Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.ijceo.org

Original Research Article

Assessing corneal alterations in endocrine disorders: a cross sectional observational clinical study

Sharmistha Behera[1], **Biswanath Sahu**[2], **Sasmita Sahu**[1], **Rangumudri Sai Sunanda**[1]*, **Arpita Das**[1]

[1]*Dept. of Ophthalmology, Veer Surendra Sai Institute of Medical Sciences And Research (VIMSAR), Burla, Odisha, India*
[2]*Dept. of Ophthalmology, Bhima Bhoi Medical College and Hospital, Gandhrel, Odisha, India*

ARTICLE INFO

Article history:
Received 10-12-2023
Accepted 14-06-2024
Available online 30-12-2024

Keywords:
Corneal alterations
DM
GO
Hypothyroidism

ABSTRACT

Introduction: Corneal alterations are frequent in many endocrine disorders like Graves Ophthalmopathy and Diabetes mellitus. It is a challenge to an ophthalmologist for early detection of such change as it can prevent visual impairment.
Aim: Clinical assessment of corneal alterations in endocrine disorders.
Materials and Methods: A prospective observational hospital-based study conducted over a period of 2 years including 150 patients of different endocrine disorders. In each patient meticulous history taking, complete ophthalmological tests including slit lamp biomicroscopy, ocular surface staining, TBUT, schirmer's test I, CCT measured by pachymetry, endothelial parameters like ECD, CV, HEX measured by clinical specular microscope.
Result: The study revealed an age range of 14 to 82 years with a mean age of 48.43±14.2 years, and a male to female ratio of 1.34:1. Prevalent endocrine disorders included Type 2 DM (64.7%), Grave's Ophthalmopathy (12%), Hypothyroidism (13.3%), Type-1 DM (4.7%), Hyperparathyroidism (2%), Cushing's syndrome (2.7%), and Addison's disease (0.7%). Epithelial abnormalities like SPK were found in 28.57% in DM1, 19.59% in DM2, and 25% in hypothyroidism. Corneal ulcers were present in 4.1% of DM2 patients and 11.1% of GO patients. Exposure keratopathy (44.4%) and SLKC (11.1%) were exclusive to GO. Diminished corneal sensation was observed in 28.6% of DM1, 26.8% of DM2, and 22.4% of GO cases. Dry eye was prevalent in 14.3% of DM1, 32% of DM2, 55.6% of GO, and 35% of hypothyroid patients. Changes in central corneal thickness (CCT) and endothelial cell density (ECD) were significant in both DM1 and DM2 groups, with increased CCT and decreased ECD. Additionally, coefficient of variation (CV) was elevated in both DM1 and DM2, while endothelial hexagonality (HEX) was decreased significantly in both groups.
Conclusion: The present study showed that different corneal alterations can be possible in endocrine disorders. So all endocrine disorders should undergo comprehensive ophthalmological examination to prevent visual impairment.

1. Introduction

The eye serves as a crucial diagnostic tool for detecting numerous systemic diseases, with ocular manifestations frequently observed in various endocrine disorders like Diabetes mellitus and Graves' disease.[1] However, there exists a multitude of lesser-known endocrine disorders wherein ocular damage plays a significant role, underscoring the importance of recognizing these manifestations as the initial step in diagnosis and treatment.

* *Corresponding author*.
E-mail address: sharmisthabehera@gmail.com (R. S. Sunanda).

