SCIENTIFIC Research and Community

Effect of Anterior Uveitis on Corneal Endothelial Cells

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ABSTRACT

Objective: Investigating the impact of anterior uveitis on changes occurring in corneal endothelial cells.

Methods: In this prospective cross-sectional study (cases and controls), the research sample included 43 patients (86 eyes) from the ophthalmic clinic attendees at Tishreen University Hospital in Latakia during the period 2023-2024.

Results: The average corneal endothelial cell count was lower in the anterior uveitis group, both granulomatous (2074.16 ± 173.70 cells/mm²) and non-granulomatous (2188.38 ± 165.7 cells/mm²) types, compared to the control group (2696.1 ± 136.60 cells/mm²) with a (p-value <0.01) in all age groups studied. The average percentage of hexagonal cells was lower in the both granulomatous ($42.41\pm2.6\%$) and non- granulomatous ($47.0\pm2.2\%$) types, compared to the control group ($61.4\pm2.0\%$) with a (p-value <0.01) in all age groups studied. The average cell volume change coefficient was higher in the anterior uveitis group, both granulomatous (40.16 ± 2.1) and non-granulomatous (34.70 ± 1.08) types, compared to the control group (29.8 ± 1.36) with a (p-value <0.01) in all age groups studied. Host and disease-related characteristics had no effect on the measured results) p-value$=0.184$(. ECC was negatively correlated to the duration of uveitis ($a=-0.513$; p-value<0.001), maximum intraocular pressure during the course of disease ($a=-0.472$; p-value $= 0.0001$), and the number of attacks ($a=-0.515$; p-value<0.001).

Conclusion: Corneal endothelial cells are affectd in patients with anterior uveitis, and this negative impact increases with the duration of the disease, the number of attacks, and the presence of elevated intraocular pressure. This negative impact is more pronounced in granulomatous uveitis.

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Introduction

The cornea is an important part of the eye's visual system and its condition is directly linked to the quality of vision. The endothelium of cornea plays an important role in the stability and transparency of the cornea. Several changes in the cornea can be seen in patients with anterior uveitis, including Band Keratopathy, iris-corneal adhesions, and deposits on the corneal endothelium [1]. Laboratory evidence suggests that corneal endothelial cell damage may occur in patients with anterior uveitis due to inflammatory cytokines in the aqueous humor or due to deposits on the endothelium. Therefore, these patients may be at increased risk of corneal decompensation as a complication of surgery if the endothelium is damaged. In our study, we evaluated the corneal endothelial cell count and morphological features in a group of patients with a history of anterior uveitis. Our research also includes a study of factors that may be associated with an increased risk of corneal endothelial cell abnormalties in patients with anterior uveitis.

Materials and Methods

Study Design: Prospective cross-sectional study (cases and controls).

Duration of the Study: 12 months between 1/3/2023 and 29/2/2024.

In this study the research sample included 43 patients (86 eyes) and the study was divided into two groups: the anterior uveitis group, which included 34 patients (46 eyes) with anterior uveitis from the ophthalmic clinic attendees at Tishreen University Hospital in Latakia during the period 2023-2024 and the control group included 31 patients (40 eyes), 9 patients(18 eyes) from ophthalmic clinic attendees without anterior uveitis, and (22 eyes) are the healthy opposite eye in patients with unilateral anterior uveitis, making the total sample size 40 eyes for result comparison.

Inclusion Criteria

Patients with anterior uveitis, aged between 20 and 50years, after obtaining informed consent. Exclusion criteria: any previous ocular surgical intervention, glucoma, using contact lenses or chronic use of eye drop, severe refractive errors, malignant neoplasms, diabetes, smoking, pregnancy and breastfeeding, any corneal disease (such as corneal thinning, corneal dystrophy and

degeneration, and corneal ulcers).

Detailed medical history was obtained, distance visual acuity was measured, comprehensive eye examination of anterior segments was conducted using a slit lamp, Subsequently, intraocular pressure was measured with a Goldman tonometer, and changes in endothelial cells were assessed using a specular microscope. The following criteria were studied: endothelial cell count, cell volume change coefficient, percentage of hexagonal cells.

Results
In our study we have included 86 patients, 46 males and 40 females. The age range of the study participants was between 20 and 50 years, they were divided into three age groups (20-30), (30-40), (40-50). No statistically significant differences were observed between the research groups in term of sex.

Table 1: The Average Values of the Corneal Endothelial Cell Count in the Sample

ECC cells/mm²	Granulomatous anterior uveitis	Non-Granulomatous anterior uveitis	CONTROL	P-value
Mean ±SD	2074.16±173.70	2188.38±165.7	2696.1±136.60	0.001
Min - Max	1850 - 2330	1900 - 2500	2500-2900	

There are statistically significant differences between the research groups regarding the average values of the corneal endothelial cell count which was lower in the Granulomatous anterior uveitis group 2074.16±173.70 compared to the control group 2696.1±136.60, and the average values of the corneal endothelial cell count was lower in the non- Granulomatous anterior uveitis group 2188.38±165.7 compared to the control group 2696.1±136.60 With (p-value=0.0001).

