

Ocular Changes in Chronic Kidney Disease

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Abstract

A prospective study was carried out in 200 patients with various stages of CKD on both conservative therapy and in dialysis cohort. The study included 149 Males and 51 Females. The mean age of the patients was 54.7 ± 12.1 years. Most of the patients were of stage 5 CKD [n=105, 52.5%] and 87 patients were on haemodialysis and 4 were on peritoneal dialysis, while 109 were on conservative therapy. Most common ocular abnormality was cataract [n=128, 64%] out of which 32 patients [16%] patients had undergone cataract surgery. Hypertensive and diabetic retinopathy were the findings in 39% and 28.5% respectively. Intra ocular pressure was normal in the most of the eyes [n=195, 97.5%]. A community based examination involving both nephrologists and ophthalmologists should be carried out to know the true prevalence of ocular changes in CKD patients.

Keywords: CKD, Ocular changes

Introduction

Chronic Kidney Disease (CKD) constitutes a major health care problem worldwide which is associated with markedly reduced quality of life and excess mortality [1]. Diabetic kidney disease followed by hypertensive nephropathy is the most common causes of chronic kidney disease [2].

A prominent pathological feature of CKD is a defect in the microcirculation due to systemic hypertension, diabetes mellitus and to a lesser extent other micro vascular diseases. Ocular changes can be the initial finding in an asymptomatic patient with hypertension. Due to effects of accumulation of nitrogenous waste products in patients with renal failure, hypertensive retinopathy changes are particularly severe among them [3]. There is also a close association between diabetic retinopathy and diabetic kidney disease [4]. Thus the eye can be a window to the disease processes in the kidney.

Kidney function can be replaced with dialysis in advance chronic kidney disease. Following haemodialysis a decrease in intra ocular pressure is mostly due to changes in oncotic pressure and ultrafiltration [5]. A sudden decrease in visual acuity is also attributed to osmotic changes in blood and extracellular fluids, including chamber fluids such as aqueous and vitreous [6].

Decreased vision in CKD patients hampers daily activities, with increased incidence of falls and difficulty in performing personal tasks. This results in sleep disorders and depression [7]. So visual rehabilitation will be beneficial in these patients to improve their quality of life.

The aim of this study was to record the visual changes in patients with CKD and to correlate severity of chronic kidney disease with disability. This approach is necessary in initiating early ocular screening as part of a comprehensive protocol for management of CKD.

Methodology

This was a prospective study conducted in a tertiary care teaching hospital [Pondicherry Institute of Medical Sciences], where all patients diagnosed with CKD above 18 years of age who attended the Nephrology and Ophthalmology OP. They were enrolled during the study period from October 2013 and included 200 patients to April 2015.

The following were entered: age, smoking status, steroid intake, duration of

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diabetes mellitus, hypertension and dialysis, if any. They were examined thoroughly for visual acuity using Snellen’s chart for distance vision and for intraocular pressure by applanation tonometry. Anterior segment examination was performed with a slit lamp bio microscope. For the posterior segment, dilated fundus examination by direct and indirect ophthalmoscope was done after pupil dilation with tropic amide. Fundus photographs were taken using a Canon fundus camera [8].

Patients were classified into Stages 1 to 5 by the CKD - EPI equation from their serum creatinine estimation. Diabetic profile and urine examination were done for all patients. Blood pressure and body weight were recorded as part of general assessment.

Hypothesis testing for association between the renal and ocular parameters was performed with a Chi- square test/ Fisher’s exact test. P value less than 0.05 was considered significant.

Results

Distribution of 200 patients as per CKD stages are shown in Table 1.

The study included 149 Males and 51 Females. The mean age of the patients were 54.7 ± 12.1 years [range: 22-85 years].

Distribution Of patients based on best corrected visual activity in each eye is shown in Table 2.

Recordings showed 6.5% of the patients had visual acuity <6/60, 33.5% had acuity between 6/60 and 6/18, 60% had good vision with acuity better than 6/18. The presence of either

Stage – eGFR (ml/min per 1.73m ²)	Frequency	Percentage	Confidence interval 95%
I >90	1	0.5	0.004 - 0.01
II 60 - 89	7	3.5	0.009 - 0.06
III 30 – 59	24	12	0.07 - 0.16
IV 15 – 29	63	31.5	0.25 - 0.37
V < 15	105	52.5	0.45 - 0.59
	200	100	

Table 1: Distribution of the study participants based on the stage of Chronic Kidney Disease (n=200)

