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RESEARCH ARTICLE
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ASSOCIATION BETWEEN PRESENCE OF PROTEINURIA AND DIABETIC RETINOPATHY AS WELL AS THEIR RELATION WITH SERUM 25(OH) VITD LEVEL DEFICIENCY AMONG TYPE 2 DIABETIC PATIENTS: A CROSS-SECTIONAL STUDY IN EASTERN INDIA

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Abstract

Background: Diabetes Mellitus(DM) is a severe and growing public health problem with substantial economic burden worldwide. Uncontrolled Diabetes leads to dreaded micro-vascular complications like diabetic retinopathy and nephropathy etc. In parallel to increase in prevalence of DM and its complications, several reports of serum 25(OH) VitD deficiency have been documented in India.

Objective: To establish the association between proteinuria and presence as well as severity of Diabetic retinopathy& their relation with VitD deficiency.

Materials & Methods: The present study was carried out in a tertiary care teaching hospital in Kolkata, approved by the institutional Research & Ethics Committee. In this present study,107 Type2 diabetic patients of 40 yrs of age & above were selected.Direct Ophthalmoscopy(Heine β - 200) was used for detection of Diabetic Retinopthy(DR) and grading of DR.Venous blood for FBS,PPBS, HbA_{1C} and 25(OH)VitD level estimation, was taken aseptically. Urinary protein was tested by Dip stick method.

Results & Conclusion: Results were analysed by using SPSS version 20. Chi square test, Fischer Exact test,Man Whitney U & Kruscal Wallis test were used in statistical analysis where they were appropriate. Most of the patients are VitD deficient. Proteinuria was present in highest percentage of total patients.There was statistically significant association between proteinuria and presence as well as severity of Diabetic retinopathy. In our study, the presence of proteinuria is significantly associated with deficient VitD status in diabetics without retinopathy group, patients with 'Severe NPDR' & total patients.Deficient Vit D status is significantly associated with severity of Diabetic Retinopathy in presence of proteinuria.

Keywords: Diabetic Retinopathy (DR), Non Proliferative Diabetic Retinopathy (NPDR), Proliferative Diabetic Retinopathy(PDR), Proteinuria, Renin-Angiotensin-Aldosterone System (RAAS)

Introduction

Diabetes mellitus is a major public health problem which affects more than 300 million individuals worldwide with significant morbidity and mortality.[1]Uncontrolled or poorly controlled diabetes increases risk of micro-vascular complications including retinopathy & nephropathy.Diabetic retinopathy is most common complication among them.[2]Diabetic Retinopathy is a micro-angiopathy primarily affecting the pre-capillary arterioles, capillaries and post capillary venules although larger vessels may also be involved. Diabetic retinopathy exhibits features of both microvascular occlusion and leakage..Incidence of Diabetic retinopathy is commoner in Type 1(40%) than in Type 2 diabetes mellitus(20%).[3] Diabetic nephropathy,characterized by presence of pathological quantity of proteinuria,diabetic glomerular lesion and decreased GFR, is a problematic challenge whichis a leading cause of ESRD world wide.[4]Congruence between microalbuminuria and retinopathy has been well reported in persons with Type 1 diabetes and lesser number of studies address the association between microalbuminuria and Type 2 diabetes.[5,6] Inspite of adequate sunlight throughout the year, several reports have documented the prevalence of hypovitaminosisD in general population of India.[7]Serum 25(OH)VitD level is widely accepted as a good indicator of VitD status in a subject.[8]

Aims

Our aim is to evaluate the association between the proteinuria and presence as well as severity of Diabetic retinopathy along with their relation with serum 25(OH)VitD deficiency among patients ofType2 Diabetes Mellitus.

Methods

Place of Study

This study was conducted in department of Medicine(Diabetic Clinic),Ophthalmology, Physiology & Biochemistry of Calcutta National Medical College & Hospital(C.N.M.C.) of Kolkata

Study Period

The study period was from May'2019 to April'2020**.**

Study Population

Type 2 Diabetic patients attending diabetic clinic of C.N.M.C.& H.

Sample Size

It was determined by applying the formula $4pq/E^2$; where p= prevalence of diabetic retinopathy among Type 2 diabetic patients attending medicine OPD of a tertiary care hospital in India which is presently 31.5%.[9]So, p=0.315 ; q =(1-p) i.e. 0.685 and E=allowable error(10% in this study)=0.1.This is why, sample size n =4×0.315× 0.685/0.01=86.31.Total 107 patients were taken for this study to avoid bias.

Study Sample

Total 107 patients of both sexes, aged 40 yrs and above with clinically diagnosed type 2 diabetes mellitus presenting to Diabetic Clinic at Calcutta National Medical College & Hospital

Inclusion Criteria

Type 2 Diabetics with 40 yrs & above were included in this study.

Exclusion Criteria

Patients with any Cardio-vascular , Hepatic & renal disease as well as other causes of retinopathy like trauma, Age Related Macular Degeneration(ARMD); Central Serous Retinopathy(CSR); Retinal Detachment(RD), Hypertensive retinopathy etc. were excluded.Subjects with H/O recent VitD supplementation, intake of medications like Rifampicin,Phenytoin or Phenobarbitone, those who were mentally challenged or unable to provide informed writtenconsent and Type 1 Diabetics were not included also.

Sampling method

It is systematic random sampling.

Experimental Designing

This is Analytical, Observational & Cross- sectional study.