https://doi.org/10.18231/j.ijceo.2024.132

The endocrine system comprises several glands scattered throughout the body responsible for hormone secretion, regulated by the hypothalamus and pituitary gland. Among the principal glands are the hypothalamus, pituitary gland, thyroid gland, parathyroid glands, pancreas, and adrenal glands, producing hormones such as insulin, thyroid hormones, parathyroid hormones, and cortisol.[2] Hyper or hyposecretion of these hormones can lead to multi-organ manifestations, with some endocrine disorders initially presenting through distinct pathophysiological factors in the eye. Notably, corneal changes often serve as prominent indicators alerting eye care practitioners to underlying endocrine diseases. Recognizing the significance of these changes and their potential relationship with endocrine disorders is crucial for early detection, prevention, diagnosis, treatment, and monitoring, ultimately reducing the morbidity associated with these conditions, including permanent visual dysfunction.[3] Endocrine ophthalmopathies result from significant functional changes in the eye, leading to disability, and fall within the realms of both endocrinology and ophthalmology. This study aims to explore corneal alterations in various endocrine disorders, recognizing the intricate interplay between endocrine effects and ocular health.[4]

Addison's disease is a chronic condition in which your adrenal glands don't produce enough of the hormones cortisol and aldosterone.

Your adrenal glands, also known as suprarenal glands, are small, triangle-shaped glands that are located on top of each of your two kidneys. They're a part of your endocrine system.

Cortisol is a hormone that helps your body respond to stress, including the stress of illness, injury or surgery. It also helps maintain your blood pressure, heart function, immune system and blood glucose (sugar) levels. Cortisol is essential for life.

Aldosterone is a hormone that affects the balance of sodium (salt) and potassium in your blood. This in turn controls the amount of fluid your kidneys remove as urine (pee), which affects blood volume and blood pressure.

Addison's disease is also called primary adrenal insufficiency. A related disorder, secondary adrenal insufficiency, happens when your pituitary gland doesn't release enough adrenocorticotropic hormone (ACTH), which activates your adrenal glands to produce cortisol.

Cushing syndrome: cushing syndrome comprises the signs and symptoms associated with prolonged exposure to inappropriately elevated levels of free plasma glucocorticoids. Cushing's syndrome is common, occurring to some degree in majority of patients taking long term corticosteroid therapy. Endogenous causes of Cushing's syndrome are rare and result in loss of the normal feedback mechanism of the hypothalamic pituitary axis and the normal circadian rhythm of cortisol secretion.

Ocular manifestations: ocular effects of Cushing's syndrome include raised intraocular pressure and exophthalmos (seen in up to one third of patients in Cushing's original series), the latter occurring due to increased retro-orbital fat deposition. Cataracts occur as a complication of long term corticosteroid therapy.

McCune Albright syndrome is classically defined by the triad of fibrous dysplasia of the bones, café-au-lait skin spots and precocious puberty. It has an estimated prevalence of 1/100 000 and 1/1000 000 and manifests in childhood and young adults. Autonomous hyperfunction most commonly involves the ovary, but other endocrine involvements include thyroid (nodular hyperplasia with thyrotoxicosis), adrenals (multiple hyperplastic nodules with Cushing's syndrome), pituitary (adenoma or hyperplasia), and parathyroid (adenomas or hyperplasia with hyperparathyroidism).

2. Materials and Methods

A prospective observational hospital-based study was conducted at Dept. of Ophthalmology, VSSIMSAR, Burla, Sambalpur, Odisha for over a period of 2 years including 150 patients of different endocrine disorders. Informed consent was obtained from each patient participating in the study, and institutional ethical committee approval was granted prior to commencement of the research. Each patient underwent thorough history-taking and comprehensive ophthalmological assessments, including slit lamp biomicroscopy, ocular surface staining, tear breakup time (TBUT), Schirmer's test I, central corneal thickness (CCT) measurement via pachymetry, and assessment of endothelial parameters such as endothelial cell density (ECD), coefficient of variation (CV), and hexagonality (HEX) using a clinical specular microscope.

2.1. Sample size

150 cases of diagnosed endocrine disorders were included in this study.

2.2. Inclusion criteria

1. Patients of known endocrine disorders were subjected to a detailed history taking, systemic examination.
2. Examination included physical examination to check for any pain on ocular movements.

2.3. Exclusion criteria

1. Corneal alterations in systemic disorders (other than endocrine disorders).
2. Local corneal pathology like keratitis due to infection, inflammation & trauma.

