Acute macular neuroretinopathy following COVID-19 infection
Luke Hawley, Louis S Han

ABSTRACT
COVID-19 is a global pandemic with over 600 million cases worldwide and over 1.7 million cases in New Zealand to date. The most recent spread of Omicron variant saw widespread infection across the country that was unable to be controlled like the initial Alpha or Delta variants. There is limited information on ocular complications of COVID 19. In our case, there was a close relationship between time of COVID-19 infection and acute visual changes including ongoing scotomas (blind spots). This report explores a case of a young female with positive visual phenomena following COVID-19 infection, with the diagnosis of acute macula neuroretinopathy.

Case report
A 21-year-old female student, with no previous medical background, presented to the acute ophthalmology clinic at Dunedin Public Hospital. Her primary concern was sudden onset visual changes. These changes included several small, bilateral paracentral scotomas (blind spots), as well as floaters and palinopsia (abnormal persistence of image once the subject has moved).

The only relevant past medical history was a recent COVID-19 infection that preceded the symptoms by two days. Due to the stability of the patient's visual acuity and no secondary symptoms, it was deemed appropriate for daily phone consultations while the patient completed her isolation period, before presenting for a full ophthalmic examination.

At the time of examination, the patient's visual acuity was 6/6 bilaterally with no relative afferent pupillary defect. Optic nerve function remained intact and colour vision was unaffected. The ocular exam showed no signs of intraocular inflammation; however, dilated fundal exam showed areas of change within the maculae. Several discrete, reddish-brown ellipsoid lesions were seen. Optical coherence tomography (OCT) was obtained which showed heterogenous, hyper-reflective thickening of the outer retina with corresponding areas of hypo-reflectivity on infrared imaging.

The working diagnosis was acute macular neuroretinopathy likely secondary to COVID-19 infection. Daily monitoring of the patient showed slow resolution of symptoms and the fundal lesions with no intervention required.

Discussion
Acute macular neuroretinopathy (AMN) is a rare disease that typically presents with unilateral central vision loss, most commonly affecting young women in their reproductive years. Acute macular neuroretinopathy is often associated with a non-specific flu-like illness. There have been documented cases associated with influenza, cytomegalovirus and more recently COVID-19. The pathophysiology is still not completely understood, although it is agreed there is a primary inflammatory component.

Clinically, there can be an associated exudative detachment of the macula with a thickening of the underlying retinal pigment epithelium. These wedge-shaped lesions are typically reddish-brown on ophthalmoscopy and fade over time.
Infrared imaging of these lesions shows hypo-reflectivity corresponding to the structural changes in the outer retina.\(^7\)

Importantly, in this case there was a close association between the time of testing positive for COVID-19 and the onset of symptoms. Therefore, although it cannot be confirmed, it is likely that the immune-mediated reaction caused by active infection is correlated to the presentation of acute macular neuroretinopathy. Furthermore, there has been documented cases overseas of acute macular retinopathy following COVID-19 vaccinations\(^8\) as well as two cases shortly after having the influenza vaccine\(^9,10\).

New Zealand has been a world leader in reducing the numbers of COVID-19 cases and complications related to COVID-19. However, with the new Omicron variant currently spreading throughout the country, it is important that we are aware of rare but potentially severe complications. Acute macular neuroretinopathy can have persistent long-term scotomas and hence input from ophthalmology services would be recommended when patients present with visual changes after recent COVID-19 infections or vaccinations.

**Figure 1:** Optical coherence tomography of both eyes with an infrared image showing the heterogenous, hyper-reflective change in the outer retina at the junction of the outer plexiform and outer nuclear layers, as indicated by the red circles. These areas are seen as dark, hypo-reflective patches in the infrared images.
COMPETING INTERESTS
There are no competing interests to declare. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

ACKNOWLEDGEMENTS
We would like to thank our patient who has provided written consent for medical information to be published in this manuscript.

AUTHOR INFORMATION
Dr Luke Hawley: Non-Training Registrar, Department of Ophthalmology, Dunedin Public Hospital, Southern District Health Board, New Zealand.
Dr Louis S Han: Registrar, Department of Ophthalmology, Dunedin Public Hospital, Southern District Health Board, New Zealand.

CORRESPONDING AUTHOR
Dr Luke Hawley MBChB, BSc: Department of Ophthalmology, Dunedin Public Hospital, Southern District Health Board, 201 Great King Street, Central Dunedin, Dunedin 9016 New Zealand.
E: Lhaw026@aucklanduni.ac.nz

REFERENCES