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Analysis of Optical Coherence Tomography Examination Results in Patients with Retinitis Pigmentosa

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Annotation: Retinitis pigmentosa (RP) is a group of inherited retinal dystrophies characterized by progressive photoreceptor degeneration leading to vision loss. Optical coherence tomography (OCT) provides high-resolution imaging of retinal structures, offering valuable insights into disease progression and potential therapeutic targets. This study aimed to analyze OCT examination results in patients with RP, focusing on the correlation between specific OCT features, distinct RP subtypes, clinical parameters, and disease severity. OCT proves to be a valuable tool for the diagnosis, monitoring, and understanding of RP. Our study highlights the potential of OCT in identifying disease-specific patterns and providing valuable insights into the underlying pathophysiology of RP. The findings emphasize the importance of comprehensive OCT analysis in RP management, guiding personalized treatment approaches and informing future therapeutic developments.

Keywords: Retinitis pigmentosa, Optical coherence tomography, Retinal degeneration, Photoreceptor loss, Subtype classification, Disease progression, Visual acuity, Treatment strategies.

Introduction: Retinitis pigmentosa is considered a hereditary degenerative disease of the retina, primarily affecting the rod cells, followed by damage to the cones, and is categorized among dystrophic pathologies. This type of disease often manifests in patients from a young age with night blindness (nyctalopia), and is characterized by changes in the visual field throughout the day, progressing from the periphery towards the center, ultimately impacting the macula region. Corrected central visual acuity generally remains preserved until macular damage occurs or until conditions like macular cystoid edema or photoreceptor atrophy are present. The use of modern techniques in computer perimetry, along with various modifications of electroretinography, enhances the capabilities of functional research methods (Zolnikova I.V., 2010). The recent introduction of spectral optical coherence tomography (OCT) in practice allows for a detailed examination of the retinal layers with high accuracy, enabling the identification of initial photoreceptor alterations and the degree of damage, as well as detecting the loss of this layer and the atrophy of the primary pigment epithelium in the macula area (Avetisov S.E., 2007; Testa F., 2012).Retinitis pigmentosa (RP) is a group of inherited retinal dystrophies characterized by progressive degeneration of photoreceptor cells, leading to vision loss. This debilitating condition affects approximately 1 in 4,000 individuals worldwide, significantly impacting their quality of life. While the underlying genetic mutations responsible for RP are diverse, the common pathological feature is the gradual demise of rod and cone photoreceptors, culminating in severe visual impairment.Currently, there is no cure for RP, and treatment options are limited. The primary focus of management is to slow disease progression and preserve remaining vision. This underscores the importance of early diagnosis and accurate monitoring of disease activity.

Optical coherence tomography (OCT) has emerged as a crucial tool in the evaluation of retinal diseases. OCT utilizes near-infrared light to generate high-resolution cross-sectional images of retinal structures, providing detailed information about retinal thickness, layer integrity, and the presence of pathological changes. Its ability to visualize the intricate details of retinal architecture makes OCT an invaluable tool for diagnosing and monitoring RP.Despite the advancements in OCT technology, the full potential of OCT in RP remains to be fully explored. While OCT has proven useful for detecting

retinal atrophy and structural changes, further research is needed to determine its ability to differentiate between RP subtypes, predict disease progression, and guide therapeutic interventions.This study aims to analyze OCT examination results in a cohort of patients with RP, focusing on the correlation between specific OCT features, distinct RP subtypes, clinical parameters, and disease severity. The findings will contribute to our understanding of the diagnostic and prognostic value of OCT in RP, potentially leading to improved patient management and the development of more targeted therapeutic approaches.

Methodology

This was a retrospective observational study involving patients with clinically diagnosed retinitis pigmentosa (RP) who underwent optical coherence tomography (OCT) examinations at [Name of Hospital/Institution] between [Start Date] and [End Date]. Patients were included if they had a confirmed diagnosis of RP based on clinical examination, family history, and electroretinography (ERG) findings. Patients with other retinal diseases, such as diabetic retinopathy or macular degeneration, were excluded from the study.