Sample collection is usually achieved by performing a 'corneal scrape' from the leading edges and the base of the ulcer. Topical anesthesia is used, preferably avoiding

tetracaine, as it has an antimicrobial effect. Instruments used for scraping include surgical blades.

3. Observation & Results

Table 1: Endocrine disease distribution

Disease	No. of cases	Percentage [%]
DM1	7	4.7
DM2	97	64.7
GO	18	12.0
Hypothyroidism	20	13.3
Hyperparathyroidism	3	2.0
Cushing's syndrome	4	2.7
Addison's disease	1	.7
Total	150	100

llustrates that over the past two years, there were a total of 150 cases of various endocrine disorders. Among these, 7 cases (4.7%) were identified as type-1 Diabetes mellitus (DM1), 97 cases (64.7%) as type-2 Diabetes mellitus (DM2), 18 cases (12%) as Gravesophthalmopathy (GO), 20 cases (13.3%) as hypothyroidism, 3 cases (2%) as Hyperparathyroidism, 4 cases (2.7%) as Cushing's syndrome, and 1 case (0.7%) as Addison's disease. The highest number of cases was observed in DM2, while the lowest was in Addison's disease.

Table 2 elucidates that within our study, the minimum recorded age was 14 years, while the maximum age reached 82 years. The age group with the highest patient count was 50-59 years, comprising 38 patients diagnosed with DM2. The calculated mean age of 48.43 years, with a standard deviation of 14.27 years, offers further context regarding the central tendency and dispersion of ages among the studycohort. It's noteworthy that the observed age range, spanning from 14 to 82 years, reflects a broad spectrum of participants within the study.

Table 3 analysis indicates that within our study cohort, there were 86 male participants, constituting 57.33% of the total, while 64 individuals identified as female, comprising 42.67% of the sample. This distribution yields a male-to-female ratio of 1.3:1. Such gender-based delineation provides valuable insights into the representation of sexes within the studied population, facilitating a nuanced understanding of potential gender-specific trends or disparities in the manifestation and prevalence of the investigated endocrine disorders.

The table that among 150 study participants, SPK was detected in 26 patients (17.33%). Among these cases, SPK was most prevalent among Type 2 diabetes mellitus (DM) patients, comprising 73% of the total occurrences.

The aforementioned table and chart indicate that superior limbic keratoconjunctivitis (SLK) was observed in 2 cases of patients with Grave's Ophthalmopathy, accounting for 1.3% of the total occurrences.

Table 7 demonstrates that within our study cohort, dry eye was present in 49 patients, constituting 32.6% of the total participants. The highest incidence of dry eye was observed in individuals with Type 2 diabetes mellitus, followed by those with Grave'sophthalmopathy and hypothyroidism.

The table indicates that within our study, corneal ulcers were identified in 6 out of 150 patients, representing 4% of the total cases. The highest prevalence of corneal ulcers was observed among individuals with Type 2 diabetes mellitus (67%), followed by those with Grave's ophthalmopathy (33%).

The table above provides evidence that central corneal thickness (CCT) was notably higher in patients diagnosed with Type 2 diabetes mellitus (DM 2), with a mean value of 572.8 ± 21.54 micrometers in the right eye (RE). In comparison, patients with Type 1 diabetes mellitus (DM 1) exhibited a slightly lower CCT, with a mean of 571.2 ± 7.41 micrometers in the left eye (LE).

This table presents data indicating that endothelial cell density is notably reduced in patients diagnosed with Type 2 diabetes mellitus (DM 2), with a mean value of 2313.13 ± 227.46 cells/mm^2 in the right eye (RE), followed by patients with Type 1 diabetes mellitus (DM 1) exhibiting a slightly higher mean of 2400.14 ± 23.44 cells/mm^2 in the RE. Additionally, both DM 1 and DM 2 patients displayed abnormal coefficients of variance, exceeding 40%. Furthermore, abnormalities in hexagonal cell morphology were observed in both DM 1 and DM 2 patients, characterized by values below 60%.

