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ORIGINAL ARTICLE

Cornea and anterior segment in cases using α1-adrenergic receptor antagonists

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Abstract

Purpose: The purpose is to evaluate anterior segment parameters using Pentacam Scheimpflug camera system in patients using α1-adrenergic receptor antagonists for benign prostatic hyperplasia (BPH).

Methods: In this cross-sectional study, 102 left eyes of patients receiving α1-adrenergic receptor antagonists for BPH were compared with 102 age- and gender-matched healthy controls. Anterior segment parameters were measured using Pentacam Scheimpflug camera system under standardized dark conditions. Parameters included are central corneal thickness, corneal volume, anterior chamber depth, anterior chamber volume, anterior chamber angle width, and pupil diameter.

Results: The mean age was 62.7±7.1 years in the treatment group and 62.1±7.8 years in controls (p=0.781). Mean duration of drug use was 16.98±16.3 months (range: 6–60). Anterior chamber depth (p=0.045), anterior chamber volume (p=0.018), anterior chamber angle width (p=0.038), and pupil diameter (p=0.024) were significantly lower in the treatment group compared to controls. No significant differences were found in central corneal thickness (p=0.812) or corneal volume (p=0.165).

Conclusion: α1-adrenergic receptor antagonist use is associated with significant changes in anterior segment parameters, especially causing a decrease in anterior chamber parameter values and pupil diameter. These findings may help to predict intraoperative floppy iris syndrome risk and highlight the importance of regular glaucoma screening in these patients.

Keywords: Anterior segment; pentacam scheimpflug camera system; pupil diameter; α1-adrenergic receptor antagonist.

Benign prostatic hyperplasia (BPH) is a condition affecting 2.7% of men in the fourth decade and approximately 24% of men over 80 year old.[1] The first step pharmacological treatment is accepted as α1-adrenergic receptor antagonists such as tamsulosin (Flomax®).[2] The main mechanism of α1-adrenergic receptor antagonists in BPH can be explained as leading to an ease of bladder outflow obstruction by blocking α1-receptors on prostate's smooth muscle and by providing muscle relaxation.[3] These agents are well recognized by ophthalmologists due to their linkage to intraoperative floppy iris syndrome (IFIS). IFIS is characterized by iris billowing, iris prolapse, and progressive pupil constriction during cataract surgery and the existence of α1-adrenergic receptors in the iris dilator muscle is responsible for this relation.[4]

Several anterior segment parameters were evaluated in the

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previous studies regarding tamsulosin use. It was suggested that blocking the α1-adrenergic receptors on the iris dilator muscle might cause iris atrophy and insufficient mydriasis during intraocular surgery.[5]

The iris constitutes an important part of the anterior segment of the eye. Alterations in iris morphology are expected to cause an impact on other anterior segment parameters as well. Pentacam (Oculus Inc., Wetzlar, Germany), also known as the rotatuary Scheimpflug camera, is a device frequently preferred in the diagnosis and follow-up of corneal and anterior segment diseases today, as it provides noninvasive, easy, fast, and repeatable measurements. [6] Many anterior segment data such as anterior chamber depth, anterior chamber volume, anterior chamber angle width, central corneal thickness, corneal refraction, corneal volume, and pupil diameter can be obtained by measuring with this device.

This study aims to evaluate the parameters that can be determined with the Pentacam Scheimpflug camera system in patients using α1-adrenergic receptor antagonist agents with the diagnosis of BPH, and to compare these findings with age- and gender-matched healthy volunteers.

Materials and Methods

This study was approved by the institutional review board of Buca Seyfi Demirsoy Training and Research Hospital and adheres to the tenets of the Declaration of Helsinki. Written informed consent was obtained from each subject. After approval by the Institutional Review Board, the left eyes of 102 patients, who applied to the Urology Department of İzmir Buca Seyfi Demirsoy Research and Training Hospital, receiving α1-adrenergic receptor antagonists for BPH were included in the study.

