

## A Cross-Sectional Study to Determine the Retinal Findings in Severe COVID-19 Patients

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### Abstract

**Background:** The ocular manifestation is having a significant impact on the health of the people and issues related to this are not completely understood. The ocular surface disorder is reported as hyper-reflective lesion on optical coherence tomography at the level of ganglion cell and inner plexiform layers. The analysis of retina and its vasculature is helping to identify the issues related to the infection and damage to the lungs. In addition to this, the acquisition of retinal colour photography is useful for identifying the issues related to the disease including the hypertension and diabetes. The consideration of pathologic phenomena can be occurred due to direct cytopathic effects and influence the retinal neurons. It might also damage the microvasculature as the covid-19 virus impact on the vessel's endothelium like in HIV.

**Aim:** The study aims to determine the retinal findings in sever COVID-19 patients considering the cross-sectional approach.

**Method:** This is a cross sectional study conducted from March 2020 to September 2021 at S.C.B. Medical College and Hospital. The study was approved by the institutional ethics committee and carried out with the relevant guidelines and standards proposed by the institute. The inclusion criteria of the study involve the concurrent endocarditis, other viral infections such as HIV and terminal cancer. There were three retinal experts have analysed the conditions and provided the information related to the treatment. The general characteristics, and baseline co-morbidities, presence of ocular systems and date of confirmatory examination was considered using the reports of RT-PCR.

**Results:** According to findings of the study 18 patients were admitted to ICU and 12 of them have invasive medicinal ventilation. Moreover, 8 patients were on Vasoactive pharmacological support, 14 patients had Anticoagulation therapy in which 8 had the Prophylactic Anticoagulation therapy and 6 had Full-intensity Anticoagulation therapy. Most of the patients were staying in ICU and had the Invasive mechanical ventilation. Moreover, the Vascoactive Pharmacological Support was offered to 5 patients.

**Conclusion:** From the study, it has been concluded that retina of the covid-19 patients is affected due to severity of the infection. The lack of clinical support and other disease like

diabetes and HIV are playing a critical role in improvement of infection in eyes that could affect the vision of the patients.

**Keywords:** COVID-19, Retina, Vessels, Veins, Vasculature, SARS-CoV-2, Eye

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## Background

There are different types of infection diseases that have direct or indirect influence on the health of the people. Covid-19 is one of the most infected diseases that have led several people to death [1]. The covid-19 is caused by the SARS-CoV-2 that was emerged from Wuhan, China in December 2019 and become the global threat for entire population [2]. Firstly, it was identified that Covid-19 is a respiratory disease as the symptoms of early diagnose shows that it is affecting the lungs of the people. The advanced clinical studies have provided the new details related to the other effects of Covid-19 infection as it can influence the organ systems, manifesting as cardiovascular, neurological, gustatory, hepatic, renal, olfactory and haematological as well as ocular symptoms [3].

According to study of Invernizzi et al., (2020) [4], the ocular manifestation is having a significant impact on the health of the people and issues related to this are not completely understood. The ocular surface disorder is reported as hyper-reflective lesion on optical coherence tomography at the level of ganglion cell and inner plexiform layers. The retinal examination is helping to analysing the vessels in vivo [5]. The retinal veins diameter is helpful for representing parameter to monitor the inflammatory response and endothelial damage in covid-19 patients. In addition to this, the coagulation disorders are also the common among the covid-19 patients [6]. It is more effective on patients who were suffering from severe disease. The analysis of retina and its vasculature is helping to identify the issues related to the infection and

damage to the lungs. In addition to this, the acquisition of retinal colour photography is useful for identifying the issues related to the disease including the hypertension and diabetes [7].

The issues related to alterations of the retina are also observed among the patients who were having the viral disease. The consideration of pathologic phenomena can be occurred due to direct cytopathic effects and influence the retinal neurons [8]. It might also damage the microvasculature as the covid-19 virus impact on the vessel's endothelium like in HIV [9]. The improvement in the infection of Covid-19 could also affect the endothelial cells that could be detected in the retina [10]. The proper analysis of symptoms and issues related to the retinal affects useful for the patients to minimize the issues of vision loss and maintaining the healthy lifestyle [11].