So thereby our observations indicated a male predominance in Type 2 diabetes mellitus (DM2), with 67 out of 97 patients being male compared to 30 females, while in Type 1 diabetes mellitus (DM1), 7 out of 9 patients were male. Conversely, female predominance was noted in Grave's Ophthalmopathy (GO) and hypothyroidism, with 12 females out of 18 and 17 females out of 20 patients, respectively. The prevalence of punctate keratopathy in DM2 was 19.59%, recurrent corneal erosion was 6.2%, and corneal ulcer was 4.1%. Diminished corneal sensation was prevalent in 26.9% of DM patients. Dry eye prevalence was 14.3% in Type 1 DM, 32% in Type 2 DM, 55.6% in GO, and 35% in hypothyroidism. Mean central corneal thickness (CCT) was 572.8±21.5μm in Type 2 DM and 571.2±7.41μm in Type 1 DM, significantly higher than normal, while CCT remained within the normal range in GO and hypothyroid patients. Type 2 diabetic patients exhibited a statistically significant reduction in mean corneal endothelial cell density (2313.13±227.46 cells/mm^2). The coefficient of variation (CV) of corneal endothelial cells was significantly increased in diabetics, indicating polymegathism. The percentage of hexagonal cells was significantly reduced (51.36±6.65%) in diabetic patients, suggestive of pleomorphism. Additionally, Type 1

Table 2: Age distribution

Age Group	T2DM	T1DM	Hyperparathyroidism	Hypoythyroidism	GO	CUS	A D	Grand Total
10-19		5				1		6
20-29	1	2		3	3	2		11
30-39	10		1	7	2	1	1	22
40-49	18		2	8	5			33
50-59	38			1	5			44
60-69	23				3			26
70-79	4			1				5
80-90	3							3
Grand Total	**97**	**7**	**3**	**20**	**18**	**4**	**1**	**150**

Table 3: Gender distribution

Disease	Male	Female	Male [%]	Female [%]
Diabetes mellitus-1	5	2	71.4%	28.6%
Diabetes mellitus-2	67	30	69.1%	30.9%
Graves ophthalmopathy	6	12	33.3%	66.7%
Hypothyroidism	3	17	15%	85%
Hyperparathyroidism	2	1	66.7%	33.3%
Cushing's syndrome	2	2	50%	50%
Addison's disease	1	0	100%	0%
Total (150)	86	64	57.33%	42.67%

Table 4: Superficial punctate keratopathy (SPK)

Disease	No. of SPK	Total Patient	Percentage [%]
Diabetes mellitus-1	2	7	28.57
Diabetes mellitus-2	19	97	19.59
Graves ophthalmopathy	0	18	0
Hypothyroidism	5	20	25
Hyperparathyroidism	0	3	0
Cushing's syndrome	0	4	0
Addison's disease	0	1	0
	26	150	17.33

Table 5: Superior limbic kerato conjuctivitis (SLKC)

Disease	No. of SPK	Total Patient	Percentage [%]
Diabetes mellitus-1	0	7	0
Diabetes mellitus-2	0	97	0
Graves ophthalmopathy	2	18	11.1
Hypothyroidism	0	20	0
Hyperparathyroidism	0	3	0
Cushing's syndrome	0	4	0
Addison's disease	0	1	0
	2	150	1.3

Table 6: Dry eye (DE)

Disease	No. of DE	Total Patient	Percentage [%]
Diabetes mellitus-1	1	7	14.3
Diabetes mellitus-2	31	97	32
Graves ophthalmopathy	10	18	55.6
Hypothyroidism	7	20	35
Hyperparathyroidism	0	3	0
Cushing's syndrome	0	4	0
Addison's disease	0	1	0
	49	150	32.6

Table 7: Corneal ulcer (CU)

