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Prevalence of Anterior Segment Changes in Chronic Kidney Disease in Srikakulam District of Andhra Pradesh

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ABSTRACT

Chronic kidney disease (CKD) is an emerging worldwide health problem. Chronic kidney disease leads to many systemic effects that affect various systems in the body. The kidney and eye share striking structural-developmental physiological and pathogenic pathways. CKD and major eye disorders like glaucoma, cataracts and Retinopathy are all linked to age and metabolic and systemic risk factors such as hypertension, diabetes and smoking. CKD patients exhibit a broad spectrum of ocular findings. Lid oedema, conjunctival pallor and elevated serum lipids are significant visual anterior segment signs linked to CKD. Secondary hyperparathyroidism can cause calcification of the cornea and conjunctiva. This was a hospital-based Observational study conducted between December 2019 and June 2021. The study was conducted on 100 CKD patients diagnosed with chronic kidney disease attending the medical and ophthalmology departments and the dialysis centres in the government medical college, Srikakulam, Andhra Pradesh. A complete physical and ocular examination was done and results were tabulated. Data were statistically analysed using IBM SPSS software. Hypertension was found to be frequently involved in the pathogenesis of CKD, followed by diabetes and then both hypertension and diabetes. Our study included 100 patients; 98 had CKD and 2 were post-transplant recipients. Anterior segment findings were reported in 74 percent of the 200 eyes studied (148 eyes). The most anterior segment abnormalities related to the CKD stage are seen in Stage 5 (37.8%), followed by Stage 4 (23%), Stage 3 (16.2%), Stage 1(12.2%), Stage 2 (9.45%) and post-transplant patients (1.35 percent). Metabolic imbalances, oxidative stress, alterations due to hypertension and diabetes, as well as fluctuations in fluid and electrolyte levels are believed to underlie the anterior segment alterations observed in chronic kidney disease. Anterior segment disorders like cataracts, Conjunctival pallor, Lid Edema, Proptosis and Band-shaped keratopathy are commonly seen in CKD patients. The frequency of occurrence rises as chronic kidney disease progresses, particularly in advanced stages such as stage 4 and stage 5. Early detection and monitoring of ocular manifestations are crucial in preserving visual function and improving patient outcomes.

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Key Words
Cataract, Conjunctival pallor, keratopathy, observational study, epidemiology

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INTRODUCTION

Chronic kidney disease (CKD) is an emerging worldwide health problem. It causes a decrease in the number of nephrons, eventually leading to end-stage renal disease and the need for renal replacement treatment for survival[1]. The prevalence is rising in both developed and developing countries around the world. Globally, it affects around 850 million people. One in ten adults has CKD1. By 2040, it is expected to rank as the fifth most prevalent cause of years of life lost[2,3]. According to an Indian CKD registry report published in 2012, among approximately 52 thousand registered CKD patients, 48% had ESRD, 16% had CKD of undetermined aetiology, hypertensive nephrosclerosis and glomerulonephritis were causes of CKD in 13% and 14% of CKD patients respectively and the most frequent pathology was diabetic nephropathy (31% of patients)[2].

Chronic kidney disease leads to many systemic effects that affect various systems in the body. The kidney and eye share striking structural-developmental physiological and pathogenic pathways[3,4]. The association of blindness with kidney disease was found much earlier in 1836 by Richard Bright[5]. CKD and major eye disorders like glaucoma, cataracts and Retinopathy are all linked to age and metabolic and systemic risk factors such as hypertension, diabetes and smoking[6]. Ocular comorbidities can also be caused by uraemia and anaemia or by the side effects of haemodialysis[7].

CKD patients exhibit a broad spectrum of ocular findings. Lid oedema, Conjunctival pallor and elevated serum lipids are significant visual anterior segment signs linked with CKD[8,9]. Secondary hyperparathyroidism can cause calcification of the cornea and conjunctiva. A rapid increase in calcium[5] may be linked to the conjunctiva's and episclera's inflammatory reactions. Pinguecula and other Conjuctival degenerative alterations are common[10,11]. Increased intracellular calcium and calcium accumulation in the lens cause early cataractogenesis[12].

This study aims to analyse the ocular state and consequences of chronic renal disease and emphasise the significance of timely ocular examinations to screen patients for potential visual threats and commence appropriate therapy before permanent vision loss occurs.

MATERIALS AND METHODS

This was a Hospital-based Observational study conducted between December 2019 and June 2021. The study was conducted on 100 CKD patients diagnosed with chronic kidney disease attending the medical and ophthalmology departments and the dialysis centres in the government medical college, Srikakulam, Andhra Pradesh. Inclusion criteria included all patients previously diagnosed with CKD, Patients undergoing Dialysis and Patients with Renal transplantation. Exclusion criteria included any ocular disease that would interfere with retinal examination -corneal opacity, Reversible acute renal failure, Ocular ischemic syndrome, Age<14 years. After obtaining the approval of the Institutional Ethics Committee, written and informed consent was obtained from the patients regarding the study in their vernacular language and English.