Patients with an additional systemic or ocular disease, any additional topical/systemic drug use, or a history of previous intraocular surgery or trauma were excluded from the study. Before inclusion in the study, all patients underwent blood pressure measurement and fasting blood glucose testing, and those with abnormal values were excluded. In addition, all participants were carefully examined for pseudoexfoliation (PXS), and those with PXS were excluded from the study.

All patients included in the study initially underwent a detailed ophthalmological examination including best-corrected visual acuity determination with the Snellen chart, intraocular pressure measurement with applanation tonometry, and anterior–posterior segment evaluations with slit-lamp biomicroscopy. After these examinations, Pentacam Scheimpflug camera images were taken under constant dark conditions without pupil dilation. All measurements were taken in a standardized environment with consistent illumination, and performed in the same windowless examination room. To ensure consistent pupillary responses, patients were adapted to the room illumination for 5 min before measurements. The data obtained by the device including central corneal thickness, corneal volume, anterior chamber depth, anterior chamber volume, anterior chamber angle width, and pupil diameter were recorded. Both examinations and Pentacam imaging were performed by the same ophthalmologist (P.K.). The data were compared with those of 102 age- and gender-matched healthy volunteers.

Statistical Analysis

IBM Statistical Package for the Social Sciences version 25 (SPSS Inc., Chicago, IL, USA) was used for statistical purposes. Categorical variables were expressed as frequencies and percentages, and numerical variables were expressed as means and standard deviations. Kolmogorov–Smirnov tests were used to determine whether the data were normally distributed. Independent t-test was used to evaluate differences in normally distributed data. Mann–Whitney U test was used to determine differences in nonnormally distributed data. A p-value less than 0.05 was considered statistically significant. For statistical purposes, values from the left eye were analyzed in both the study and control groups.

Results

The mean age was 62.7±7.1 (range, 52–74) years in the group receiving α1-adrenergic receptor antagonists and 62.1±7.8 (range, 52–75) years in the control group (p=0.781). In the group using α1-adrenergic receptor antagonists, the mean duration of drug use was 16.98±16.3 (6–60) months.

Anterior chamber depth, anterior chamber volume, anterior chamber angle width, and pupil diameter were found to be significantly lower compared to the control group (p=0.045, p=0.018, p=0.038, p=0.024, respectively). No significant difference was observed between the groups in terms of central corneal thickness and corneal volume (p=0.812, p=0.165, respectively) (Table 1).

Discussion

Since the initial report on IFIS in 2005, many reseach has emerged on the impact of α1-adrenergic receptor antagonists on iris morphology and function. A significant interest has been generated in order to understand the underlying pathophysiology and to establish a link between

Table 1. Comparison of corneal and anterior segment parameters of the groups

	α1-adrenergic receptor antagonists group (Mean±SD) (min–max)	Control group (Mean±SD) (min–max)	P
Anterior chamber depth (mm)	2.69±0.62 (2.27–3.99)	2.93±0.39 (2.22–3.97)	0.045
Anterior chamber volume (mm^3)	144.44±39.09 (106–233)	158.44±31.23 (111–232)	0.018
Anterior chamber angle width (degree)	32.78±7.67 (27.1–40.7)	35.18±6.03 (28.2–40.6)	0.038
Pupil diameter (mm)	2.51±0.52 (1.55–3.69)	2.94±0.65 (1.95–4)	0.024
Central corneal thickness (μm)	533.87±32.15 (467–602)	534.47±29.96 (475–590)	0.812
Cornea volume (mm^3)	57.23±3.89 (47.9–66.9)	58.43±3.82 (50–64.6)	0.165

SD: Standard deviation.

these agents and complications during cataract surgery.