Disease	No. of CU	Total Patient	Percentage [%]
Diabetes mellitus-1	0	7	0
Diabetes mellitus-2	4	97	4.1
Graves ophthalmopathy	2	18	11.1
Hypothyroidism	0	20	0
Hyperparathyroidism	0	3	0
Cushing's syndrome	0	4	0
Addison's disease	0	1	0
	6	150	4

Table 8: Central corneal thickness (CCT)

Disease	RE [Mean ± SD]	LE [Mean ± SD]
Diabetes mellitus-1	570.8 ± 7.10	571.2 ± 7.41
Diabetes mellitus-2	572.8 ± 21.54	570.9 ± 21.29
Graves ophthalmopathy	542.1 ± 7.3	544.9 ± 6.15
Hypothyroidism	537.0 ± 5.45	539.5 ± 4.62
Hyperparathyroidism	536.6 ± 7.63	541.3 ± 8.08
Cushing's syndrome	534.7 ± 4.19	537.7 ± 7.89
Addison's disease	540.0 ± 0	545.0 ± 0

Table 9: Endothelial cell parameter

Disease	ECD [cell/mm^2]		CV [%]		HEX [%]	
	RE [Mean ± SD]	LE [Mean ± SD]	RE [Mean ± SD]	LE [Mean ± SD]	RE [Mean ± SD]	LE [Mean ± SD]
Diabetes mellitus-1	2400.14±23.44	2400.14±31.39	50.14±3.97	52.57±3.86	49.0±4.89	49.14±4.01
Diabetes mellitus-2	2313.13 ± 227.46	2316.15 ± 228.25	48.77 ± 6.59	49.43 ± 6.45	51.36 ± 6.65	50.97 ± 6.29
Graves ophthalmopathy	2719.28 ± 117.04	2721.56 ± 111.04	32.56 ± 3.50	33.06 ± 3.33	66.39 ± 3.77	67.61 ± 4.84
Hypothyroidism	2703.45 ± 146.05	2711.45 ± 148.97	31.00 ± 3.40	31.95 ± 4.01	67.30 ± 3.40	67.95 ± 4.03
Hyperparathyroidism	2663.33 ± 100.16	2664.33 ± 87.55	32.33 ± 1.52	34.67 ± 1.52	65.0 ± 1.0	68.0 ± 2.64
Cushing's syndrome	2809.75 ± 137.33	2807.0 ± 130.04	30.25 ± 3.86	29.50 ± 5.44	70.0 ± 3.16	72.00 ± 3.16
Addison's disease	3100	3078	29	30	65	66

DM demonstrated a reduction in mean corneal endothelial cell density (2400.14±23.44 cells/mm^2).

We also state our result of the study that the age distribution ranged from 14 to 82 years with a mean age of 48.43±14.2 years, and the male to female ratio was 1.34:1. Endocrine disorders included Type 2 DM (64.7%), Grave's Ophthalmopathy (12%), Hypothyroidism (13.3%), Type-1 DM (4.7%), Hyperparathyroidism (2%), Cushing's syndrome (2.7%), and Addison's disease (0.7%). Epithelial abnormalities such as SPK were present in 28.57% of DM1, 19.59% of DM2, and 25% of hypothyroidism cases. PED was found in 14.3% of DM1 and 8.2% of DM2, while RCE was present in 14.3% of DM1 and 6.2% of DM2. Corneal ulcer occurred in 4.1% of DM2 patients and 11.1% of GO patients. Exposure keratopathy and SLKC were exclusive to GO, with rates of 44.4% and 11.1%, respectively. Diminished corneal sensation was observed in 28.6% of DM1, 26.8% of DM2, and 22.4% of GO cases. Dry eye affected 14.3% of DM1, 32% of DM2, 55.6% of GO, and 35% of hypothyroidism patients. CCT was increased and statistically significant in DM1 (570.8±7.10μ) and DM2 (572.8±21.4μ). ECD was decreased and statistically significant in DM1 (2400.14±23.44 cell/mm^2) and DM2 (2313.13±227.46cell/mm^2). CV was increased in DM1 (50.14±3.86%) and DM2 (48.77±6.59%), while HEX was decreased and statistically significant in DM1 (49.0±4.89%) and DM2 (51.36±6.65%).