A detailed history was taken regarding chief complaints, medical history and relevant co-morbidities, which included Duration of CKD, severity and stage of CKD, any history of Diabetes mellitus and its duration, Hypertension and its duration, Renal disease, Coronary arterial disease, Cerebro-vascular disease, systemic or ocular medications. Clinical examination of the patient included a detailed general physical examination and systemic examination, including pulse rate, blood pressure and auscultation of lungs and heart. A local examination of the head, face and neck was done. Every patient was subjected to a complete Ophthalmological examination.

Thorough ocular examination includes recording the visual acuity with Snellen's chart (uncorrected and best-corrected visual acuity) and extraocular movements. Examining the anterior segment of both eyes is done with Slit-lamp bio-microscopy, which includes eyelids, conjunctiva, cornea, anterior chamber, iris, pupil and lens. Fundus examination of both eyes was done after dilating using tropicamide 5% and phenylephrine drops with a direct ophthalmoscope, Slit- lamp Bio microscopy with +78 Diopter lens followed by Indirect Ophthalmoscopy. Fundus pictures are taken using the Canon Fundus camera whenever necessary. The information collected was recorded and evaluated. The Chi-Square test and SPSS software version were used for statistical analysis. A Probability value (p-value) of <0.05 was considered statistically significant.

RESULTS

Out of 100 patients in the study, the majority are in the age group 50-59 years, with a Mean age of 51.49 years and S.D of 4.9 years, accounting for 36 percent of the total cases and the 60-69 age group accounting for 21% of the total cases. Out of 100, 76 were men and 24 were women.

The study group comprised 38 subjects with stage V disease, 22 Stage IV and 9 patients - With stage II disease. 15 patients were evenly distributed in groups of stages I, III and 2 in the post-transplant category, of which the maximum patients belonged to the 51-60 age group (Table 1).

Hypertension was found to be frequently involved in the pathogenesis of CKD, followed by diabetes and then both hypertension and diabetes. Our study included 100 patients; 98 had CKD and 2 were Post-transplant recipients (Fig. 1).

Good vision (6/18 or better) was present in 52% of the total individuals recruited. About 48% of participants have decreased Visual acuity (Table 2).

Anterior segment findings were reported in 74% of the 200 eyes studied (148 eyes). The most anterior segment abnormalities related to CKD stage are seen in Stage 5 (37.8%), followed by Stage 4 (23%), Stage 3 (16.2%), Stage 1(12.2%), Stage 2 (9.45%) and post-transplant patients (1.35%). Details of the findings are elaborated in Table 3 (Fig. 2-7).

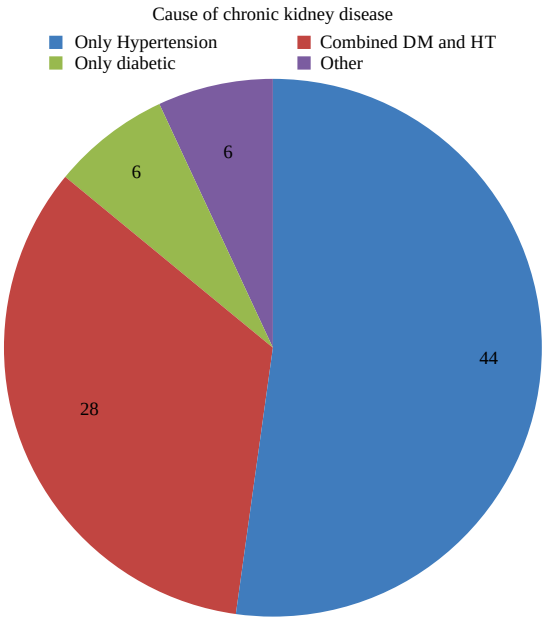

Fig. 1: Diagram showing distribution according to the cause of CKD

Table 1: Distribution of CKD patients according to Stage of CKD

Stage of CKD	No. of Patients	Total percentage
Stage I	15	15
Stage II	9	9
Stage III	14	14
Stage IV	22	22
Stage V	38	38
Post-Transplant	2	2

DISCUSSION

Chronic kidney disease is emerging as a major health problem worldwide. CKD is a slowly progressive renal function deterioration that can occur in any age group. About 100 patients were studied, the maximum is between the age group 50-59 Years with a mean age of 51.49 Years and an SD of 4.9 years, which constituted 36% of the total cases, followed by the 60-69 age group comprising 21% of the total cases.

