THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Ocular Findings in Diabetics and Hypertensives Undergoing Hemodialysis

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Abstract:
Renal failure affects every organ including eye. The aim of this study is to observe and estimate ocular pathologies in patients undergoing haemodialysis due to diabetic and/ or hypertensive retinopathy. 100 patients, undergoing haemodialysis, between December 2012 to December 2013 were screened in this cross sectional, analytical type of study. 41% of patients were between 51-60 years of age. Male: female ratio 1.7:1. 71% were underweight. Out of 200 eyes examined, 16% had a visual acuity less than 5/60. Lid oedema was present in 13.5% & conjunctival pallor in 16.5%, 66.5% had cataract & 57.5% had IOP in the range of 10-15mm Hg. Fundus showed hypertensive retinopathy in 27%, non proliferative diabetic retinopathy in 29%, macular oedema in 12%, PDR in 5.5%, disc pallor in 5%, vitreous haemorrhage in 4%, glaucomatous optic atrophy in 3.5%, ERM in 1.5%, BRVO 0.5% and CRVO in 0.5%. Vision threatening ocular conditions is prevalent among patients undergoing haemodialysis. Early detection and treatment of these can help in improving the daily life of these patients.

Keywords: *Haemodialysis, Diabetes, Hypertension, Retinopathy*

1. Introduction

Diabetes is one of the world's greatest health problems[1]. It is projected that total number of people with diabetes will rise from 171 million in 2000 to 366 million in 2030[2]. Recurrent styes, blepharoconjunctivitis, xanthelasma, epithelial defects, primary open angle glaucoma, narrow angle glaucoma, iris neovascularisation, pupil abnormalities, cataract, optic atrophy, non arteritic ischemic optic neuropathy, other cranial nerve abnormalities and various vitreo-retinal findings are seen in patients with diabetes[1].

Frank coined the name 'hypertonie essential' in 1952, the name 'hypertensive vascular disease' was introduced by Janeway in 1913[6]. The number of adults with hypertension is predicted to increase by 60% to a total of 1.56 million people by 2025[2]. Acute and chronic hypertensive changes may manifest in the eyes from long term systemic hypertension. Ocular changes can be the initial finding in an asymptomatic patient with hypertension. Generalized attenuation of retinal arterioles, choroidopathy, optic neuropathy, branch retinal vein occlusion and papilloedema are some of the changes seen in hypertensive patients[7]. Symptomatic patients may be referred to an ophthalmologist for visual problems caused by hypertensive changes. Untreated hypertension is usually associated with a progressive rise in blood pressure. The vascular and renal damage may culminate in treatment resistant state[8].

Diabetes and Hypertension are 'Life Style Diseases'[3,4,5]. The overlap between diabetes and hypertension increases the risk of nephropathy and retinopathy[2]. Hypertension affects 70% of patients with diabetes. Both diabetes and hypertension are very closely related to chronic kidney disease[10]. The most common cause of chronic renal failure is diabetic nephropathy followed by hypertensive nephropathy[11].

When diabetes and hypertension occur together, arterial intimal and medial calcification occurs causing chronic kidney disease[3]. This is irreversible and results in end stage kidney disease, where the patient has to be dependant on renal replacement therapy for survival. Ocular morbidity may be directly due to diabetic and/or hypertensive nephropathy and in some cases can be due to hemodialysis per se.

It is a means by which the normal kidney function is taken over by an external blood 'purification' apparatus[10]. This prolongs the life span of a person who would otherwise be poisoned to death by their own waste products. However, haemodialysis does not promise an improved quality of life for the patient. This depends on various other factors, one of them being the level of visual disability the person suffers from.

Haemodialysis patients, especially the elderly, have visual acuity levels that are much lower than their age related counterparts and visual rehabilitation is useful in these patients as decreased vision hampers their daily activities with increased incidence of fall and difficulties in performing personal tasks resulting in sleep disorders and depression[10].

