Changes in the organ of vision with a delta strain of coronavirus infection

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https://doi.org/10.5281/zenodo.5895268

Relevance

As researchers around the world work to identify risk factors for severe COVID-19, there is growing evidence that certain strains cause different symptoms of organ damage.

As of the end of July 2021, almost all cases of COVID-19 in the UK and the US were caused by a new strain of coronavirus known as the delta strain. In June 2021, the spread of this strain among patients with COVID-19 was also confirmed in the Republic of Uzbekistan. On August 10, the delta strain was found in 142 countries around the world. The third and fourth waves of the spread of COVID-19 infection have shown a larger and faster spread of infection since the beginning of the pandemic. This is due to the delta strain, which more easily and more strongly binds to the receptors of target cells and leads to a wider spread of this infection among the population.

Like other strains of coronavirus, the new one, verified in 2021. and I delta strain can cause certain symptoms associated with the organ of vision, but so far there are few publications describing these changes.

Due to the rapid onset of life-threatening symptoms of the patient and polymorphic consequences, this category of patients requires a detailed study both during the period of reconvolition and during the height of the disease.

According to L. Chen et al., In 2019, various lesions of the structures of the organ of vision in COVID-19 during the period of manifestation were recorded, which was confirmed by other authors [8, 9]. The most often diagnosed with the anterior segment of the eyes was conjunctivitis, conjunctival chemosis, lacrimation and impaired tear production. Less often, pain in the eye, sensation of a foreign body, itching were noted. A number of authors claim that conjunctival hyperemia preceded the development of respiratory symptoms of the underlying disease [10].

The purpose is to study and compare the features of pathological changes in the organ of vision in patients suffering from coronavirus infection at the height of the disease in 2020. and 2021.

Materials and methods 154 patients (302 eyes) were examined for ocular manifestations. 78 patients (156 eyes) were included in group 1, hospitalized in a specialized clinic for the treatment of coronavirus patients "Zangiota-1" in August 2021, where the Delta strain of coronavirus infection was verified. Group 2 included data from 76 patients (152 eyes) treated for coronavirus infection in August 2020. Both groups included patients without concomitant somatic and chronic ophthalmic diseases. With a confirmed diagnosis of COVID-19. The control group consisted of data from 20 healthy individuals (40 eyes) of the same age and sex.

In accordance with the "Temporary guidelines of the Ministry of Health of the Republic of Uzbekistan for the prevention, diagnosis and treatment of new coronavirus infection," patients received symptomatic, immunomodulatory, antiviral, anticoagulant, prophylactic antibiotic therapy and oxygenation as indicated.

All patients underwent general clinical, laboratory and traditional ophthalmology, including collection of complaints, external examination, visometry, studies of pupillary reactions, determination of corneal sensitivity, tonometry (without contact), biomicroscopy, ophthalmoscopy.

In addition, optical coherence tomography in angio mode (OCT-A), as well as to determine the level of tear fluid production, Schirmer's test 1 (reflex secretion) and Schirmer's test 2 (basic secretion, after instillation of local anesthetic), ultrasound (B-scan).

Statistical analysis was carried out using the IBM SPSS Statistics v25 software (IMB corp., USA).

For qualitative signs, the absolute (n) and relative (%) frequencies were calculated. The frequencies in the two groups were compared using the X^2 test or Fisher's exact test in cases of expected values of frequency ≤5. Differences were considered statistically significant at $p<0.05$.

