A Discussion of Central Retinal Vein Occlusion and Axial Length

William H Morgan
McCusker Glaucoma Centre, Lions Eye Institute, University of Western Australia, Nedlands, Australia

In this issue of Asian Journal of OPHTHALMOLOGY, there are 2 fascinating studies of the relationship between retinal venous occlusion and axial length. The article by Mehdizadeh et al concluded that the axial length in branch and central retinal vein occlusion (BRVO and CRVO) was shorter than that in a control group.[1] However, the work by Mirshahi et al was case-control in design and suggested that the axial length in the CRVO group was no different from that in a control group.[2] We are thus placed in the interesting position of making some sense of these differing conclusions.

CRVO is a cause of devastating visual loss with a 5-year incidence of 0.2% in the older age group.[3] The landmark study of risk factors for CRVO was a case-control study examining 258 patients with CRVO and 1142 carefully matched controls.[4] The authors found controls who matched the patients for point of entry into the specialty or general clinic, as well as roughly matching the age, race, and sex. The major risk factors identified were elevated intraocular pressure (IOP), glaucoma history, and elevated blood pressure.

The selection of controls for a case-control study is never easy. Finding the controls can be more difficult than the patients because one needs to select controls matched for characteristics that may be associated with the variable(s) under investigation. Mehdizadeh's group used 18 controls taken from a cataract assessment clinic having measurements for intraocular lens calculation. The mean age was 64 years and the mean axial length was 23.77 mm.[1] A recent study examining the relationship between age and axial length in American patients undergoing cataract surgery demonstrated a longer axial length in younger patients, with a mean axial length of 24.1 mm in the 60- to 70-year-old patients.[5] Additionally, patients with any degree of myopia are more likely to undergo cataract surgery than those with emmetropia or hyperopia.[6] Hence, it is possible that the inclusion of patients undergoing cataract surgery induced an axial length bias, which may also account for some of the axial length difference in the control groups from the 2 articles (23.11 mm vs 23.77 mm).

As both authors say, there is some evidence of a relationship between refractive error and CRVO, but this is also contentious and the results of studies are inconsistent.[4] If we suppose that a relationship between axial length and CRVO does exist, then we need to ask how this could be so. There is a relationship between optic disc size and axial length.[7] However, there is no proven relationship between optic disc size and CRVO.[8] There is a relationship between glaucoma, IOP, and myopia,[9] which could explain some of any relationship between axial length and CRVO.

Of all the putative factors possibly implicated with CRVO, glaucoma and elevated IOP have the greatest odds ratio.[4] Spontaneous venous pulsation is less frequent in glaucoma, and a greater ophthalmo-dynametric force is required for its induction with more severe field loss.[10,11] The latter is a likely index of venous resistance along the hemi- and central retinal veins in the optic nerve head region,[12] the implication being that this segment of retinal vein may narrow in glaucoma. Why this should occur is not clear. However, we do know that the pressure gradient along the central retinal vein in the lamina cribrosa region may be high,[13,14] and with lamina thinning from glaucoma,[15] will rise further. This may lead to elevated shear stress within the vein and result in endothelial cell proliferation and change,[16] with resultant luminal narrowing. This is supported by histological evidence of endothelial cell proliferation from patients with CRVO.[17] Histopathological studies of CRVO have usually examined eyes removed due to neovascular glaucoma, and so one cannot be certain what changes occurred leading up to the venous occlusion, at the time of the occlusion, or as a neovascular sequela.

Sadly, our ability to treat CRVO and BRVO is very weak. It is difficult to know the place for direct optic disc surgery at present.[18] Laser anastomotic techniques are currently being trialled and may prove useful for certain forms of CRVO.[19] Unfortunately, current laser photocoagulation therapy for prevention of neovascular glaucoma often does not work.[20] Further investigation of risk factors predictive of CRVO and BRVO is certainly warranted. The links between CRVO, retinal vascular changes, and glaucoma, including the other vascular features of glaucoma such as optic disc rim haemorrhages and venous collaterals, deserve more study.[17]

References

1. Mehdizadeh M, Ghassemifar V, Ashraf H, Mehryar M. Relationship between retinal vein occlusion and axial length of the eye. Asian J Ophthalmol 2005;7:146-148.
2. Mirshahi A, Moghimi S, Rajabi MT. Central retinal vein occlusion: role of axial length. Asian J Ophthalmol 2005;7:149-151.
3. Klein R, Klein BE, Moss SE, Meuer SM.

