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Sir,

**Reply: 'A review of central retinal artery occlusion:
clinical presentation and management'**

We thank Dr Jacobs¹ for drawing attention to the work showing 'persistence' of retinal tissue viability post central retinal artery occlusion (CRAO)^{2–4} and to the studies by Kottow and Hendrickson⁵ and Brown⁶ demonstrating retinal viability post CRAO as a result of ocular neovascularisation.

The pioneering studies by Hayreh *et al*⁷ in monkeys with direct occlusion showed that if the degree of central retinal artery occlusion can be reversed before 97 min, then there is retinal tissue viability, as evidenced by normalisation of the electroretinogram. However, the degree of electroretinogram recovery declines thereafter. The issue of the true retinal tolerance time where there is no viable return of function is still not known. A CRAO resembles an ischaemic cerebral vascular event since 'time is tissue'. Therefore, we respectfully disagree that there is persistence of retinal tissue viability.

Neovascularisation is a process of unregulated and misguided growth of new vessels in the eye.⁸ Many variables affect neovascularisation, including the extent of ischaemia. Thus, the time to ocular neovascularisation onset ranges from 2 weeks to 4 months post CRAO.⁸ Ocular neovascularisation is principally due to chronic retinal ischaemia and multiple mediators. Vascular endothelial growth factor (VEGF) is highly implicated in its pathogenesis.⁸

Neovascularisation in the eye is a maladaptive process occurring in ischaemic penumbral retinal tissue from events such as CRAO or ischaemic diabetic retinopathy, when there is insufficient blood supply to the retina. Neovascularisation results in an increased tendency to bleed, resulting in vitreous haemorrhage. If neovascularisation of the iris and angle occurs, this can result in neovascular glaucoma (NVG) with acute rise in intraocular pressure causing congestion and pain.

We showed a clear empirical correlation between thromboembolic CRAO and ocular neovascularisation.⁸ The overall rate of neovascularisation in our cohort was

18.2%, consistent with most other studies. In the majority of neovascularisation cases there were no clinical features of ocular ischaemia and no association with a haemodynamically significant stenosis of the carotid artery. Given the association between neovascularisation and CRAO, it is prudent to review all patients with acute CRAO at regular intervals as early as 2 weeks and up to 4 months post CRAO.

Conflict of interest

The authors declare no conflict of interest.

References

- Jacobs N. Concerning central retinal artery occlusion (CRAO) and cerebral stroke. *Eye* 2014; **28**: 1269–1270.
- Varma DD, Cugati S, Lee AW, Chen CS. A review of central retinal artery occlusion: clinical presentation and management. *Eye* 2013; **27**: 688–697.
- Jacobs NA, Trew DR. Occlusion of the central retinal artery and ocular neovascularization: an indirect association? *Eye* 1992; **6**: 599–602.
- McLeod D. Letter to the editor: partial central retinal artery occlusion offers a unique insight into the ischemic penumbra. *Clin Ophthalmol* 2012; **6**: 9–22.
- Kottow M, Hendrickson P. Iris angiographic findings in retinal arterial occlusions. *Can J Ophthalmol* 1974; **9**: 435–443.
- Brown GC. Isolated central retinal artery obstruction in association with ocular neovascularization. *Am J Ophthalmol* 1983; **96**: 10–11.
- Hayreh SS, Zimmerman MB, Kimura A, Sanon A. Central retinal artery occlusion. Retinal survival time. *Exp Eye Res* 2004; **78**: 723–736.
- Rudkin AK, Lee AW, Chen CS. Ocular neovascularization following central retinal artery occlusion: prevalence and timing of onset. *Eur J Ophthalmol* 2010; **20**: 1042–1046.

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