Deterioration of visual acuity can occur both due to uncontrolled hypertension and poor glycemic control. Many studies have reported sudden decrease in visual acuity during haemodialysis[2]. Hypertensive retinopathic changes are particularly severe in renal failure due to effects of retained nitrogen[13]. When Haemoglobin levels fall below 5 gm%, retinopathic features like retinal haemorrhages, hard and soft exudates and pallor of optic disc can be present[11].

Our study is not to evaluate the ocular changes occurring directly due to haemodialysis per se, but rather to find out the various ocular pathologies seen in this sub-set of patients who have end stage renal disease and are undergoing haemodialysis as a means of prolonging their life span, regardless of duration of haemodialysis. Our aim is to estimate the percentage of ocular pathologies occurring in them, especially those causing visual disability, which indirectly affects the quality of life of these patients. By this we aim to highlight the importance of an ophthalmic evaluation and visual rehabilitation in this sub-set of patients.

Ocular Findings	**Panda (2010)[19]** (%)	**Pakdel (2011)[26]** (%)	**Vrabec (2005)[17]** (%)	**Bajracharya (2008)[11]** (%)
Hypertensive retinopathy	69.94%	73.70%		47.10%
Non proliferative diabetic retinopathy	47.83%		6%	
Proliferative retinopathy	11.11%		1.50%	
Photocoagulation			3%	
Lid edema				63.00%
Conjunctival pallor				75.60%
Corneal conjunctival calcification	18.36%	24.10%		1.60%
Pinguecula				39.40%
Cataract	27.83%	60.30%		18%
Vitreous haemorrhage				8.30%
Proliferative vitreoretinopathy				2.50%
Maculopathy	14.26%			20.20%
Bullous retinal detachment				0.10%
Branch retinal vein occlusion				0.10%
Pallor of the disc	23.04%			3%
Disc edema				3.30%
Glaucoma	15.20%			1.60%
Chemosis	7.36%			
Conjunctivitis	18.83%			

Table 1: Prevalence of various ocular findings in published studies

2. Materials and Methods

This cross-sectional, analytical, hospital-based study was conducted from December 2012 to December 2013. 100 patients with diabetes mellitus and/or hypertension undergoing haemodialysis in the dialysis unit of Dr. SMCSI Medical College and Hospital were enrolled in the study. Informed consent was obtained from all subjects. Institutional review board approval was obtained. The inclusion criteria were patients undergoing haemodialysis due to diabetic and/or hypertensive retinopathy and age more than 18 years. The exclusion criteria were patients undergoing haemodialysis due to other kidney diseases and patients with systemic diseases other than diabetes and hypertension. Data was collected with the help of a pre-structured profroma. All subjects fulfilling the inclusion criteria were enrolled in the study.

2.1. Sample Size Calculation

Sample size was calculated for an effect size of 10% and Type 1 error of 5% (Za=1.96). Prevalence of ocular findings varying from diabetic retinopathy to branch retinal vein occlusion ranged from 88.33% to 0.1%. These prevalence's were used to calculate sample size.

Formula used is: Za^2pq/d^2 Where, a=Type 1 error

p=Prevalence

q=1-q

We obtained a sample size ranging from 1 to 96. For our assessment the sample size decided upon was 100 patients, therefore 200 eyes were examined. Ethical Clearance was obtained from Institutional Review Board (Dr. S.M. C.S.I. Medical College).

The height and weight of each subject was recorded and BMI was calculated for each. A detailed ophthalmic examination including BCVA, anterior segment examination and dilated fundus examination was performed in all these patients.

The BCVA letter score was assessed with Snellens chart, Illiterate E and C charts. Slit lamp examination for corneal and conjunctival changes was done. Lens opacities and degree of cataract, if present, was observed by slit lamp. The intraocular pressure was measured using a slit lamp mounted Goldmann Applanation tonometer. Dilated fundus examination was done with 90D lens and biomicroscopy and by indirect ophthalmoscope. The number of times the patient underwent dialysis was noted, but not taken into account for analysis in this particular study.