WHO CRITERIA	Best Corrected Visual Acuity in the better eye	Total	Percentage	Confidence Interval 95%
Good Vision	6/6 -6/18	120	60	0.53 - 0.66
Impaired Vision	6/24-6/60	67	33.5	0.27 - 0.4
Legally Blind	<6/60	13	6.5	0.03 - 0.99
Total		200	100	

Table 2: Distribution of participants based on the Best Corrected Visual Acuity in each eye (n=200)

Co morbidities	Frequency*	Percentage	Confidence Interval 95%
Diabetes mellitus	106	53.5	0.46 - 0.60
hypertension	144	71.5	0.65 - 0.77
diabetes mellitus and hypertension	87	43.5	0.36 - 0.50
Absent diabetes mellitus or hypertension	37	18.5	0.13 - 0.23

Table 3: Distribution of participants based on the proportion of co morbidities (n=200)

diabetes mellitus or hypertension or both in 163 patients are shown in Table 3. Most of the patients were of stage 5 CKD [n=105, 52.5%] and 87 patients were on haemodialysis and 4 were on peritoneal dialysis, while 109 were on conservative therapy.

The proportion of patients with anterior segment findings was 72% [95% Confidence Interval (CI) = 65-78%], most common of which was cataract [n=128, 64%] out of which 32 patients [16%] patients had undergone cataract surgery (Figure 1). Pinguecula and pseudo exfoliation was found in 9 patients [4.5%] and 7 patients [3.5%] respectively. We did not find any anterior segment changes in 56 patients [28%] (Table 4).

The spread of anterior segment findings related to stage of CKD is shown in Figure 2. There was no statistically significant association between CKD staging and presence of anterior segment findings [p=0.22].

Posterior segment findings were present in 59% [95% CI=52-65%]. Hypertensive and diabetic retinopathy were the findings in 39% and 28.5% respectively (Table 4).

Twenty nine patients [50.9%] had non proliferative diabetic retinopathy, 11 patients [19.3%] had proliferative diabetic retinopathy and 3 patients [5.3%] had clinically significant macular enema (Table 5). The spread of posterior segment findings with stage of CKD was as in Table 5. There was a statistically significant association between the grades of CKD

Parameter	Frequency	Percentage	Confidence interval 95%
Proportion of patients with anterior segment findings	144	72	0.65- 0.78
Proportion of patients with posterior segment findings	118	59	0.52 -0.65
Proportion of patients with both anterior and posterior segment findings	78	39	0.32-0.45
Proportion of patients with normal findings	16	8	0.04-0.11

Table 4: Prevalence of ocular changes among CKD patients (n=200)

The proportion of ocular changes in both anterior and posterior segment is 39% (ie,95% Confidence Interval 0.32-0.45)

Proportion of patients with anterior segment findings is 72% (i.e, 95% Confidence Interval 0.65-0.78) and posterior segment findings is 59% (ie,95% Confidence Interval 0.52-0.65)

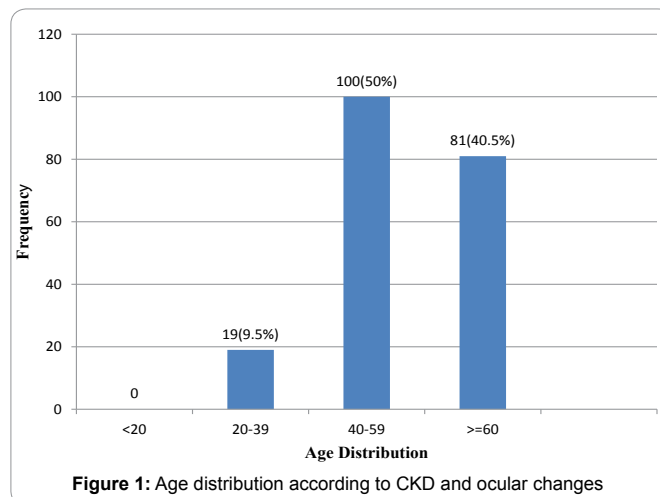


Figure 1: Age distribution according to CKD and ocular changes

with presence of posterior segment changes (Figure 3) [p=0.02]. Distribution of participant based on the grade of hypertensive retinopathy (n=78) shown in (Table 6). Association between the anterior segment findings and different stages of CKD among the study participants are shown in Table 7, which was not statistically significant? (P=0.22).

Association between the posterior segment findings and different stages of CKD among the study participants are shown in Table 8.

Association between diabetic nephropathy and anterior segment findings in each eye of CKD patients are shown in Table 9. Slit lamp findings were more common among those with diabetes P<0.05.