## Aim

The study aims to determine the retinal findings in severe COVID-19 patients considering the cross-sectional approach.

## Method and Material

This is a cross sectional study conducted from March 2020 to September 2021 at S.C.B. Medical College and Hospital. The researcher has got the approval from by the institutional ethics committee and carried out with the relevant guidelines and standards proposed by the institute.

## Participants

For the study, the researcher has involved the participants who were confirmed with Covid-19 and admitted to the emergency ward of the hospital. The inclusion criteria

of the study involve the concurrent endocarditis, other viral infections such as HIV and terminal cancer.

#### Eye examination and retinography

To conduct the study, the eyes examination was performed by taking the help of the retina experts that has used the binocular indirect ophthalmoscope and used the 20 D lens after 30 minutes of installation of tropicamide. In addition to this, the optical mentor OH was also used for analysing the retinal conditions and the findings of the individual was described by each of the individual. There were three retinal experts have analysed the conditions and provided the information related to the treatment.

#### Clinical data

To analyse the health conditions of the patients and finding the issues related to the key issues with the patients, the general characteristics, and baseline co-morbidities, presence of ocular systems and date of confirmatory examination was considered using the reports of RT-PCR.

#### Statistical analysis

The results of study were presented as medians and IQR for analysing continues variables. Here, the categorical variables were expressed as proportions with 95% CIs that are compared using Wilison-Brown hybrid method. Moreover, the Graphical Pad version 8.0 was also used for analysing the condition of the patients.

#### Results

**Table 1: Clinical characteristics**

| Measures                               | Total (N=20) |
|--|--------------|
| Age, median, years                     | 63.4         |
| Male                                   | 10 (50)      |
| Hypertension                           | 12 (60)      |
| Diabetes mellitus                      | 8 (40)       |
| Eye examination time, median, days     | 12.3         |
| ICU stay                               | 18 (90)      |
| Invasive medicinal ventilation         | 12 (60)      |
| Vasoactive pharmacological support     | 8 (40)       |
| Any Anticoagulation therapy            | 14 (70)      |
| Prophylactic Anticoagulation therapy   | 8 (40)       |
| Full-intensity Anticoagulation therapy | 6 (30)       |

The above table (1) has provided the information related to the general characteristics of the patients. For study 20 patients were selected and mean age of the patients was 63.4 years. Here, 50% of the patients were male and 12 patients were having the hypertension and 8 found with diabetes mellitus. 18 patients were

admitted to ICU and 12 of them have invasive medicinal ventilation. Moreover, 8 patients were on Vasoactive pharmacological support, 14 patients had Anticoagulation therapy in which 8 had the Prophylactic Anticoagulation therapy and 6 had Full-intensity Anticoagulation therapy.

**Table 2: Retinal Finding**

| Patient no./ Sex / Age Range | Baseline co-morbidities | Inpatient unit | Invasive mechanical ventilation | Vasoactive Pharmacological Support |
|------------------------------|-------------------------|----------------|---------------------------------|------------------------------------|
| 1/M/ 41s                     | CKD, DM, HBP            | ICU            | Not required                    | Not required                       |
| 2/M 61s                      | DM, HBP                 | ICU            | Required                        | Not required                       |