The epidemiology of retinal vein occlusion: the Beaver Dam Eye Study. Trans Am Ophthalmol Soc 2000;98:133-141.
4. The Eye Disease Case-Control Study Group. Risk factors for central retinal vein occlusion. Arch Ophthalmol 1996;111:545-554.
5. Tuft SJ, Bunce C. Axial length and age at cataract surgery. J Cataract Refract Surg 2004;30:1045-1048.
6. Younan C, Mitchell P, Cumming RG, Rochtchina E, Wang JJ. Myopia and incident cataract and cataract surgery: The Blue Mountains Eye Study. Invest Ophthalmol Vis Sci 2002;43:3625-3632.
7. Rudnicka AR, Frost C, Owen CG, Edgar DF. Nonlinear behavior of certain optic nerve head parameters and their determinants in normal subjects. Ophthalmology 2001;108:2358-2368.
8. Mansour AM, Walsh JB, Henkind P. Optic disc size in central retinal vein occlusion. Ophthalmology 1990;97:165-166.
9. Wong TT, Klein BEK, Klein R, et al. Refractive errors, intraocular pressure, and glaucoma in a white population. Ophthalmology 2003;110:211-217.
10. Jonas JB. Central retinal artery and vein collapse pressure in eyes with open angle glaucoma. Br J Ophthalmol 2003;87: 949-951.
11. Morgan WH, Hazelton ML, Azar SL, et al. Retinal venous pulsation in glaucoma and glaucoma suspects. Opthalmology 2004; 111:1489-1494.
12. Morgan WH, Balaratnasingam C, Hazelton ML, House PH, Cringle SJ, Yu DY. The force required to induce hemivein pulsation is associated with the site of maximal field loss in glaucoma. Invest Ophthalmol Vis Sci 2005;46:1307-1312.
13. Morgan WH, Yu DY, Alder VA, et al. The correlation between cerebrospinal fluid pressure and retrolaminar tissue pressure. Invest Ophthalmol Vis Sci 1998;39: 1419-1428.
14. Morgan WH, Yu DY, Cooper RL, Alder VA, Cringle SJ, Constable IJ. Retinal artery and vein pressures in the dog and their relationship to aortic, intraocular, and cerebrospinal fluid pressure. Microvasc Res 1997;53:211-221.
15. Jonas JB, Berenshtein E, Holbach L. Anatomic relationship between lamina cribrosa, intraocular space, and cerebrospinal fluid space. Invest Ophthalmol Vis Sci 2003;44:5189-5195.
16. DePaola N, Gimbrone MA, Davies PF, Dewey CF. Vascular endothelium responds to fluid shear stress gradients. Arterioscler Thromb 1992;12:1254-1257.
17. Green W, Chan CC, Hutchins GM, Terry JM. Central retinal vein occlusion: a prospective histopathologic study of 29 eyes in 28 cases. Trans Am Ophthalmol Soc 1981;79:371-422.
18. Martinez-Jardon CS, Meza-de Regil A, Dalma-Weiszhausz J, et al. Radial optic neurotomy for ischaemic central vein occlusion. Br J Ophthalmol 2005;89: 558-561.
19. McAllister IL, Douglas JP, Constable IJ, Yu DY. Laser-induced chorioretinal venous anastomosis for nonischemic central retinal vein occlusion: evaluation of the complications and their risk factors. Am J Ophthalmol 1998;126:219-229.
20. Hayreh SS, Klugman MR, Podhajsky P, Servais GE, Perkins ES. Argon laser panretinal photocoagulation in ischemic central retinal vein occlusion. A 10-year prospective study. Graefes Arch Clin Exp Ophthalmol 1990;228:281-296.

Address for Correspondence

Dr William H Morgan
McCusker Glaucoma Centre
Lions Eye Institute
University of Western Australia
2 Verdun St
Nedlands, WA
Australia, 6009
E-mail: whmorgan@cyllene.uwa.edu.au

With Grateful Thanks

The members of the Editorial Board of Asian Journal of OPHTHALMOLOGY wish to express their gratitude to the following individuals for their invaluable input as reviewers of articles submitted to the Journal in 2005.

Dr Shantha Amrith
Dr Muna Bhende
Dr Helen V Danesh-Meyer
Dr Gus Gazzard
Dr Raf Ghabrial
Dr Stuart Graham
Dr Santosh Honavar
Dr Alex P Hunyor
Dr Patricia Khu
Dr Sao Bing Lee
Dr Edgar Leuenberger
Dr Kenneth Li
Dr Seng Chee Loon
Dr Rajat Maheshwari
Dr Michael Munoz
Dr Gerard Nah
Dr Rajul Parikh
Dr Vilavun Puangsricharern
Dr Jovina See
Dr Santiago Antonio B Sibayan
Dr Mandeep Singh
Dr James Smith
Dr Gangadhara Sundar
Dr Anna Tan
Dr Clement Tan
Dr Clement Tham
Dr Lennard Theane
Dr Ravi Thomas
Dr Wasee Tulvatana
Dr Joseph Anthony J Tumbocon
Dr Marissa Valbuena
Dr. Sharadini Vyas
Dr Mark Walland
Dr Jenn Chyuan Wang
Dr Inez Wong
Dr Mario Yatco
Dr Leonard Yip