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Evaluation of retinal and optic disc vascular structures in individuals before and after Pfizer-BioNTech vaccination

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Abstract

Introduction

We conducted this study to detect possible changes in posterior segment structures using the optical coherence tomography angiography (OCTA) in individuals vaccinated with the Pfizer-BioNTech vaccine.

Materials and methods

The study included healthcare professionals who presented to the Ophthalmology Clinic of Health Sciences University Antalya Training and Research Hospital, who were scheduled to receive the first dose of the Pfizer-BioNTech vaccine. The exclusion criteria were any eye pathology (e.g., glaucoma, uveitis, diabetic retinopathy, amblyopia), myopia with the absolute value of refractive error >6, axial length >26mm, history of eye surgery, and presence of systemic disease.OCTA was performed to 40 healthcare professionals before vaccination and on the third day after vaccination.

Results

After Pfizer-BioNTech vaccination, there was a statistically significant decrease in the total vascular, foveal vascular, parafoveal vascular and perifoveal vascular density of the superficial capillary plexus and the perifoveal vascular density of the deep capillary plexus and a statistically significant increase in the retinal foveal thickness and total retinal parafoveal thickness compared to the pre-vaccination values ($p<0.0001$, $p=0.009$, $p<0.0001$, $p=0.001$, $p=0.04$, $p=0.03$, and $p=0.05$, respectively).

Conclusion

We consider that the decrease in the retinal vascular density may be due to vascular endothelial damage and inflammation in vaccinated people. It can be suggested that increased inflammation plays a role in the

retinal thickness in vaccinated people similar to patients with a history of COVID-19. We also consider that spike protein may be effective in these processes.

Introduction

Coronavirus disease is a systemic disease that affects the whole body. The disease has spread across the world, causing a pandemic and has been termed as COVID-19 (where “CO” stands for corona, “VI” for virus, “D” for disease, and “19” indicates the year in which it emerged) (Chen et al., 2020; Guan et al., 2020). The general findings of COVID-19 are fever, cough, fatigue, loss of taste, loss of smell, lower back pain, and sore throat (Wang et al., 2020). These symptoms can also be accompanied by ocular findings, including eye watering, itching, stinging, blurred vision, limitation of eye movements, conjunctivitis, and double vision (Wu et al., 2020).

The Pfizer-BioNTech vaccine is based on a technique known as messenger ribonucleic acid (mRNA). This is one of the new-generation vaccines that do not use live virus. In previous studies, the side effects of the Pfizer-BioNTech vaccine have been reported as redness, itching and pain around the injection site, fever, headache, myalgia, fatigue, nausea and vomiting, and anaphylactic reaction (Riad et al., 2021).

Optical coherence tomography angiography (OCTA) is a non-invasive imaging method used to visualize retinal vascular blood flow. OCTA can measure retinal vessel density based on motion contrast in blood flow (Gedik et al., 2021). In previous studies, retinal and choroidal vascular density values were compared between patients with COVID-19 and healthy controls using OCTA, and statistically significant results were obtained (Cennamo et al., 2021; Savastano et al., 2020).

The current study aimed to compare the retinal, choroidal and optic disc vascular density values of the same individuals using the OCTA device before and after COVID-19 vaccination to identify possible changes.

Section snippets

Patient selection

The study included healthcare professionals who presented to the Ophthalmology Clinic of Health Sciences University Antalya Training and Research Hospital for a routine eye examination, who did not have any known disease, did not have a history of coronavirus disease, and were scheduled to receive the first dose of the Pfizer-BioNTech vaccine. The exclusion criteria were any eye pathology (e.g., glaucoma, uveitis, diabetic retinopathy, amblyopia, and epiretinal membrane), myopia with the…

Results

The mean average age (±SD) of the 40 patients participating in the study was calculated as 37.65±11.13 years. Twenty-four of the participants were women and 16 were men.

After Pfizer-BioNTech vaccination, burning-stinging in eyes, redness in eyes, itching in eyes, conjunctivitis, eye pain, and vision loss were detected in two (5%) patients each. No ocular side effects were observed after vaccination in 32 patients (80%) (Table 1).

Changes in the vascular density values of the superficial…

Discussion

COVID-19 is a systemic disease that affects the whole body. The general findings of COVID-19 include fever, cough, fatigue, headache, sore throat, loss of taste, loss of smell, and lower back pain (Guan et al., 2020; Wang et al., 2020). In this disease, ocular findings also draw attention, sometimes even appear as the first finding. Among the ocular findings of COVID-19 are eye watering, itching, foreign body sensation, double vision, blurred vision, limited eye movements, dry eye, exposure…

Conclusion

This is the first study in the literature to evaluate changes in retinal and optic disc vascular density values in people vaccinated with the Pfizer-BioNTech vaccine. We consider that the decrease in the retinal vascular density values of patients after Pfizer-BioNTech vaccination compared to the pre-vaccination period may be due to vascular endothelial damage and pathogenesis similar to the intravascular coagulation cascade observed in COVID-19. It can be suggested that increased inflammation…

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Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Also, informed consent were obtained from patients in this study.…

CRediT authorship contribution statement

Birumut Gedik: Writing – review & editing, Writing – original draft, Visualization, Methodology, Data curation, Conceptualization. **Muhammet Kazim Erol:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Elcin Suren:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Conceptualization. **Sibel Yavuz:** Writing – review & editing, Methodology, Investigation, Formal analysis, Data…

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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