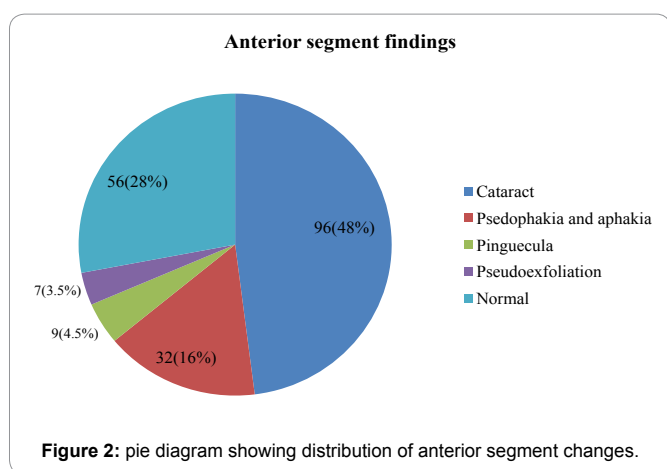


Figure 2: pie diagram showing distribution of anterior segment changes.

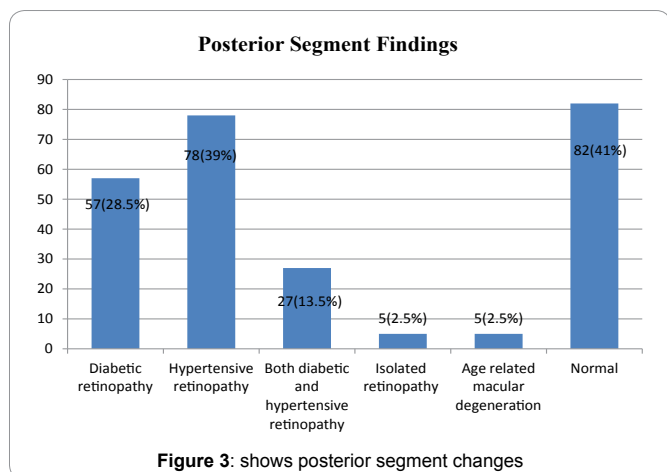


Figure 3: shows posterior segment changes

Grading of diabetic retinopathy	Frequency	Percentage	Confidence interval 95%
NPDR	29	50.9	0.43-0.57
PDR	11	19.3	0.13-0.24
Treated group	14	24.6	0.18-0.30
CSME	3	5.3	0.02-0.08
Total	57	100	

Table 5: Distribution of participants based on the grade of diabetic retinopathy (n=57)

Grading of hypertensive retinopathy	Frequency	Percentage	Confidence interval 95%
1	34	44.1	0.33 -0.55
2	14	17.9	0.09-0.26
3	28	36.4	0.25-0.47
4	2	2.7	0.009-0.06
Total	78	100	

Table 6: Distribution of participant based on the grade of hypertensive retinopathy (n=78)

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
Anterior segment changes present	1	5	16	52	70	144
Anterior segment findings absent	0	2	8	11	35	56
Total	1	7	24	63	105	200

Table 7: Association between the anterior segment findings and different stages of CKD among the study participants

	CKD Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
Posterior segment changes present	1	4	10	30	73	118
Posterior segment findings absent	0	3	14	33	32	82
Total	1	7	24	63	105	200

Table 8: Association between the posterior segment findings and different stages of CKD among the study participants

Anterior segment findings	Diabetes	Without Diabetes	Total
Cataract	100(59.17%)	69(40.8%)	169(100%)
Normal	50(40%)	75(60%)	125(100%)
Pseudophakia and Aphakia	56(70.4%)	25(29.6%)	81(100%)
Pinguecula	5(35.7%)	9(64.2%)	14(100%)
Pseudoexfoliation	1(9%)	10(90.9%)	11(100%)
Total	212(53%)	188(47%)	400(100%)

Table 9: Association between diabetes and anterior segment findings in each eye of CKD patients (n=200) Slit lamp findings were more common among those with diabetes P value <0.05. It is statistically significant

Ocular changes in both anterior and posterior segment was present in 39% [95% CI=32-45%]. Most of the eyes [n=195, 97.5%] had an IOP within normal range.

Discussion

CKD is emerging as a major health problem worldwide with 15% of the Indian population affected with various stages. The eyes are equally affected as the other organ systems Ocular examinations are not done routinely in patients with chronic kidney disease. Early changes in the eye may be missed until the patient presents with visual symptoms. An ocular screening is important in patients with CKD for an early detection of changes.