Research results

The study was conducted on the second day of hospitalization; the average length of hospitalization was 17.5 days. A positive nasopharyngeal smear for SARS-CoV-2 RNA polymerase chain reaction was found in 126 people. Of the surveyed 174 patients, 97 were men (55.7%), women - 77 (44.2%). Moreover, their distribution over the years did not differ statistically. As for the age composition, in the 1st group the number of persons of younger age prevailed, compared with the 2nd group Fig. 1. According to the severity of the underlying disease, patients were divided into: severe course 75 (43%), and moderately severe course 99 (57%). Respiratory support was needed in 89 (89%) patients with a moderate course and 75 (100%) patients with a severe course. The maximum corrected visual acuity in all subjects was 1.0 according to the Sivtsev-Golovin table. 135 had emmetropia, 9 had mild hypermeiropia, 21 had moderate myopia and 5 had mild myopia. The intraocular pressure values were also within the normal range and varied from 15 to 22 mm. rt. Art. Among the complaints from the organ of vision in group 1, 38 (44.8%) patients complained of pain in the eyes, 26 (33.3%) patients complained of discomfort and rapid fatigue in the eyes, 12 patients in the ICU department complained of lacrimation. Ophthalmological examination revealed signs of eyelid irritation and injection of conjunctival vessels with the formation of microaneurysms in the form of ampoules or spindles, a decrease in corneal sensitivity was recorded in 65 (83.3%), photophobia in 34 (23.0%). Indicators of tear production in the Schirmer-1 test (total tear production) decreased to ≤10.5 / 10.8 ± 1.6 mm. Schirmer's samples - 2 x 4.8 / 4.5 ± 1.7 mm. The study of pupillary reflexes revealed: impaired pupillary reactions in the form of a hypus were noted in 31, weakening of the pupillary reaction to light in 21 (26.9%) only with a severe course of the disease, in patients with moderate severity, a decrease in reactions was not observed. Ophthalmoscopy on the fundus in 59 (75.6%) patients revealed narrowing of the arterioles (ratio 1: 3), which was confirmed by OCT-angiography (Fig. 2). According to the B-scan data, hyperechoic exudate above the optic disc was visualized in both eyes in 56 (71.7) patients, a transient disturbance of focusing in the distance and near was observed in 35 patients.

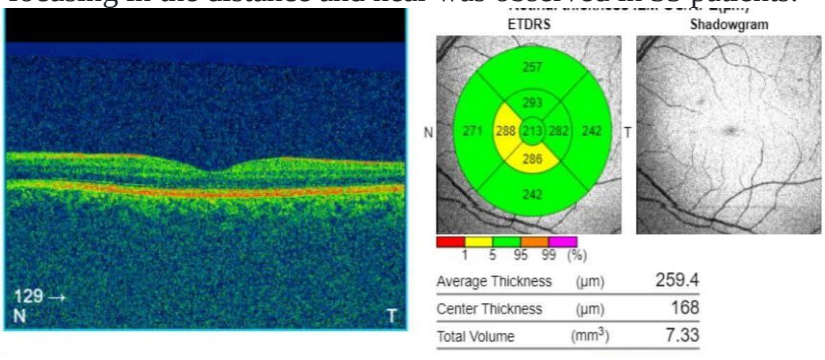
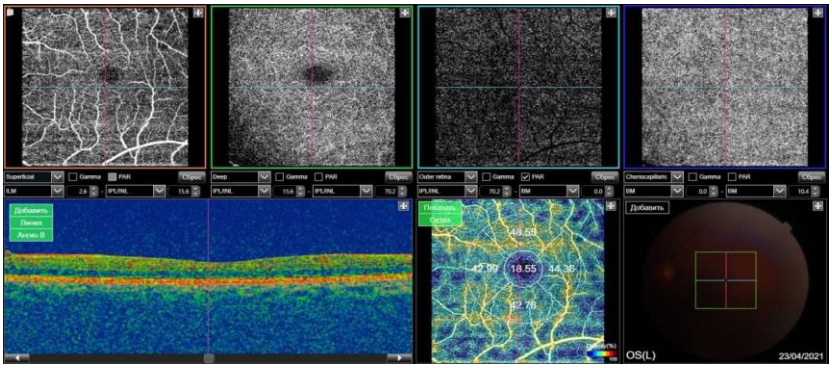


Fig. 2



Patient J.D. Born 1974 OD

The foveolar fossa is of the correct shape, the reflex is preserved. The differentiation of the inner layers is intact. All layers are traceable, thinned. Pigment epithelium of uneven reflectivity, decreased density of photoreceptors, atorophia of photoreceptors and REB along the inner segment. The choriocapillary layer is thickened. Retinal thickness 223 microns, thinning along the inner segment. Uneven decrease in the ganglion cell complex and the average number of nerve fibers in the central zone and a significant decrease in the inner segment (scatoma)