The present study revealed a reduction in pupil diameter among the patient group, which is an important property for successful cataract surgery. Previous studies have investigated the structural changes in iris morphology associated with α1-adrenergic receptor antagonist use. In Altan-Yaycioglu et al.'s study[7] decreased pupil diameter under mesopic and scotopic conditions following tamsulosin treatment was reported. Moreover, Theodossiadis et al.[8] evaluated the effect of α1-adrenergic receptor antagonists on pupil dynamics with a digital pupillometer and revealed a significant decrease in the maximum pupil diameter. Tufan et al.[9] investigated pupil diameter alterations with an infrared pupillometer and they observed significantly reduced photopic pupil diameter values, in the study group. Furthermore, in Prata et al.'s study,[10] which employed anterior segment optical coherence tomography (AS-OCT) in patients receiving systemic α1-adrenergic receptor antagonists, a significant decrease was detected in iris dilator muscle region thickness suggesting potential drug-induced atrophy. On the other hand, another study by Shtein et al.[11] no difference was detected in iris thickness or photopic pupil measurements with AS-OCT. Finally, in Aktas et al.'s study,[12] ultrasound biomicroscopy was used and patients using tamsulosin and alfuzosin were reported to have a decrease in dilator muscle region thickness.

Investigations have focused on α1-adrenergic antagonists' direct effects on the iris dilator muscle. Chronic receptor blockage leading to vascular dysregulation and causing dilator muscle atrophy might be the main contributor to abnormal iris behavior during cataract surgery in patients receiving these agents.[5]

In the current study, a significant decrease was detected in anterior chamber depth, volume, and angle width in patients receiving α1-adrenergic receptor antagonists. These findings show similarity to those of Al-Kharashi et al.'s[13] This result may be due to alterations in iris morphology in addition to reduced aqueous humor production.[3] α1-adrenergic receptors are known to play a crucial role in aqueous humor turnover. Zhan et al.[14] reported that bunazosin which is an α1-adrenergic receptor antagonist, significantly lowered intraocular pressure by increasing uveoscleral outflow in rabbits. In addition, Krupin et al.[15] reported decreased aqueous humor production with prazosin. These studies show that α1-adrenergic receptor antagonists may cause anterior chamber shallowing through leading alterations in iris structure and reducing aqueous humor volume. Another contributing mechanism in decreasing anterior chamber depth and angle might be by reducing pupil dilation capacity. This effect might cause a contraction of the longitudinal ciliary muscle and might result in anterior displacement of the lens-iris diaphragm.[16]

The iris is an anatomical structure that plays a crucial role in the anterior segment of the eye, especially constitutes the anterior chamber angle and contributes to anterior chamber volume and depth measurements. It is not surprising that pharmacological agents' impact on iris morphology is likely to cause alterations in these anterior segment parameters.

A study by Yüksel et al.[16] which is the most similar to the present one in terms of methodology, the Pentacam Scheimpflug camera system was used under standardized dim light conditions to evaluate corneal and anterior segment parameters in patients receiving α-1 adrenergic receptor antagonists for BPH. Although they had a smaller sample size compared to this, their findings were consistent with our results, demonstrating statistically significant decreases in pupil diameter, anterior chamber depth, and anterior chamber angle in the patient group. In addition, like in the current study, central corneal thickness and corneal volume values showed no difference when

compared to healthy controls. However, contrary to the present study, Palamar et al.[17] reported that patients receiving tamsulosin for BPH were found to have a significant increase in central corneal thickness detected with Pentacam Scheimpflug camera system 1 month after initiation of the treatment.

Conclusion

This study has two main limitations. First, imaging was performed only under standard dim light conditions. Using various techniques under both scotopic and photopic conditions could provide more reliable results. Second, the wide range of α1-adrenergic receptor antagonist usage duration (6–60 months) may affect the results influenced by the duration. A study comparing anterior segment measurements before and after treatment would offer more reliable results.

Pentacam Scheimpflug camera system is a noncontact, noninvasive, rapid, and easy technique for assessing anterior segment changes in patients using α-1 adrenergic receptor antagonists. This study's findings are valuable because of the common co-occurrence of cataracts and BPH in the elderly population. To detect the alterations in the anterior segment might serve two purposes including prediction of IFIS and leading ophthalmologists to take precautions during cataract surgery and emphasizing the necessity for regular glaucoma screening in these patient groups.

Ethics Committee Approval: Buca Seyfi Demirsoy Training and Research Hospital Ethics Committee granted approval for this study (date: 06.02.2023, number: HNEAH-KAEK 2023/12-4060).

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