2.2. Statistical Analysis

Data were collected by examination method. The data was entered into a MS Excel worksheet. Later data was transferred into Statistical packages social sciences (SPSS Version 16.0). Frequency tables were constructed and percentages were computed. Association between variables were tested with the help of Chi square test. Estimated percentage of each ocular findings was calculated using descriptive statistics. The level of significance was fixed at 5%.

3. Analysis Of Results Of Study

In this study, we screened 200 eyes of 100 patients undergoing haemodialysis in the Nephrology Unit of the Dr. S.M. C.S.I. Medical College and Hospital.

Age	Count	Percent
21 - 30	2	2
30 - 40	4	4
41 - 50	24	24
51 - 60	41	41
61 - 70	27	27
71 - 80	2	2

Table 2: Distribution according to Age

- Figure 1: Distribution according to Age
  Majority of patients were in the age group of 51-60years (41%), followed by 27% between 61-70 years and 24% between 41-50 years. Only 6% were younger than 40 years and 2% above 71 years

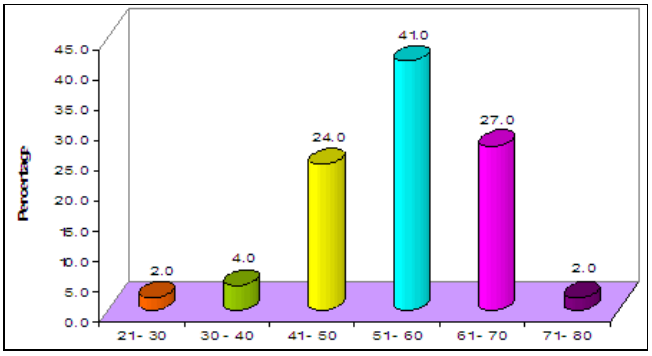

Figure 1: Distribution according to Age

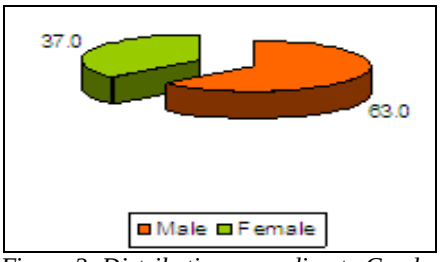

Figure 2: Distribution according to Gender

- More than half (63%) of the patients were males

BMI	Count
Under Weight	71
Normal Weight	25
Over Weight	4

Table 3: Distribution according to BMI

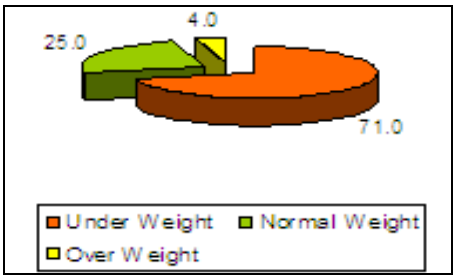

Figure 3: Distribution according to BMI

- In our study, 71% of the subjects were under weight.

Time of haemodialysis	Count	Percent
1-20	23	23
21 - 40	12	12
41 - 60	16	16
61 - 80	16	16
81 - 100	16	16
101 - 120	7	7
121 - 140	4	4
141 - 160	6	6

Table 4: Distribution according to number of Haemodialysis

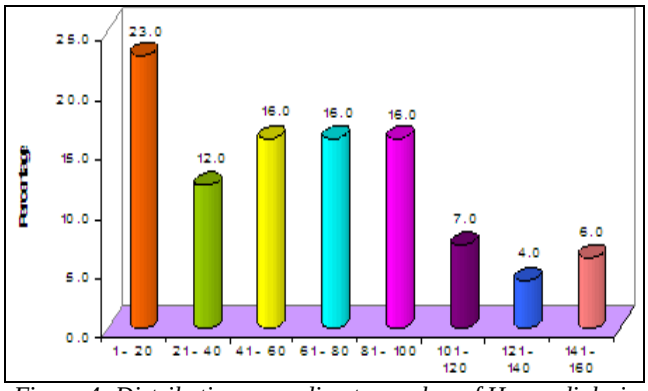

Figure 4: Distribution according to number of Haemodialysis

- Among our study subjects, 83% had undergone dialysis upto a 100 times while the remaining 17% had hemodialysis more than a hundred times.