Fig. 2: Pinguecula

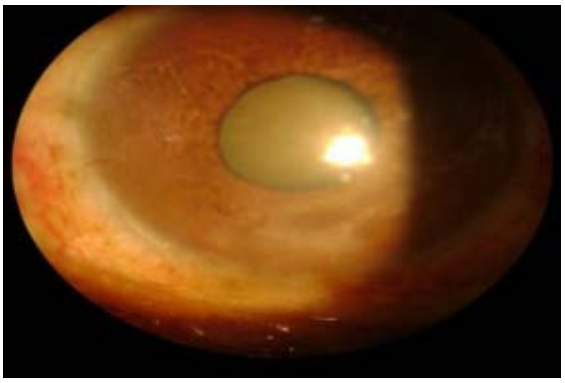

Fig. 3: Band shaped keratopathy

Table 2: BCVA in the eyes among different stages of CKD:

BCVA	Stage I	Stage II	Stage III	Stage IV	Stage V	Post- Transplant	Total Eyes	Total Eyes (%)
6/6-6/18	26(25%)	12(11.5%)	18 (17.4%)	20(19.2%)	26 (25%)	2(1.9 %)	104	52**
6/24-6/60	4(6.9%)	4(6.9%)	6 (10.3%)	14(24.1%)	28 (48.2%)	2(3.5%)	58	29**
<6/60	-	2(5.3%)	4(10.5%)	10(26.3%)	22 (57.9%)	-	38	19**
Total	30	18	28	44	76	4	200	100**

**All values are highly significant, with a level of significance p<0.0001 using the Chi-square test of value: 55.4909

Table 3: Distribution of anterior segment finding in CKD subjects

Anterior Segment findings	Stage I	Stage II	Stage III	Stage IV	Stage V	Post Transplant	Total eyes	Percentage
Lid oedema	-	4 (22%)	8 (44.4%)	2 (11%)	4 (22%)	-	18	12.2%*
Conj. Pallor	12 (37.5%)	4 (12.5%)	2 (6.25%)	4 (12.5%)	10 (31.3%)	-	32	21.6%*
Pinguecula	2 (16.7%)	-	4 (33.3%)	6 (50%)	-	-	12	8.1%*
Band shaped Keratopathy	-	-	-	-	2 (100%)	-	2	1.35%*
Cataract	4 (5%)	6 (7.5%)	10 (12.5%)	22 (27.5%)	36 (45%)	2 (2.5%)	80	54%*
EOM Restriction	-	-	-	-	2 (100%)	-	2	1.35%*
Proptosis	-	-	-	-	2 (100%)	-	2	1.35%*
Total	18 (12.2 %)	14 (9.45%)	24 (16.2%)	34 (23%)	56 (37.8%)	2 (1.35%)	148	100%

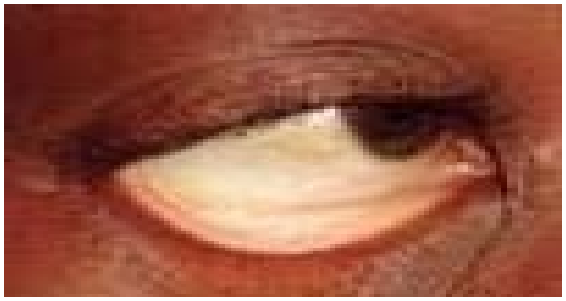

Fig. 4: Conjunctival pallor

Fig. 5: Lid Edema

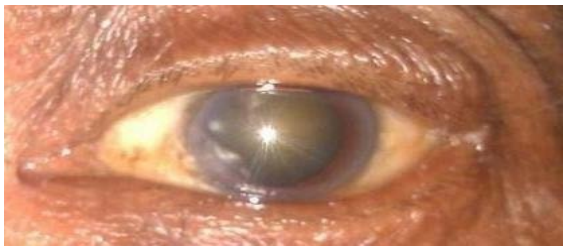

Fig. 6: Nuclear cataract

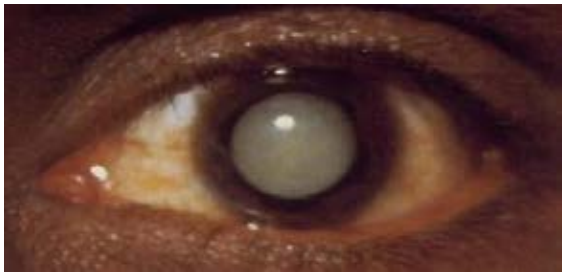

Fig. 7: Mature cataract

The present study results are in accordance with studies done by Sunita *et al*.[13], Maheshwari *et al*.[14], Manjula *et al*.[14], Mithun *et al*.[16], Dheeraj *et al*.[17], Mathew *et al*.[18] study. Out of 74% (148 eyes) of significant a/s changes, the most common was cataract, constituting about 54%; other findings include Conjunctival pallor in 21.6%, lid oedema in 12.2%, Pinguecula in 8.1 and 1.35% of Band shaped Keratopathy, EOM restriction with proptosis each. Anterior segment changesarenotseenin 26% (52 eyes). Out of 74%, Cataract, Conjunctival pallor, Lid oedema, Pinguecula, Band-shaped keratopathy, extraocular movement restriction with proptosis, etc., were commonly seen.

