cases it was anterior. In left affected eyes, 103 crossings were present, out of which in 33 cases the vein was anterior and in 70 cases it was posterior. Its fellow unaffected right eye showed 92 crossings, of which in 35 cases the vein was anterior and in 57 cases it was posterior (Table 2).

In the fellow eyes, of the 271crossings counted, 164(60.2%) were arterial over crossings and 107(39.8%) were venous over crossings. Test of proportion (chi-square) was applied to compare fellow eyes with the vein occlusion sites and the vein occlusion eyes. The differences were statistically significant, with a greater prevalence of arterial over crossings in the affected eyes. Arterial over crossings were considerably less in fellow eyes compared to BRVO sites and BRVO eyes (Table 3)..

Fifty seven (81.4%) cases had associated hypertension, two (2.85%) had diabetes, seven (10%) had diabetes and hypertension, and four (5.7%) had no associated diseases.

The study seems to show that more hypertensives present with BRVO as compared with diabetics and diabetics cum hypertensives. But the above inference cannot be made with certainity because the study includes a very small number of cases.

Discussion

Obstruction of a branch retinal vein is one of the most common retinal vascular problems encountered in ophthalmology. It is typically seen in middle aged or older individuals.[14] Our study showed a similar trend, however we could not generalize which age group was more prone to BRVO because our study population was less. The number of female patients was less than males. It could be either because of less disease in the females, or because of the decreased turnout of females. The slight male preponderance was also reported in other studies[14] but the reason has not been explained. Bilateral occurrence of the retinal venous occlusive disease is uncommon.[15] There were two cases of bilateral BRVO in our study who also had associated hypertension. A relationship could not be ascertained between hypertension and bilateral BRVO. In all, there were seventy two cases of which, forty four had Superotemporal occlusion and twenty eight had inferotemporal occlusion. Occlusion in nasal quadrant was not observed. The pattern of occlusions that was noticed in our cases was similar to that reported in the literature.[16] The greater preponderance of Superotemporal occlusions has been related by Jensen (1936) to the greater number of crossings in the Superotemporal quadrant than in the inferotemporal quadrant.[17] Another possible explanation for Superotemporal occlusion to present early could be that they affect the vision.[18,19] The risk of BRVO at each vein posterior crossing is approximately 12 times higher than each vein anterior crossing.[20] In our study seventy two eyes were affected with BRVO. Of them, sixty-three showed the vein to be posterior at the site of occlusion. At two crossings the vein was anterior at the site of occlusion. At seven crossings position of the vein could not be determined. The frequency of venous over crossings increased from the involved eye to the fellow eye and from fellow eye to control eye.[3] Our study found the same trend of venous crossings in involved and fellow eye. Involved eyes had 86 (30.4%) venous over crossings out of 283. In fellow eyes there were 107 (39.4%) out of 271 crossings. The numbers of venous over crossings were higher in fellow eyes as compared to the involved eyes. Less number of high risk crossings will decrease the risk of occlusion. Arterial ovecrossings are at high risk of BRVO than venous over crossings.[3] Our study showed 197 (69.6%) arterial ovecrossings out of 283 in involved eyes and 164 (60.5%) out of 271 crossings in fellow eye A greater proportion of vein posterior crossings in eyes with BRVO compared to fellow eye were seen.

The association of the retinal vein occlusion with other systemic diseases like hypertension, diabetes mellitus and others has been well documented. With the

increase in number of persons being affected from these disorders, patients with retinal vein obstruction are also increasing.[21] Our study showed fifty seven (81.4%) BRVO patients with hypertension two (2.9%) with diabetes and seven (10%) with both diabetes and hypertension. Four (5.7%) had no disease. This finding is consistent with various case series[19] which have reported rates of systemic hypertension among cases of BRVO ranging from 55% to 75%. The study seems to show that more hypertensives present with BRVO as compared to diabetics and diabetics cum hypertensives. But the above inference cannot be made with certainity because the study includes a very small number of patients.

Conclusion

The study showed that in BRVO at the site of occlusion, the artery is anterior to vein more often than would be predicted by chance alone. More hypertensives present with BRVO as compared to diabetics and diabetics cum hypertensives. The high association of various systemic disorders, especially hypertension, further supports the need of early and periodic eye examination for subjects with hypertension.

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