BCVA	Percentage of eyes
6/6 - 6/18	60.5
6/24 - 6/60	23.5
5/60 - 1/60	11.5
FC at 1m - HM	4
PL-Nil	0.5

Table 5: Distribution according to BCVA

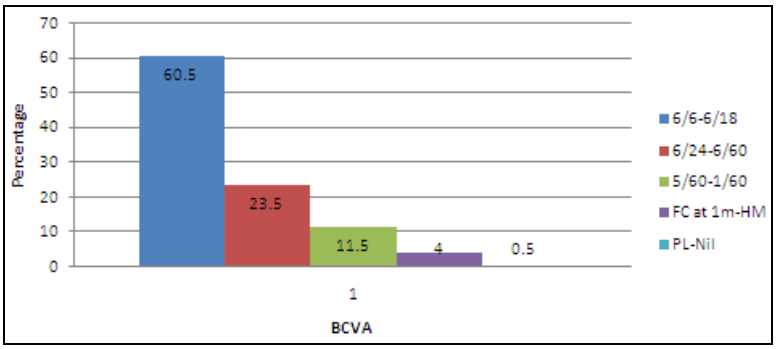

Figure 5: Distribution according to BCVA

- Assessment of visual acuity in eyes taken individually showed that 60.5% of the 200 eyes had visual acuity ranging between 6/6-6/18,23.5% had between 6/24-6/60 and 16% had only less than 5/60. Of these, one eye could not even perceive light.

EYELIDS	Percentage
Normal	81.5
Lid Edema	12
Dermatochalasis	6
Ectropion	1.5

Table 6: Distribution according to Lids and Adnexa

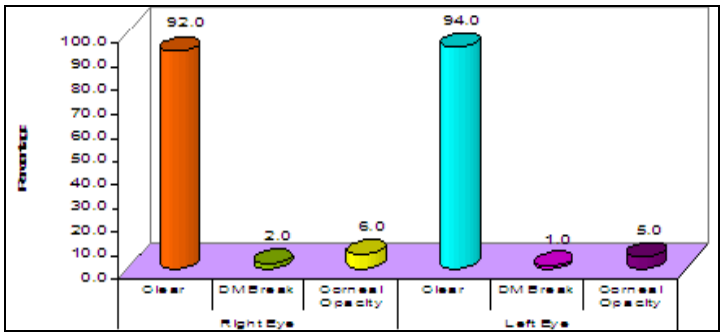

Figure 6: Distribution according to Cornea

- 94% of eyes examined had clear corneas with some having varying degrees of arcus senilis. No significant corneal pathology was detected except for one eye with a Descemet's membrane break. The remaining eyes showed non-specific corneal opacities, suggestive of old scars.

CONJUNCTIVA	Percentage
Normal	78.5
Chemosis	1
Conjunctivitis	1
Conjunctival Pallor	16
Conjunctivochalasis	2
Dermoid	1
SCH	0.5

Table 7: Distribution according to Conjunctiva

- Conjunctival examination revealed pallor in 16% of eyes, conjunctivochalasis in 4 eyes & Subconjunctival haemorrhage in one.

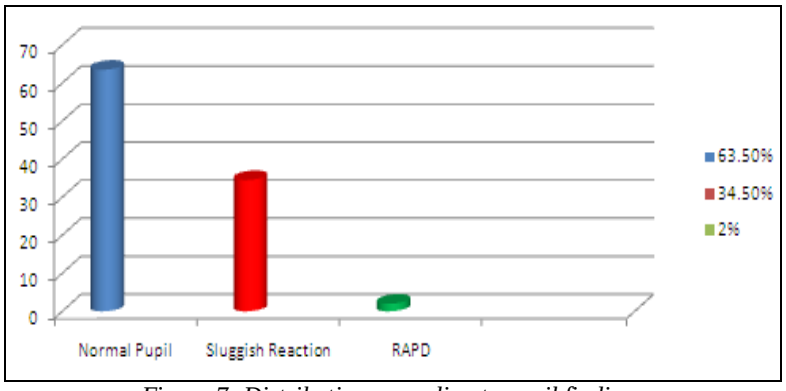

Figure 7: Distribution according to pupil findings

- 34.5% of pupils were sluggishly reacting and 4 eyes had a relative afferent pupillary defect by the swinging flash-light test.