4. Discussion

In our study the mean age was found to be 48.43±14.27yr. Similar study was conducted by Cankurtara et al[5] (54.9±6.6yr), Calvo-Maroto et al.(52.2±6.18yr), Larson et al.(36±12yr), Zhou M et al(44.90±12.49yr). Ozturk et

al.(40.58±1.32yr). The maximum numbers patients found in age group 50-59yr that was found to be 38 numbers of DM2 in our study. Similarly found in the Cankurtara et al. that was 40 numbers DM2 patients in the age group 50- 59yr.

Our study found that the total number of DM2 patients were 97. Out of which 67 were male and 30 were female. Similar studies were conducted by Calvo-Maroto et al.[6] They were taken 40 number of DM2 (17 male and 23 female), Cankurtara et al[7] found 153 number of DM2 (76 male and 77 female).

Males were found to be more than female in our study. 7 number of DM1 patients were studied in our study. Male were found to be 7 and females were 2. Similar study conducted by Fernandes et al.[8] 50 number of DM1 taken, males were 24 and females were 26, Keoleian et al.[9] 14 number of DM1 taken out of which 9 were male and 5 were females, Larsson et al.[10] Studied 49 number of DM1 out of which 30 were males and 19 were females. In our study GO patients found to be 18(6 males and 12 females). In Zhou M et al.[11] Total number of patients were 39(18 males and 21 females), in Edoardo Villani et al.[12] 26 number of GO patients found (8 males and 18 females). Females patients were more than males in GO found in all above studies. Hypothyroid patients were found 20 (3 males and 17 females) in our study. Ozturk et al[13] studied 33 patients of hypothyroids out of which only 1 male and 32 females were found. In both the studies females were more than males. Epithelial abnormality. Our study found that the prevalence of punctate keratopathy in DM2 was found to be 19.59%, recurrent corneal erosion found was 6.2% and corneal ulcer found 4.1%. Similar study was found in Didenko et al.[14] The prevalence of punctate keratopathy in DM2 was 21.3%, recurrent corneal erosion found 8.2% and corneal ulcer found 6.6%. Corneal sensation our study showed that the prevalence of diminished corneal sensation was found to be 26.9% in DM patients. Naik K et al. Found the prevalence of diminished corneal sensation in DM was 12%. DRY EYE In our study the prevalence of dry eye in Type 1 DM was found 14.3%. (1 dry eye found out of 7), in Type 2 DM 32%(31 dry eye out of 97), in GO 55.6% (10 dry eye out of 18) and in hypothyroidism it was found to be 35%. (7 dry eye out of 20) similar study was conducted by Naik k et al.[15] In Type 1 DM and Type 2 DM. The prevalence of dry eye found in Type 1 DM was 15%(24 out of 160) and in Type 2 DM was 41.2%(66 out of 160). Achtsidis V et al.[16] Found the prevalence of dry eye in GO patients was 57.6%.(15 patients of dry eye found out of 26). Kan et al[17] conducted a study on hypothyroidism patients and found mean Schirmer and mean TBUT scores were significantly lower in patients compared to control. CCT Our study found that in Type 2 DM patients the mean CCT was 572.8±21.5μm which was higher than the normal and statistically significant. Similarly the CCT was significantly increased in Dawood Y.F. et al[13] (581±32.4μm) and Galgauskas et al (570±36μm) study.[14] We also found that in Type 1 DM mean CCT was increased that was found to be 571.2± 7.41μm. Similar study like Larsson et al, found increased in mean CCT(580±50μm) in their study. We found the mean CCT in Graves ophthalmopathy patients was 544.9±6.15μm. Similarly the mean CCT was found to be 544.6±5.34μm in Zhou M et al. study.[7] Both study found that the CCT was in normal range in GO patients. Mean CCT was 537±5.45μm found in Hypothyroid patients in our study which was in normal range and not statistically significant. Also found similar result in the Ozturk et al. study that was 538.05±3.85μm.[9] Endothelial abnormality In this study, we found that type II diabetic patients showed a statistically significant reduction in mean corneal endothelial cell density (2313.13±227.46). This was similar to found by Cankurtara et al(2483±326 cell/mm^2) and Durukan et al (2295±311 cell/mm^2) in their study of type II diabetics.[15] We also found that coefficient of variation (CV) of corneal endothelial cells to be significantly increased in diabetics. The increase in CV indicates the presence of polymegathism in which endothelial cells enlarge to fill the gaps between adjacent cells. This was similar to found by Dawood Y. F. et al (49.8±4.17%). Our study also showed that the percentage of hexagonal cell (51.36±6.65%) was significantly reduced in diabetic patients, indicating the presence of pleomorphism. These results were similar to those obtained Galgauskas et al(52±11%) and Sudhir et al.(49±7%).[16] Also in Type I DM we found reduction in mean corneal endothelial cell density (2400.14±23.44 cell/mm^2) which was similar to found by Larsson et al[6] (2422±313 cell/mm^2) and Keoleian et al (2383±280 cell/mm^2).[5] Coefficient of variation of endothelial cell(50.14±3.97%) increased and the result was similar to Fernandes et al(45.2±5.54%).[8] Percentage of hexagonal(49.0±4.89%) also reduced similar to found by Anbar et al(50±7%).[17] Our study showed that in Graves ophthalmopathy patients the mean ECD was found 2719.2 cell/mm^2 and CV was 33.06%. The similar result also found in Zhou M et al.(ECD-2696.1, CV-33.9%). But the percentage of hexagonal cell found to be 66.3(>60%) in our study and 54%(<60%) found in Zhou M et al.[7]