This study's most prevalent ocular abnormality was cataracts, accounting for 54 % of anterior segment abnormalities in stage 4 and stage 5 CKD patients. It's the major cause of a reduction in visual acuity. This could be linked to increased intracellular calcium and calcium deposition in the lens as renal failure progressed. Similar to Mithun Tulsidas *et al*.[16], cataract diagnosis was associated with the advancement of renal illness in the Severe (27.5%) and ESRD (45%) groups compared to the mild group.

Conjunctival Pallor, which was detected in 21.6 percent of the total eyes in this study, was the second most frequent anterior segment finding. It was mostly seen in Stage 1 and Stage 5 CKD patients and it may be regarded as a persistent finding in CKD. This could be due to low haemoglobin levels in chronic kidney disease patients, Similar to Sunita *et al*.[13]. study.

Lid oedema was seen in 18 eyes, constituting the third anterior segment finding in 12.2% of the total eyes. The distribution of lid oedema is seen almost equally in all stages of CKD in this study. The reason may be due to deranged renal function in CKD. This impaired renal function inhibits the body from excreting salt and water efficiently, resulting in fluid retention and widespread swelling, including pedal oedema, face puffiness and lid oedema. Conjunctival degenerations like Pinguecula Band-shaped keratopathy were seen in 8.1 and 1.35% of the patients. The reason is that an abnormal balance of calcium and phosphorus metabolism in chronic kidney disease patients leads to relative hyperphosphatemia, which may result in an inflammatory reaction due to the accumulation of toxic materials in the body and leading to ectopic calcification, including Conjuctival calcification and corneal calcification.

The study showed two patients of Diabetic with CKD fifth stage had proptosis and extraocular movement restriction. Investigations revealed mucormycosis of the maxillary sinus with orbital involvement. The patient underwent surgical debridement of the sinus with appropriate medical therapy. On analysing the symptoms, it is found that the majority of anterior segment signs were seen with Stage 5 CKD constituting 37.8%, followed by Stage 4 CKD at 23%, Stage 3 CKD at 16.2%, Stage 1 CKD at 12.2% and Stage 2 CKD at 9.45%. All the anterior segment findings are highly significant as per the statistics with <0.001. These results are by the study of Sunita *et al*.[13], where the commonest anterior segment finding was Cataract (52.5%), followed by Conjunctival pallor (25%) followed by lid oedema

Table 4: Comparison of Anterior Segment findings with other similar studies

			Cataract		Conjunctival Pallor		Lid Edema	
Patients as per Stage of CKD	Total Samples	A/S %	Total %	M/c Stage	Total (%)	M / C Stage	Total (%)	Mlc Stage
Our Study	200 Eyes	74.6%	54%	Stage V	21.6%	Stage I	12%	Stage II
Sunita et al	100 Eyes	80%	52.5%	Stage V	25 %	Stage I	12%	Stage III
Mithin Tulsidas et al.	288 Eyes	91%	11%	Stage V	56.9%	Stage I	3.5%	Stage V
Malleswari et al	128 Eyes	72%	38%	Stage V	13 %	Stage II	12%	Stage III
P.Shoba et al.	200 Eyes	80%	57.5%	Stage V	17.5%	Stage III	17%	Stage V

(12%). Similar results are seen in the study Of Malleswari *et al*.[14], where Cataract constitutes 38% of the cases, followed by Conjunctival pallor at 13% and Lid Edema at about 12%. In the Shoba *et al*. study, frequent anterior segment findings were cataracts constituting 57.5%, followed by Conjunctival pallor and Lid oedema at 17% each.

The findings of this study differ from those of Manjula *et al*.[15] and Bajracharya et al.[5], who found that Lid oedema was the M/C anterior segment finding in 44% of the cases. Conjunctival pallor was the most frequent finding in Mithun Tulsidas et al.[16] study, accounting for 56.9%, which is not the case in our analysis. Details are explained in Table 4.

CONCLUSION

Based on the study's findings, it is evident that ocular abnormalities are closely linked to chronic kidney disease (CKD). Anterior segment disorders like cataracts, Conjunctival pallor, Lid Edema, Proptosis and Band-shaped keratopathy are commonly seen in CKD patients. The frequency of occurrence rises as chronic kidney disease progresses, particularly in advanced stages such as stage 4 and stage 5. Early detection and monitoring of ocular manifestations are crucial in preserving visual function and improving patient outcomes. The study underscores the importance of regular eye examinations for CKD patients to facilitate timely intervention and prevent visual loss.

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