Review Immun Inflamm Dis. 2022 Jun;10(6):e619. doi: 10.1002/iid3.619.

Retinal microvascular impairment in COVID-19 patients: A meta-analysis

Suzhen Wang [1], Jie Wang [2], Jianbin Hu [2], Ningli Wang [1]

Affiliations expand

PMID: 35634955 PMCID: PMC9091999 DOI: 10.1002/iid3.619

Abstract

Background: The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to a global pandemic in an unprecedented time frame. Systemic vascular involvement in COVID-19 has been identified, and SARS-CoV-2 has also been found to cause multiple organ ischemia and posterior ocular segment disease in mammals, raising concerns about the human retinal microvascular involvement in SARS-CoV-2.

Objective: To objectively assess the presence of retinal microvascular impairment in COVID-19 patients by optical coherence tomography angiography (OCTA), so as to facilitate the clinical system management of COVID-19 patients.

Methods: We searched PubMed, Cochrane Library, EMBASE, Ovid, CBM to collect eligible studies. The main outcomes included the vessel density (VD), area or perimeter of foveal avascular zone (FAZ), central foveal thickness (CFT), subfoveal choroidal thickness (SCT) in our meta-analysis.

Results: We eventually included five studies with a total of 401 participants. Our meta-analysis showed that nonacute infectious COVID-19 or post-COVID-19 patients presented significantly lower foveal VD of deep capillary plexus (WMD = -4.22, 95% CI [-8.00, -0.43]) and thinner SCT (WMD = -10.33, 95% CI [-19.08, -1.57]) than healthy controls. The foveal VD and parafoveal VD of superficial capillary plexus, parafoveal VD of deep capillary plexus, CFT, area, and perimeter of FAZ showed no significant differences between the groups.

Conclusion: The patients of nonacute infectious COVID-19 or post-COVID-19 displayed alterations in the retinal microvasculature and choroidal vessels, including a significantly lower foveal VD in deep capillary plexus and thinner SCT. The impairment may be a medium to long-term process. Close ophthalmic surveillance is necessary for COVID-19 patients or post-COVID-19 patients.

Keywords: COVID-19; SARS-CoV-2; optical coherence tomography angiography; retinal microvascular; vessel density.

Conflict of interest statement

The authors declare no conflicts of interest.

Figures

Figure 1 Flowchart of eligible studies

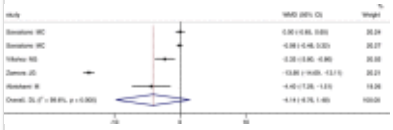

Figure 2 Forest plot of the comparison…

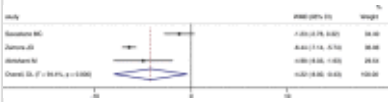

Figure 3 Forest plot of the comparison…

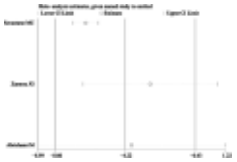

Figure 4 Sensitivity analysis of the comparison…

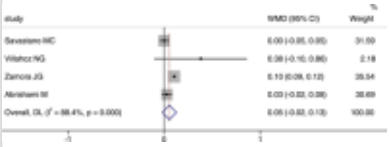

Figure 5 Forest plot of the comparison...

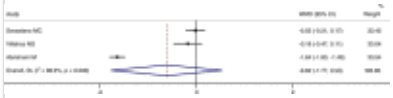

Figure 6 Forest plot of the comparison...

All figures (8)

Similar articles

Retinal Microvascular Changes in COVID-19 Bilateral Pneumonia Based on Optical Coherence Tomography Angiography.

Kal M, Winiarczyk M, Cieśla E, Płatkowska-Adamska B, Walczyk A, Biskup M, Pabjan P, Głuszek S, Odrobina D, Mackiewicz J, Zarębska-Michaluk D.

J Clin Med. 2022 Jun 23;11(13):3621. doi: 10.3390/jcm11133621.

PMID: 35806907 **Free PMC article.**

Retinal microvascular changes in patients recovered from COVID-19 compared to healthy controls: A meta-analysis.

Kazantzis D, Machairoudia G, Theodossiadis G, Theodossiadis P, Chatziralli I.

Photodiagnosis Photodyn Ther. 2023 Jun;42:103556. doi: 10.1016/j.pdpdt.2023.103556. Epub 2023 Apr 5.