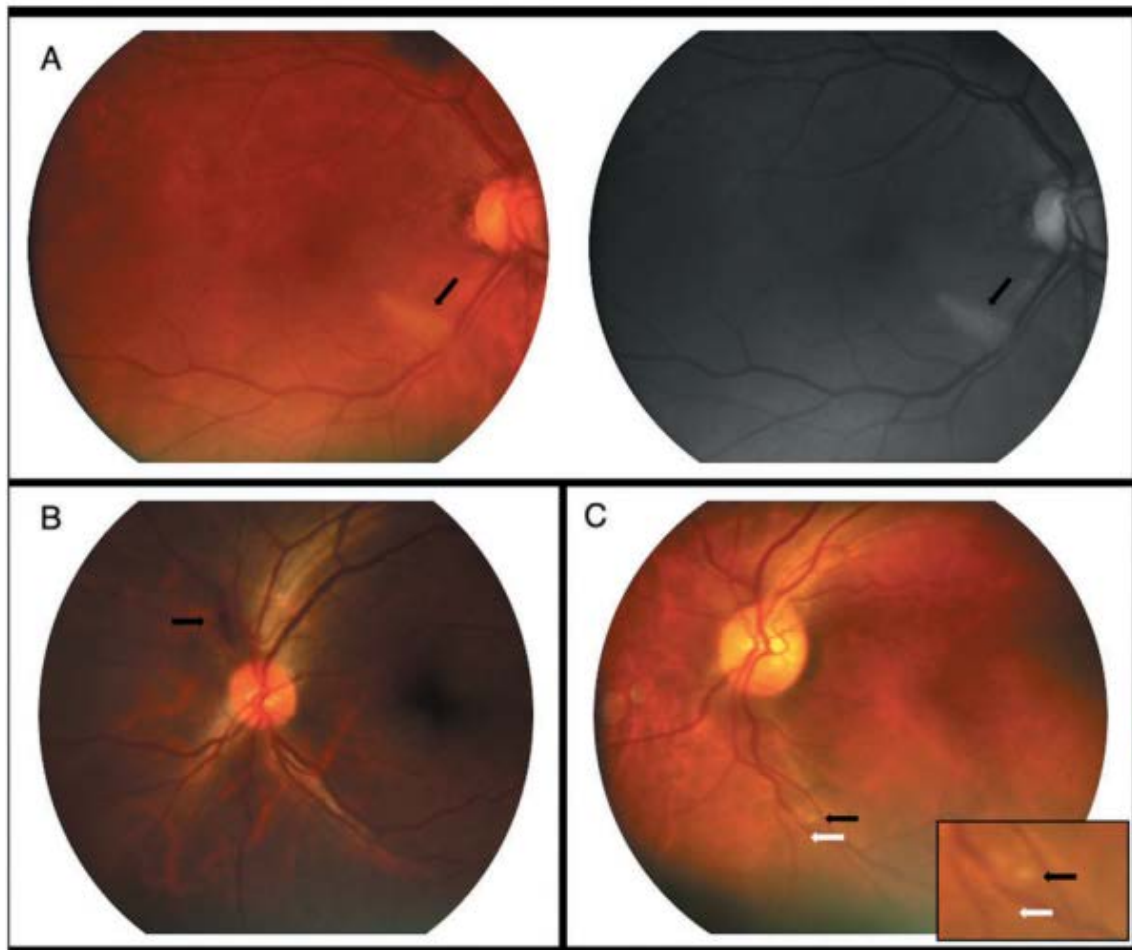
|            |              |          |              |              |
|------------|--------------|----------|--------------|--------------|
| 3/F/60s    | --           | Infrmary | Not required | Not required |
| 4/M/60s    | AF, HBP      | ICU      | Required     | Required     |
| 5/ M/ 70s  | DM, HBP      | ICU      | Required     | Not required |
| 6/ M / 50s | DM, HBP      | ICU      | Required     | Required     |
| 7 / M/ 50s | HBP, CHF, DM | ICU      | Required     | Required     |
| 8/ M/ 60s  | --           | ICU      | Required     | Required     |
| 9/F/ 60s   | --           | ICU      | Required     | Not required |
| 10/M/40s   |              | ICU      | Required     | Required     |

According to outcome of the table (2) it has been carried out that most of the patients were staying in ICU and had the Invasive mechanical ventilation. Moreover, the Vascoactive Pharmacological Support was offered to 5 patients.