Conclusion: OD -0T Isolated retinal ischemia

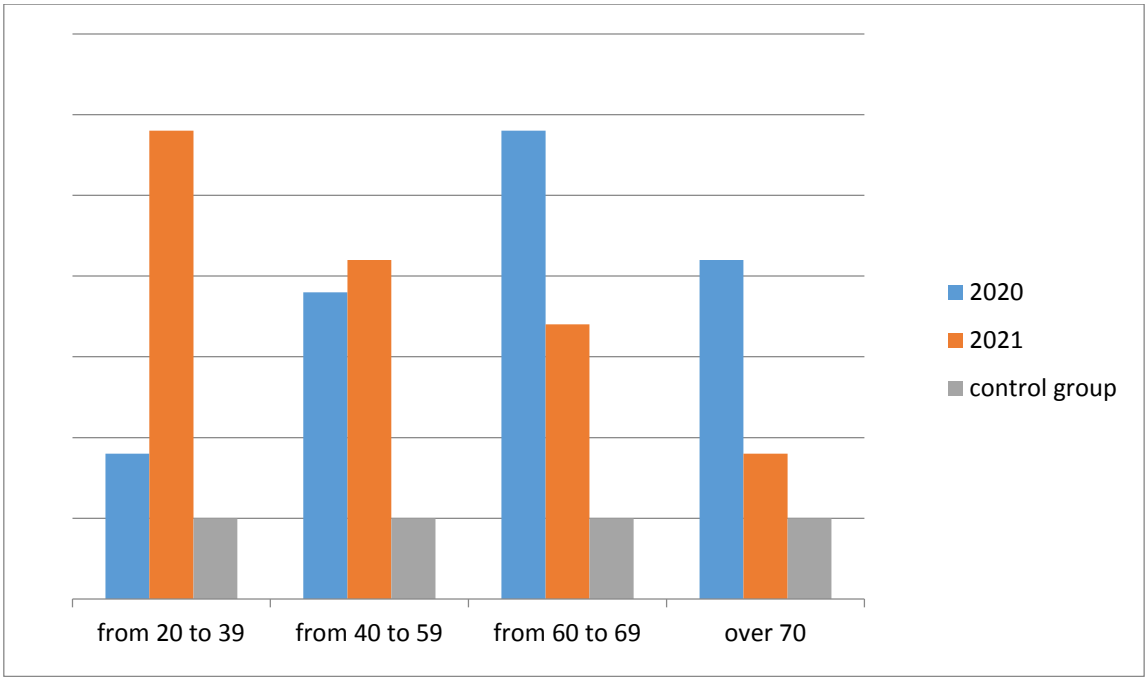


Fig.1

Table 1

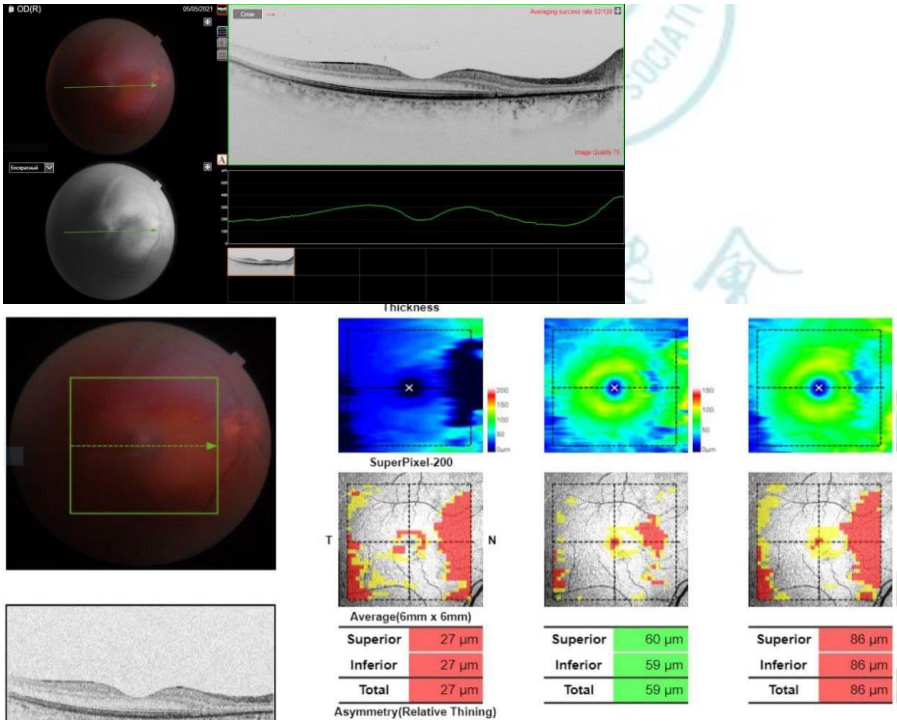
Indicators of the Schirmer-1 and Schirmer-2 sample