The prevalence of ocular changes in both anterior segment and posterior segment in the present study was found to be 39%. In a cross sectional study done by Grunwald, et al. the prevalence of ocular pathology was found to be 45% [8] whereas Gao, et al. has shown that the prevalence of ocular findings was 32% [9].

In the present study, majority of the patients had cataract 64% and 28% of the patients had normal finding in the anterior segment. We found no association between anterior segment

findings and the stage of CKD. In a prospective study done by Klein et al no association was found between renal function abnormalities and cataract [10].

In this study, 64% of patients had cataract as the anterior segment finding which was the major cause of reduction in visual acuity. In a population based study done by Wang et al at Taiwan it was found that 33.08% with CKD had cataract in comparison to 28.9% without CKD [11].

A hospital based study by Bhajracharya et al. has found that 18% of CKD patients had cataract [2]. In a study done by Hilton et al it was found that in 46.2% of patients undergoing dialysis had cataract [12].

The present study was carried out at a tertiary care teaching hospital at the coastal area of Southern India and proportion of cataract among CKD patients was found to be 48%. The present study showed a high prevalence which may be due to the fact that patients presented at a later stage in the course of CKD.

In this study the posterior segment findings were highly associated with the stage of CKD. Majority of the patients (39%) had hypertensive retinopathy and 41% of patients had normal finding in the posterior segment.

In this study 43.5% of the patients had both diabetes and hypertension. Both diabetic and hypertensive retinopathy was found in 13.5%. Hypertensive retinopathy was present in 39% as the posterior segment finding, among which 44.1% had grade 1 hypertensive retinopathy and a study by Bhajracharya, et al. found 47.1% of CKD patients had hypertensive retinopathy [2]. Hypertension prevalence is high in CKD patients and almost 80% of the patients on maintenance dialysis are hypertensive. The regular ocular examination with retinal findings should be documented for future intervention in CKD patients.

In a study done by Kabedi, et al. 83.6% of the patients had hypertensive retinopathy (grade 1: 42.1%; grade 2: 11.3%; grade 3: 23.3%; grade 4: 6.9%) [13].

In the present study, 28.5% of the total patients had diabetic retinopathy. In a cross sectional study done by Sheen, et al. it has been found that 26.6% of the CKD patients defined by stages of CKD in diabetic nephropathy had diabetic retinopathy [14]. In a study done by Bhajracharya et al diabetic retinopathy was present among 88.3% of the diabetic patients with CKD [2]. In the present study 53.7% of diabetics were found to have diabetic retinopathy. In India with 63 million diabetics and a substantial percentage of these patients develop progressive diabetic nephropathy, ocular examination should be carried out at regular intervals to prevent blindness.

In this study 50.9% of the patients had non proliferative diabetic retinopathy (NPDR) and 19% of the patients had PDR. A study done by Sandhu, et al. has shown that 70% of kidney disease patients had NPDR [15].

In the present study age related macular degeneration (ARMD) was found in 5(2.5%) patients. Other studies have shown a similar prevalence [8,9].

The signs which are similar to the classic diabetic retinopathy and hypertensive retinopathy signs, when observed in a non diabetic and normotensive patient are known as isolated retinopathy. In the present study these signs were present in

5(2.5%) patients. In a cross sectional study by Wong et al. in elderly population 8.3% of CKD patients without diabetes had retinopathy [16].

IOP was within the normal range in 97% of the eyes in our study. A study done by Cecchin, et al. has found that during haemodialysis, IOP increase in 18% of patients [17]. In our study IOP was not measured during haemodialysis.

The strengths of the study was that the patients were selected based on the well established definition criteria for CKD. All the stages of CKD including patients on different modalities of dialysis were taken therefore providing an insight into the spectrum of eye changes. Each patient was meticulously examined clinically and the findings were noted. The limitations are that, it is a tertiary care study and unless a community based examination involving both nephrologists and ophthalmologists are carried out the true prevalence will not be known.

Conclusion

This study has shown the extend of an ocular changes in CKD. It reiterates the need for regular ocular examination for all the CKD patients for early detection and prevention of visual disability. In this study the major cause of visual disability was cataract.

The major risk factors for kidney disease are diabetes mellitus and hypertension. They are prone for developing retinopathy as the duration of disease progresses. Also regular follow ups are essential for CKD patients who have developed retinopathy, for monitoring the progression and for active intervention when required. This will ensure a better quality of life for CKD patients.

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