**Table 3: Retinal findings**

| <b>Patient no./ Sex / Age Range</b> | <b>Anticoagulation therapy</b> | <b>Time between confirmatory and dilated eye examination days</b> | <b>Retinal findings</b>   |
|-------------------------------------|--------------------------------|---|---|
| 1/M/ 41s                            | Prophylactic                   | 8   | Peripheric retinal haemorrhages in OS   |
| 2/M 61s                             | Prophylactic                   | 10  | Lesions suggestive of RPE hyperplasia in OS, macular hyperpigmented                             |
| 3/F/60s                             | None                           | 9   | Retina sectorial pallor at LTA and choroidal naevus in OD                                       |
| 4/M/60s                             | Prophylactic                   | 50  | Peripheric retinal haemorrhages in OU   |
| 5/ M/ 70s                           | Prophylactic                   | 11  | Peripapillary flame-shaped haemorrhage in OS, macular haemorrhages and hard exudates in OU,     |
| 6/ M / 50s                          | Full-intensity                 | 13  | Cotton wool spots at UTA in OS  |
| 7 / M/ 50s                          | Full-intensity                 | 13  | Peripapillary flame-shaped haemorrhage in OD  |
| 8/ M/ 60s                           | Full-intensity                 | 16  | Cotton wool spots at UTA in OS  |
| 9/F/ 60s                            | None                           | 40  | Cotton wool spot with adjacent flame- shaped haemorrhage at LTA in OS, asteroid hyalosis in OD, |
| 10/M/40s                            | Prophylactic                   | 0   | Peripapillary flame-shaped haemorrhage in OS  |

Table (3) has provided the information related to the Anticoagulation therapy and outcome of the analysis has suggested that 5 patients had Prophylactic and 3 patients had the full-intensity therapy. Moreover, the retinal findings have suggested the different aspects for individual.



**Figure 1: Retinal findings**

The graphical analysis of patient's retinal effects has been conducted and it has provided the information related to different changes among the patients. The image A was right eye of the female patient 60 years and revealing that there is well-delimited sartoial pallor at the lower temporal arcade. The mage B was the eye of male age 40 years that revealing the haemorrhage (black arrow). Apart from this, image C is left eye of female 60 years old and revealing that cotton wool spot (black arrow) and adjacent flame-shaped haemorrhage (white arrow) at the lower temporal arcade. Vasoactive pharmacological support is not required as the patient was admitted to hospital.

### Discussion

The ocular manifestation is having a significant impact on the health of the people and issues related to this are not

completely understood. The ocular surface disorder is reported as hyper-reflective lesion on optical coherence tomography at the level of ganglion cell and inner plexiform layers. According to the findings of the current study, it has been carried out that most of the patients were staying in ICU and had the Invasive mechanical ventilation. Moreover, the Vasoactive Pharmacological Support was offered to 5 patients.

The analysis of retina and its vasculature is helping to identify the issues related to the infection and damage to the lungs. In addition to this, the acquisition of retinal colour photography is useful for identifying the issues related to the disease including the hypertension and diabetes. The improvement in the infection of Covid-19 could also affect the endothelial cells that could be detected in the retina.

Additionally, the findings of the study have also identified that 8 patients were on Vasoactive pharmacological support, 14 patients had Anticoagulation therapy in which 8 had the Prophylactic Anticoagulation therapy and 6 had Full-intensity Anticoagulation therapy. Apart from this, the study of Bastola and Dahal (2021) [12] has found that the consideration of pathologic phenomena can be occurred due to direct cytopathic effects and influence the retinal neurons. It might also damage the microvasculature as the covid-19 virus impact on the vessel's endothelium like in HIV [13]. Moreover, the Zhou et al., (2020) [14] has suggested that the retinal examination is helping to analysing the vessels in vivo. This type of treatment is not much costly for the patients. The retinal veins diameter is helpful for providing the details related to the parameters used for evaluating the inflammatory response and damage related to endothelial among the covid-19 patients. In addition to this, the coagulation disorders are also the common among the covid-19 patients [15,16].

### Conclusion

From the analysis of the outcome of the study, it has been concluded that retina of the covid-19 patients is affected due to severity of the infection. The lack of clinical support and other disease like diabetes and HIV are playing a critical role in improvement of infection in eyes that could affect the vision of the patients. Moreover, the scientific community is also sure about the possibility of retina abrasion in patients who were suffered with severe covid-19.

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