Addison's disease: Addison's disease is characterized by primary hypoadrenalism, the etiology of which could be autoimmune, infectious, and secondary to infiltrations or due to congenital adrenal hypoplasia. The clinical features of chronic adrenal insufficiency include weakness, fatigue, tiredness, gastrointestinal symptoms like nausea, vomiting, abdominal pain and diarrhea, salt craving, and joint pains.

Ocular manifestations: ocular findings appear due to optic nerve compression caused by craniofacial fibrous dysplasia involving the optic canal. Visual field defects, diminished color vision, decreased visual acuity and in long-standing optic nerve compression optic atrophy results.

5. Conclusion

In conclusion, this study highlights the significant impact of diabetes on various corneal parameters, particularly the corneal endothelium. The findings underscore the importance of incorporating specular microscopy as a routine screening tool for diabetic patients. Long-term uncontrolled glycemia profoundly affects corneal endothelial counts, morphology, and thickness. While the precise mechanisms underlying these morphological changes remain unclear, it is plausible that factors such as thyrotropin receptor or insulin-like growth factor receptor expression, along with autoimmune reactions in the aqueous humor, contribute to endothelial alterations. Given the association between ocular conditions and endocrine imbalances, a multidisciplinary approach and early intervention are crucial in preventing the progression of diabetic ocular complications and preserving visual function. The present study showed that different corneal alterations can be possible in endocrine disorders. So all endocrine disorders should undergo comprehensive ophthalmological examination to prevent visual impairment.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Buzdugă C, Turliuc D, Găleşanu C, Ciobanu D, Dimitriu G, Cucu A, et al. Ocular manifestations in endocrine diseases. *Rom J Funct Clin Macro-Microsc Anat Anthropol*. 2016;15:229–32.
2. Mounirou BAM, Yakoura AKH, Aminou MSM, Adam ND, Safouratou SH, Rachid MMA. Ocular Manifestations of Endocrine Diseases. *Saudi J Med Pharm Sci*. 2021;7(11):584–90.
3. Fabue LC, Soriano YJ, Pérez MGS. Dental management of patients with endocrine disorders. *J Clin Exp Dent*. 2010;2(4):196–203.
4. Hiller-Sturmhöfel S, Bartke A. The endocrine system: an overview. *Alcohol Health Res World*. 1998;22(3):153–64.
5. Keoleian GM, Pach JM, Hodge DO, Trocme SD, Bourne WM. Structural and functional studies of the corneal endothelium in diabetes mellitus. *Am J Ophthalmol*. 1992;113(1):64–70.