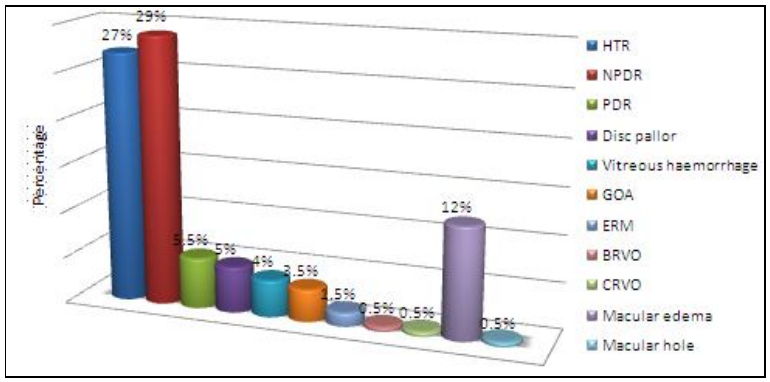

Figure 8: Distribution according to Fundus changes

- 29% of patients had non proliferative diabetic retinopathy of varying severity, 27% had hypertensive retinopathy changes and 12% had clinically significant macular oedema. 5.5% of eyes showed proliferative diabetic retinopathy changes, while 2 eyes had retinal vein occlusions. Vitreous haemorrhage was seen in 8 eyes and a macular hole in 1.

4. Discussion

In this cross-sectional, analytical hospital-based study, of the subjects undergoing haemodialysis, 29% had diabetes mellitus and 47% had hypertension and the remaining had both. 68% of our subjects were between 51-70 years. According to USRDS study, the median age of patient at the time of initiation of haemodialysis was 64.4years, while in a study conducted in India, median age at presentation was 53 years (30-76 years)[18]. Overall, male: female ratio was 1.7:1. The worldwide data records a ratio of 2.3:1. The reason for this could be faster deterioration of kidney function in males[11].

Seventy one subjects were underweight. The change in body weight after haemodialysis is possibly due to body fluid loss[16]. 16 % of eyes had a visual acuity less than 5/60. Studies have shown that in renal failure, blindness of 5-15% occurs in the first year of diagnosis.

Many conflicting results about IOP and haemodialysis have been reported and the outcome remains unclear[20]. In 2005, Levy et al[23] and in 2010, Dinc et al reviewed studies and 3 reports were obtained; a report showing an increase in IOP, reports showing decrease in IOP and reports showing no significant change in IOP. Tokuyama et al[24], first examined the relationship between plasma colloid osmotic pressure and IOP during haemodialysis. Plasma is separated from aqueous humor by blood aqueous barrier and from dialysate by the dialyzer membrane. Volume of plasma decreases due to removal of water from plasma with a relative increase in plasma proteins which results in increase in plasma colloid osmotic pressure causing water to be pushed from aqueous humor to plasma causing a decrease in IOP[20]. In our study, 57.5% had IOP between 10-15 mmHg, which is within the normal range. Only 2 patients had intraocular pressure in the range of 26-30 mmHg. In a study done in Italy[25], average IOP was slightly less than the control group.

Lid edema and conjunctival pallor were present in 13.5% and 16.5% , as compared to other studies in which it was seen in 63.0% and 75.6% of patients respectively[11]. We did not observe any instances of corneal/conjunctival calcification, but other studies have shown that such calcification was present in 60-80% of patients. Positive correlation between duration of haemodialysis and ocular calcium deposition has been noted in literature. However, others, like Dursun et al, found no correlation between conjunctival changes and serum calcium. Calcium deposits mainly consists of calcium phosphate salts. The pathogenesis of ocular calcification is not fully understood. It is possibly due to loss of CO_2 from tissues with rise in pH, which causes precipitation of calcium and phosphate salts[20]. A limitation of our study is that the duration of haemodialysis was not considered.