PMID: 37023998 **Free PMC article.** Review.

Optical coherence tomography angiography analysis of the retina in patients recovered from COVID-19: a case-control study.

Abrishami M, Emamverdian Z, Shoeibi N, Omidtabrizi A, Daneshvar R, Saeidi Rezvani T, Saeedian N, Eslami S, Mazloumi M, Sadda S, Sarraf D.

Can J Ophthalmol. 2021 Feb;56(1):24-30. doi: 10.1016/j.jcjo.2020.11.006. Epub 2020 Nov 14.

PMID: 33249111 **Free PMC article.**

Optical coherence tomography-based assessment of macular vessel density, retinal layer metrics and sub-foveal choroidal thickness in COVID-19 recovered patients.

Karkhur S, Chauhan K, Soni D, Sharma B, Yadav N, Banerjee L, Nyodu R, Verma S.

Indian J Ophthalmol. 2023 Feb;71(2):385-395. doi: 10.4103/ijo.IJO_1236_22.

PMID: 36727324 **Free PMC article.**

Overview of the retina and imaging in patients with severe acute respiratory syndrome coronavirus 2.

Abdolrahimzadeh S, Lodesani M, Rullo D, Mariani A, Scuderi G.

Int Ophthalmol. 2022 Nov;42(11):3601-3610. doi: 10.1007/s10792-022-02338-x. Epub 2022 May 11.

PMID: 35546380 **Free PMC article.** Review.

See all similar articles

Cited by

Acute macular neuroretinopathy and COVID-19 vaccination: Case report and literature review.

Fekri S, Khorshidifar M, Dehghani MS, Nouri H, Abtahi SH.

J Fr Ophtalmol. 2023 Jan;46(1):72-82. doi: 10.1016/j.jfo.2022.09.008. Epub 2022 Nov 24.

PMID: 36496293 **Free PMC article.** Review.

Bilateral acute macular neuroretinopathy associated with COVID-19 infection presenting with central scotoma.

Sinha S, Kumar VB, Anand A, Sinha BP.

Am J Ophthalmol Case Rep. 2024 Feb 11;35:102001. doi: 10.1016/j.ajoc.2024.102001. eCollection 2024 Sep.

PMID: 38827998 **Free PMC article.**

Optical coherence tomography characteristics and prognostic predictors of acute macular neuroretinopathy following SARS-CoV-2 infection.

Huang Y, Sun Z, Li Y, Huang S, Zhou R, Yang C, Lin B.

Indian J Ophthalmol. 2024 Aug 1;72(8):1175-1180. doi: 10.4103/IJO.IJO_2997_23. Epub 2024 Jul 29.
PMID: 39078962 **Free PMC article.**

References

1. Bertoli F, Veritti D, Danese C, et al. Ocular findings in COVID-19 patients: a review of direct manifestations and indirect effects on the eye. J Ophthalmol. 2020;2020:4827304. - PMC - PubMed
2. Giamarellos-Bourboulis EJ, Netea MG, Rovina N, et al. Complex immune dysregulation in COVID-19 patients with severe respiratory failure. Cell Host Microbe. 2020;27(6):992-1000. e3. - PMC - PubMed
3. Lai CC, Ko WC, Lee PI, Jean SS, Hsueh PR. Extra-respiratory manifestations of COVID-19. Int J Antimicrob Agents. 2020;56(2):106024. - PMC - PubMed
4. Siedlecki J, Brantl V, Schworm B, Mayer WJ, Priglinger S. COVID-19: ophthalmological aspects of the SARS-CoV 2 global pandemic. Klin Monbl Augenheilkd. 2020;237:675-680. - PMC - PubMed
5. Inomata T, Kitazawa K, Kuno T, et al. Clinical and prodromal ocular symptoms in coronavirus disease: a systematic review and meta-analysis. Invest Ophthalmol Vis Sci. 2020;61(10):29. - PMC - PubMed

Show all 30 references

Publication types

Meta-Analysis

Review

MeSH terms

COVID-19*

Fluorescein Angiography / methods

Humans

Retina / diagnostic imaging

Retinal Vessels* / diagnostic imaging

SARS-CoV-2

Related information

MedGen

LinkOut - more resources

Full Text Sources

Europe PubMed Central
Ovid Technologies, Inc.
PubMed Central
Wiley

Medical

MedlinePlus Health Information

Miscellaneous

NCI CPTAC Assay Portal