Patient groups	**Schirmer's test-1 (mm) for 5 min. Schirmer's test-2**	**Schirmer's test-1 (mm) for 5 min. Schirmer's test-2**
	OD/OS	*OD/ OS*
Norm	15-35	≥10
First group	≤10,5/10,8±1,6	4,8/4,5±1,7
Second group	12,0±1,01/11,7±1,7	5,7/5,4±1,1

Control group	32,5±0,6	8,5±0,8

(p>0,05)

When analyzing the data of the second group, 45 (59.2%) patients complained of itching in the eyes, a feeling of fatigue in 68 (89.4%), lacrimation was observed in 68 (98.45%), photophobia in 33 (43.4%) patients. ... Moreover, 17 (22.3%) patients stated that the first symptoms of the onset of the disease were exactly one of the above eye symptoms. Transient visual impairment was noted by 17 (22.3%) patients with a severe course of the underlying disease, the examination of which did not reveal any central or peripheral visual impairment. On ophthalmological examination, conjunctival hyperemia was recorded in 28 (36.8%), decreased corneal sensitivity in 53 (69.7%) patients. Indicators of Schirmer's test-1 (total tear production) showed a decrease to 12.0 ± 1.01 / 11.7 ± 1.7 mm, Schirmer's test -2 to 5.7 / 5.4 ± 1.1 mm. Violation of pupillary reactions in the form of a hypus in 8 (10.5%) patients with severe COVID-19 in patients in the ICU, weakening of the pupillary reaction to light in 46 (60%) patients of varying severity of the underlying disease. Ophthalmoscopy data showed that 30 (39.4%) patients had retinal phlebopathy in the fundus, (the ratio of arteries to veins was 2: 5) in both eyes, in 7 (9.2%) in one eye, in the latter on OCT - angiography, a picture of general retinal ischemia was revealed. Fig. 3 No pathological manifestations were observed on the B-scan.