66.5% patients had visually significant cataract. This was similar to other studies where 60% of patients had cataract[17].However, vision threatening and irreversible causes for visual loss were mostly found in the posterior segment. We found varying grades of NPDR in 29% and PDR in 5.5%. Hypertensive retinopathy was present in 27% and macular edema in 12%. Disc pallor was observed in 5% and vitreous haemorrhage in 4% while glaucomatous optic atrophy was seen in 3.5%. A study published in the Asian journal of diabetology in 2011 done with 64 patients undergoing hemodialysis for chronic renal failure demonstrated that 44 patients had hypertensive vascular changes, 6 had advanced vascular sclerosis, 7 had diabetic retinopathy and 6 had ARMD. Research from Nepal detected hypertensive retinopathy in 47.1%, diabetic retinopathy in 88.3% and 1 case of bilateral serous detachment among the patients studied[11]. In India, hypertensive retinopathy and non proliferative retinopathy are the most common pathologies as reported by Panda[19]. Graefe's Archive for Clinical and Experimental Ophthalmology also mentioned macular edema as the most common cause of poor visual acuity in diabetics which gets exaggerated in renal failure and is not improved after haemodialysis[20]

Fundus examination is, therefore, very important in these patients as early detection is key in the treatment and prevention of visual loss in these individuals.

Ocular findings	Percent
20% visual impairment	57%
40% visual impairment	29%
Lid edema	13.50%
Dermatochalasis	3%
Corneal opacity	5.50%
Conjunctival pallor	16.50%
IOP (10-15)	57.50%
Cataract	66.50%
Fundus findings	
NPDR	29%
PDR	5.50%
Hypertensive retinopathy	27%
Macular edema	12%
Disc pallor	5%
Vitreous haemorrhage	4%
Glaucomatous optic atrophy	3.50%
Photocoagulation	2%
ERM	1.50%
BRVO	0.50%
CRVO	0.50%

Table 8: Ocular findings of this study

5. Conclusion

It is necessary to prevent any ocular pathology in patients on dialysis because every deterioration in visual system can have great implication in everyday life and the social ability of these patients. In conclusion, we suggest ocular examination for all patients with diabetes and/or hypertension undergoing hemodialysis for the early detection and treatment of the various pathologies prevalent in them.

6. References

1. Anil Negi, Stephen A Vernon. An overview of the eye in diabetes. J R Soc Med. 2003; 96(6):266-272.
2. Rodrigo M Lago, Premranjan P Singh, Richard W Nesto. Diabetes and hypertension. Nature clinical practice endocrinology & metabolism. 2007; 3:667.
3. VN Acharya. Diabetic and Hypertensive Nephropathy. Japi 2011; 59.
4. AR Vijay Kumar, T Geetha, KB Rojith. Hypertension Challenges in Diabetes. Asian Journal of Diabetology 2010; 12:9-11.
5. Rajapurkar M, Dabhi M. Burden of disease-prevalence and incidence of renal disease in India. Clinical Nephropathy 2010; 74:9-12.
6. P M Esunge. From blood pressure to hypertension: the history of research. Journal of the Royal Society of Medicine 1991; 84:621.
7. Kean Theng, Nader Moinfar, V Al Pakalnis. Ophthalmic manifestations of Hypertension. Medscape Reference. 2012.
8. National institute for health and care Excellence. NICE Clinical guidelines. Hypertension: Clinical management of primary hypertension in adults. 2011.
9. Carol Willis. Introduction to haemodialysis. P111_1093_01 UHB/P1/1093 (Edition) 2012.
10. Hassan Ghasemi, Reza Afshar, NikanZerafatjou, SaeidAbdi, Ali Davati, Mani KhorsandAskari, HodaShabpiray. Impact of Haemodialysis on Visual parameters in patients with End stage renal disease. Iranian Journal of Kidney Diseases. 2012; 6:457-463.
11. L Bajracharya, DN Shah, KB Raut, S Koirala. Ocular evaluation in patients with Chronic renal failure-a hospital based study. Nepal Med Coll J. 2008; 10(4):209-214.