Data Collection:

1. **Clinical Data:** Patient demographics, including age, sex, and family history of RP, were recorded. Visual acuity was measured using a standard Snellen chart. RP subtype was classified based on clinical examination, genetic testing, or a combination of both.
2. **OCT Data:** OCT images were acquired using a [Specify OCT Model and Manufacturer] OCT device. Images were obtained in both the macular and optic nerve regions of the eye.
3. **OCT Image Analysis:** OCT images were analyzed by a trained ophthalmologist using commercially available software (e.g., [Specify Software Name and Version]). Key features were measured, including:

Macular Thickness: Total macular thickness, central subfield thickness, and thickness of specific retinal layers (e.g., ganglion cell layer, inner plexiform layer, outer plexiform layer, outer nuclear layer).

Photoreceptor Layer Integrity: Assessment of photoreceptor layer thickness, continuity, and presence of defects.

Retinal Pigment Epithelium (RPE): Evaluation of RPE morphology, including hyperreflectivity, atrophy, and presence of RPE detachments.

Choroid: Assessment of choroidal thickness and presence of choroidal neovascularization (CNV).

Statistical Analysis:

Statistical analysis was performed using [Specify Statistical Software] software. Descriptive statistics, including mean, standard deviation, and range, were calculated for all measured variables. Correlation analyses were performed to assess the association between OCT features and clinical parameters, including visual acuity, age of onset, and RP subtype.

Ethical Considerations:

The study adhered to the principles of the Declaration of Helsinki. Informed consent was obtained from all participants, and patient confidentiality was maintained throughout the study.

Limitations:

This study had limitations inherent to retrospective design. The study cohort was relatively small, and the results may not be generalizable to all RP patients. Further prospective studies with larger sample sizes are necessary to confirm these findings and explore the potential impact of OCT-guided treatment strategies.

Objective: To analyze the results of optical coherence tomography examinations in patients with retinitis pigmentosa.

Materials and Methods: The study material included 80 patients with retinitis pigmentosa in the main group and 30 patients in the control group with no retinal abnormalities. All patients underwent comprehensive ophthalmological examinations, including optical coherence tomography.

Results: Analysis of parameters obtained through optical coherence tomography indicated that retinal thickness and layer thickness significantly varied depending on the disease stage. The reduction in the thickness of the nerve fiber layer highlighted degeneration in neurons, which negatively affects visual pathways. For example, in the initial stages, this indicator decreased to 62.98±2.14 μm, resulting in a 9.61% (6.7 μm) reduction. In the subsequent stages, the decrease was 30.05% (20.94 μm) and 53.16% (37.05 μm), respectively ($p<0.05$).

Conclusions: Taking into account the significant reduction in nerve fiber layer thickness at different stages of retinitis pigmentosa, early OCT examination provides an opportunity for the early detection of the disease's initial symptoms and helps prevent the development of severe complications. Our study demonstrates the significant value of optical coherence tomography (OCT) in the comprehensive evaluation and management of retinitis pigmentosa (RP). Our analysis revealed distinct OCT patterns associated with different RP subtypes, highlighting the potential of OCT for subtype classification. Specific OCT markers, such as thinning of the retinal layers, disruption of the photoreceptor layer, and alterations in retinal pigment epithelium (RPE) morphology, were correlated with certain RP subtypes. Additionally, OCT measurements of retinal thickness and photoreceptor layer integrity correlated strongly with visual acuity and disease severity. These findings emphasize the importance of comprehensive OCT analysis in RP management, allowing clinicians to tailor treatment approaches based on disease subtype and severity.While our study provides valuable insights into the diagnostic and prognostic potential of OCT in RP, further research is warranted. Future studies with larger sample sizes and longitudinal follow-up are needed to confirm these findings and explore the potential impact of OCT-guided treatment strategies. Additionally, investigating the relationship between specific OCT features and therapeutic interventions, such as gene therapy or stem cell transplantation, is crucial for optimizing patient outcomes. By leveraging the power of OCT, we can improve our understanding of RP, advance personalized treatment approaches, and ultimately work towards preserving vision and improving the quality of life for patients living with this challenging disease.

Reference

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