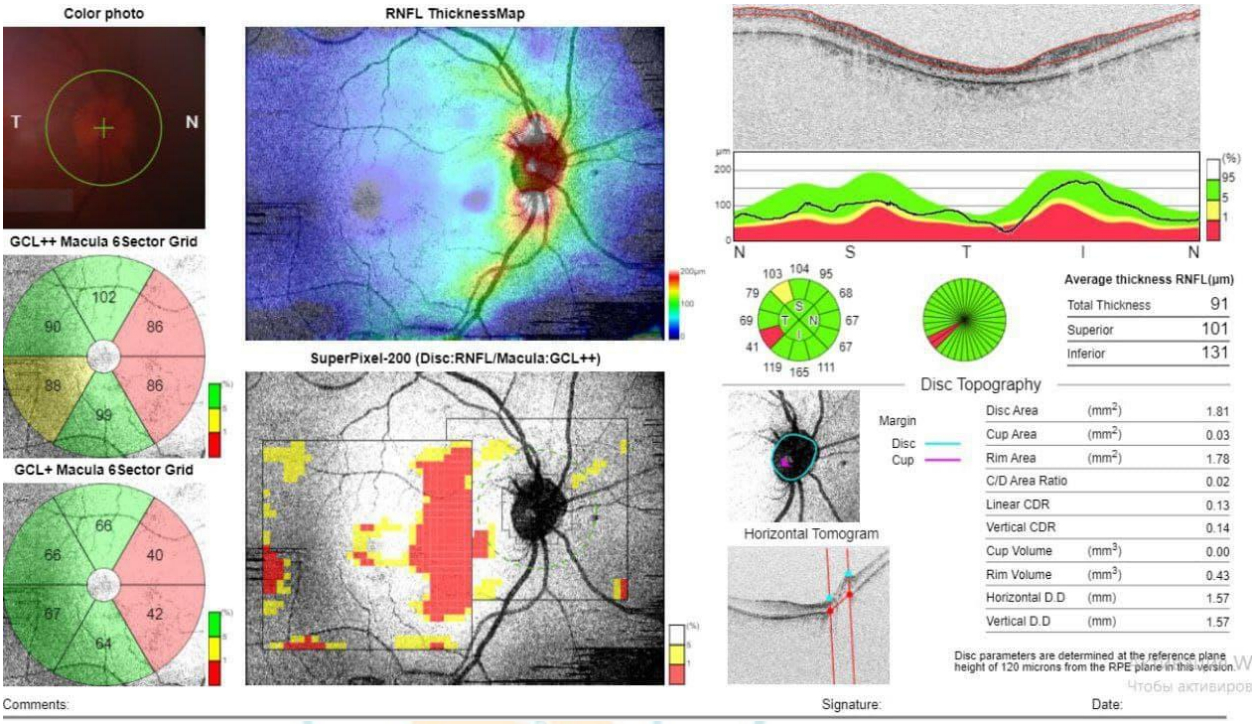


Fig. 3 Patient D. born in 1959 OD. Foveolar fossa of the correct form, the reflex is preserved. The differentiation of the inner layers is intact. All layers can be traced, uniform thinning of the neuroepithelium. Pigment epithelium of uneven reflectivity, decrease in the density of photoreceptors, atrophy of photoreceptors and REP in the internal segment. The choriocapillary layer is thickened. The thickness of the retina is 280 microns, thinning along the outer segment. Uneven decrease in the complex of ganglion cells and the average number of nerve fibers in the central zone and a significant decrease in the outer segment

Conclusion: OD -0m Isolated retinal ischemia

Differences in complaints of ophthalmological complaints of patients in 2021 and 2020.

Table 2

Complaints	1st group n = 78	2nd group n = 76	Control n = 20
Itching	5	45	-
Redness	26	39	-
Pain in the eyes	38	-	-
Feeling tired in the eyes	26	68	-
Lachrymation	56	68	-
Photophobia	64	33	-
Decreased vision	35	17	

Ophthalmic manifestations of COVID-19 2020 and 2021.

Symptoms	1st group n = 78	2nd group n = 76	Control n = 20
Conjunctival injection	26	28	-
Decreased sensitivity Cornea	65	53	-
Violation of pupillary reactions	52	46	-
Fundus pathology	59	30	-

Discussions The result of assessing the differences between ophthalmological complaints and symptoms of patients suffering from COVID-19 in 2021 and 2020 revealed that among patients of the first group, younger people prevail, which confirms the literature data on the susceptibility to the delta strain of a younger category of people. F. Frei et al., Reported on dry eye syndrome, confirmed by the Schirmer test, in 36 patients during the onset of the disease. Summarizing the data of complaints and symptoms of damage to the anterior segment, it can be judged that in the first group, in addition to a decrease in tear production, the anterior segment suffers less than in the second.

According to the literature, in patients with COVID-19, an increase in the level of biomarkers of CNS damage (glial fibrillar acidic protein –GFAP and serum thin polypeptide neurofilament – NFL) was found in blood plasma, which correlated with the severity of the patient's condition, which proves damage to the central nervous system during infection with SARS-CoV -2 [18]. It is noteworthy that impaired pupillary reactions were recorded more in patients with a severe

course of the disease, more in the first group of patients, which may be a consequence of damage to the central nervous system.

Scientists in the UK described changes in the inner layers of the retina in the form of hyperreflective foci, according to OCT data, included in the study of patients in the period from 11 to 33 days after the onset of the first symptoms of COVID-19. In our study, no identical foci were found, however, according to OCT-A data, total retinal ischemia observed in patients with transient visual impairment and infiltration over the optic disc on the B-scan in the first group of patients, it can be assumed that the 2021 COVID-19 strains more aggressively cause ischemia of the entire organ of vision, in contrast to 2020.

Conclusion

Changes in the organ of vision in patients suffering from coronavirus infection in 2020. predominantly associated with the ocular surface, in contrast to patients who are ill in 2021 who are most likely infected with a delta strain, not only the anterior segment suffers, but also the entire organ of vision, which is in a state of ischemization.

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