Table 2: The Average Values of Percentage of Hexagonal Cells in the Sample

EX %	Granulomatous anterior uveitis	Non-Granulomatous anterior uveitis	CONTROL	P-value
Mean ± SD	42.41±2.6	47.0±2.2	61.4±2.0	0.0001
Min - Max	40-47	44 - 52	58-64	

There are statistically significant differences between the research groups regarding the average values of percentage of hexagonal cells which was lower in the Granulomatous anterior uveitis group **42.41±2.6** compared to the control group **61.4±2.0**, and the average values of percentage of hexagonal cells which was lower in the non- Granulomatous anterior uveitis group **47.0±2.2** compared to the control group **61.4±2.0** With (p-value=0.0001).

Table 3: The Average Values of Cell Volume Change Coefficient in the Sample

CV	Granulomatous anterior uveitis	Non-Granulomatous anterior uveitis	CONTROL	P-value
Mean ± SD	40.16±2.1	34.70 ±1.08	29.8 ±1.36	0.002
Min - Max	37-43	33-37	32-28	

There are statistically significant differences between the research groups in terms of average cell volume change coefficient with (p-value of 0.002).

Table 4: Correlations between Uveitis-Associated Factors and Corneal Endothelial Cell Count for Eyes with Anterior Uveitis

Factor	r	P-value
Maximum IOP	-0.472	0.001
Interval since diagnosis of uveitis	-0.513	0.0001
Number of attacks	-0.515	0.0002

Note: r: Spearman Correlation Coefficient.

We found that Maximum IOP values levels, Interval since diagnosis of uveitis, Number of attacks were significantly associated with lower central ECD with P-value<0.05.

Discussion
In our study, we found that the average corneal endothelial cell count was lower in the Granulomatous anterior uveitis group (2074.16±173.70cells/mm²) and Non-Granulomatous anterior uveitis group (2188.38±165.7cells/mm²) compared to the control group (2696.1±136.60cells/mm²) with a (p-value of 0.0001). This can be explained by several mechanisms, including injury to the corneal endothelium due to the disturbance in the aqueous humor, the impact of existing inflammation, and the breakdown of the blood-aqueous barrier. In aqueous humor, inflammatory cells and proteins such as cytokines are in direct contact with corneal endothelial cells in these patients, causing toxic damage and accelerating of apoptosis [2,3]. Our study agreed with the study of Alfawaz et al. and also

with the study of Guclu et al. and Chen X et al. [2-4]. The average percentage of hexagonal cells was lower in the Granulomatous anterior uveitis group (42.41±2.6 %) and Non-Granulomatous anterior uveitis group (47.0±2.2%) compared to the control group (61.4±2.0%) with a (p-value of 0.0001). This can be explained as part of the compensatory mechanism for the loss of endothelial cells so the characteristic hexagonal shape of the remaining cells is lost and Under stressful situations, endothelial cells will lose their uniform hexagonal shapes, a phenomenon that is reflected in the variable "percent hexagonal cells" (pleomorphism) [5]. Our study agreed with the study of Alfawaz et al. and also with the study of Guclu et al. and Chen X et al. [2-4]. The average cell volume change coefficient was higher in the Granulomatous anterior uveitis group (40.16±2.1) and Non-Granulomatous anterior uveitis group (34.70±1.08) compared to the control group (29.8±1.36) with a (p-value of 0.002). This can be explained as part of the compensatory mechanism for the loss of endothelial cells, where the cell increases its volume to fill the resulting space [6]. Our study is consistent with the study of of Guclu et al. and Chen X et al. and our study differed with the study of Alfawaz et al. and the reason for this difference may be because the difference in the device used in the study [2-4]. In our study, we used (CSO/Perseus-Italien), while in Alfawaz study, used (Konan SP-8300USA). We tried to address the issue of chronicity by investigating the Interval since diagnosis of uveitis as a risk factor for lower central ECD and found a significant, negative correlation between central ECD and Interval since diagnosis of uveitis with a (p-value of 0.0001) This can be explained by the chronic elevation of inflammatory cytokines in the queous humor, meaning an increased duration of cotact of these inflammatory factors with endothelial cells and resulting toxic effect on them . and we found a significant, negative correlation between central ECD and Maximum IOP with a (p-value of 0.001) and This can be explained by the damage to the function of the physical barrier of the corneal endothelial cells, in addition to the nutritional changes to the endothelial cells, leading to an acceleration of their loss [5,6]. and found a significant, negative correlation between central ECD and Number of attacks according to the impact of flare and inflammatory cells in aqueous humor as found by AL-Fawaz et al. [2].

Conclusion
Anterior segment inflammation is associated with lower central ECD and variation of morphologic features of these cells.

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