12. FarrokhlaghaAhmadi, AzinMohebi-Nejad. Intraocular changes during haemodialysis and the role of blood glucose. Iranian Journal of Kidney diseases, Vol. 7, Number 1, January 2013. 36
13. Duane's TD, Jaeger EA. Duane's clinical ophthalmology. Vol. 5. Revised ed. USA: Harper and Row 1987; Chapter 31,1-2.
14. Peyman GA, Sanders DR, Goldberg MF. Principles and Practice of Ophthalmology. New Delhi: Jaypee Brothers 1987; 1205-35, 1633-40.
15. Rajiv Agarwal. Body mass index-mortality:can it be explained by blood pressure?hypertension 2011; 58:1014-1020.
16. The paradox of "body mass index paradox in dialysis patients:associations of adiposity with inflammation. Am J Clinical Nutrition 2005; 82:909-11.
17. RomanaVrabec, ZoranVatavuk, DraskoPavlovic, Antonio Sesar, SvjetlanaCala, KresimirMandic, KajoBucan. Ocular Findings in patients with chronic renal failure undergoing haemodialysis, Coll. Antropol.29.2005; 1:95-98.
18. U.S. Renal Data System: USRDS 2008 Annual Data Report:Atlas of chronic kidney disease and End stage renal disease in the united states. Bethesda, MD, National Institute of Diabetes and Digestive and Kidney, 2008.
19. Dr. Jitendra Kumar Panda, Dr. Gunsagar Das, Dr. SharmisthaBehera, Dr. D.N. Bhuyan, Dr. SitikanthaPradhan, Dr. Chita RarjanKar, Dr. LopamudraBeura. Necessity of ocular screening in patients undergoing heamodialysis-Hospital based cross sectional survey from tertiary health care centre, Western Orissa. Miscellaneous session:335.
20. Ji Wong Jung, Myung Hun Yoon, Seoung Woo Lee, HeeSeeung Chin. Graefes Arch ClinExpOphthalmol. DOI 10.1007/s00417-012-2032-6.
21. BahriAYdin, Mesut EKURMUS, Ranazan YAGCI, RemziKaradag, Mehmet Kenbay, Ibrahim Hepsen, Mustafa Durmus. Effects of Hyperuricemia treatment with Allopurinol on intraocular pressure, Central corneal thickness, Nerve fibre layer and Visual field. Glo-Kat 2008; 3:176-180.
22. Nancy L. Richardson, David A. Higgs, Richard M. Beans and Jack R. Mcbride. Influence of Dietary Calcium, Phosphorus, Zinc and Sodium Phytate Level on Cataract Incidence, Growth and Histopathology in Juvenile Chinook Salmon. The Journal of Nutrition Nov 28,2013. 37
23. Levy J, Tovbin D, Lifshitz T, Zbotnik M, Tessler Z(2005). Intraocular pressure during haemodialysis: a review: Eye 19:1249-1256.
24. Tokuyama T, Ikeda T, Sato K (1998). Effect of plasma colloid osmotic pressure on intraocular pressure during haemodialysis. Br J Ophthal 82:751-753.
25. De Marchi S, Cecchin E, Tesio F. Intraocular pressure changes during haemodialysis:prevention of excessive dialytic rise and development of severe metabolic acidosis following Acetazolamide therapy. Ren Fail 1989; 11:117-124.
26. FarzadPakdel, HamidrezaSamimagham, Amin Shafaroodi, MehrdadSheikhvatan. Changes of Serum Calcium, Phosphorus and Parathyroid hormone Concentrations and Ocular findings among patients undergoing haemodialysis. Saudi J Kidney Dis Transpl 2011; 22(6):1142-1148.
27. Rights of visually impaired. A publication of vision rehabilitation centres. Categories of viaual disability. Newsletter 16. March 2005.
28. Source: No. 16-18/96-NI.I, Government of India, Ministry of Social Justice & Empowerment**,** New Delhi (India), Dated August 28, 1998