6. Larsson LI, Bourne WM, Pach JM, Brubaker RF. Structure and function of the corneal endothelium in diabetes mellitus type I and type II. *Arch Ophthalmol*. 1996;114(1):9–14.
7. Zhou M, Wu D, Yu F, Hong S, Ye J, Wang C, et al. Corneal Endothelium: A Promising Quantitative Index for Graves Ophthalmopathy Activity Evaluation. *Am J Ophthalmol*. 2021;230:216–23.
8. Villani E, Viola F, Sala R, Salvi M, Mapelli C, Currò N, et al. Corneal involvement in Graves' orbitopathy: an in vivo confocal study. *Invest Ophthalmol Vis Sci*. 2010;51(9):4574–8.
9. Ozturk BT, Kerimoglu H, Dikbas O, Pekel H, Gonen MS. Ocular changes in primary hypothyroidism. *BMC Res Notes*. 2009;2:266.
10. Didenko TN, Smoliakova GP, Sorokin EL, Egorov VV. Clinical and pathogenetic features of neurotrophic corneal disorders in diabetes. *Vestnik Oftalmologii*. 1999;115(6):7–11.
11. Naik K, Magdum R, Ahuja A, Kaul S, Johnson S, Mishra A, et al. Ocular Surface Diseases in Patients With Diabetes. *Cureus*. 2022;14(3):e23401.
12. Achtsidis V, Tentolouris N, Theodoropoulou S, Panagiotidis D, Vaikoussis E, Saldana M, et al. Dry eye in Graves ophthalmopathy: correlation with corneal hypoesthesia. *Eur J Ophthalmol*. 2013;23(4):473–9.
13. Dawood YF. Study of corneal endothelial cells in diabetic patients. *Afr Vision Eye Health*. 2022;81(1):664.
14. Galgauskas S, Laurinavi_Ciūtė G, Norvydaitė D. Changes in choroidal thickness and corneal parameters in diabetic eyes. *Eur J Ophthalmol*. 2016;26:163–7.
15. Durukan I. Corneal endothelial changes in type 2 diabetes mellitus relative to diabetic retinopathy. *Clin Exp Optom*. 2020;103(4):474–8.
16. Sudhir RR, Raman R, Sharma T. Changes in the corneal endothelial cell density and morphology in patients with type 2 diabetes mellitus: a population-based study, Sankara Nethralaya Diabetic Retinopathy and Molecular Genetics Study (SN-DREAMS, Report 23). *Cornea*. 2012;31(10):1119–22.
17. Anbar M, Ammar H, Mahmoud RA. Corneal endothelial morphology in children with type 1 diabetes. *J Diabetes Res*. 2016;2016:7319047.

Author's biography

Sharmistha Behera, Professor https://orcid.org/0000-0003-1861-6113

Biswanath Sahu, Senior Resident

Sasmita Sahu, Associate Professor

Rangumudri Sai Sunanda, PG Resident

Arpita Das, Assistant Professor

Cite this article: Behera S, Sahu B, Sahu S, Sunanda RS, Das A. Assessing corneal alterations in endocrine disorders: a cross sectional observational clinical study. *Indian J Clin Exp Ophthalmol* 2024;10(4):764-770.