Method of Data Collection

After screening 107 Type 2 diabetic patients, Direct Ophthalmoscopy(β Heine-200) was done to detect presence of diabetic retinopathy & to perform grading of retinopathy if retinopathy is present.In this current study, we have used the following Diabetic Retinopathy disease severity scale.

Table1:International Clinical Diabetic Retinopathy Disease Severity Scale[10]

Proposed disease Severity scale	Findings observable on dilated ophthalmoscopy
1.No apparent retinopathy -	No micro-aneurysm
2.Mild NPDR -	Micro-aneurysm only
3.Moderate NPDR –	More than just microaneurysm but less than severe NPDR
4.Severe NPDR –	Any of the following: i)More than 20 intra-retinal hge in each of 4 quadrants ii)Definite venous beadings in2+ quadrants iii)Prominent IRMA in 1+ quadrant & no sign of PDR
5.PDR –	One or more of the followings: i)Neovascularisation 1.NVD 2.NVE ii)Vitreous/ Pre-retinal hge

(Diabetic maculopathy may or may not be present)

Venous blood was taken for FBS, PPBS ,HbA_{1C} & 25(OH)VitD level examination aseptically. Serum 25(OH)VitD estimation was done by automated immuno-assay using ELISA kit.Here we divided the patients into 3 groups according to VitaminD status.[11]

Level	**Range(ng/ml)**
SUFFICIENTVITAMINDLEVEL	>30
INSUFFICIENT VITAMINDLEVEL	20-30
DEFICIENTVITAMINDLEVEL	<20

Urinary protein was detected by Dip stick method using reagent strips.All procedures in this current study were done with due permission of institutional Ethics committee.

Results

Table 2: Distribution of study participants according to their Socio-demographic characteristics (N=107)

Characteristics	**Frequency(%)**	**Descriptivestatistics**
Age(Yr)		Minimum:40Yrs Maximum:82Yrs Mean:56.19Yrs Median:56Yrs SD:8.51Yrs Range:40-82Yrs
40-49	22(20.6)	
50-59	48(44.9)	
60-69	28(26.2)	
70-79	8(7.4)	
80-89	1(0.9)	
Gender		
Female	64(59.8)	
Male	43(40.2)	

Table 3:Different grades of diabetic retinopathy in our study according to International Clinical Diabetic Retinopathy Disease Severity Scale

DRGrading	Frequency	Percentage
No Apparent Retinopathy	46	43.0
Mild NPDR	12	11.2
Moderate NPDR	33	30.8
Severe NPDR	13	12.1
PDR	3	2.8
Total	107	100.0

Table 4:Distribution of serum VitD status of patients in current study

VitD	Frequency	Percent
Deficient	55	51.4
Insufficient	44	41.1
Sufficient	8	7.5
Total	107	100.0

Table 5: Distribution of presence or absence of proteinuria in patients in our study group

Urine Protein	Frequency	Percent
Absence of Protein	45	42.1
Presence of Protein	62	57.9
Total	107	100.0

Table 6:Comparison of FBS,PPBS,HbA_{1C} &VitD level in present study participants(N=107)

	FBS(mg/dl)	PPBS(mg/dl)	HbA_{1c} (%)	VitD (ng/ml)
Minimum	72.00	88.00	6.00	7.60
Maximum	351.00	584.00	15.00	98.83
Mean	149.09	214.45	8.30	21.20
Median	138.00	190.00	8.10	19.80
Std.Deviation	54.38	95.59	1.77	11.40

Table 7:Comparison of FBS, PPBS, HbA_{1C} & VitD level with presence or absence of diabetic retinopathy in the study participants(Mann Whitney U Test)

DR		FBS	PPBS	HbA_{1c}	VitD
	Mean	148.72	205.64	7.72	25.21
	Median	132.00	173.00	6.80	22.65

NO DR	Std. Deviation	63.32	108.25	2.08	15.29
DR	Mean	149.38	221.10	8.73	18.18
	Median	146.00	207.00	8.20	18.20
	Std.Deviation	47.07	85.14	1.36	5.71
	p Value	0.483	0.060	<0.001	0.001
	Significance	Not Significant	Not Significant	Significant	Significant

Table 8:Comparisonof FBS,PPBS,HbA_{1C} & VitD level among different grading of Diabetic Retinopathy (Kruscal Wallis Test)

DR		FBS (mg/dl)	PPBS(mg/dl)	HbA_{1c}(%)	VitD(ng/ml)
No Retinopathy	Mean	148.72	205.64	7.72	25.21
	Median	132.00	173.00	6.80	22.65
	Std.Deviation	63.32	108.25	2.08	15.29
Mild NPDR	Mean	176.25	265.08	8.84	20.45
	Median	170.00	248.00	7.90	20.45
	Std. Deviation	73.23	118.11	2.12	6.36
Moderate NPDR	Mean	139.94	202.69	8.37	18.43
	Median	145.00	196.00	8.20	18.50
	Std.Deviation	38.81	67.77	0.93	5.88
Severe NPDR	Mean	152.31	240.46	9.38	16.46
	Median	148.00	228.00	8.90	16.38
	Std. Deviation	32.74	83.68	1.26	4.36
PDR	Mean	133.00	163.73	9.30	13.71
	Median	131.00	158.20	8.70	15.00
	Std. Deviation	14.11	25.95	1.31	3.07
	p Value	0.581	0.082	<0.001	0.004
	Significance	Not Significant	Not Significant	Significant	Significant

Table 9: Relation between presence of Proteinuria and presence or absence of Diabetic Retinopathy (Pearson's Chi Square Test for Independence of Attributes)

		DR				
		NO DR	DR	Total	p Value	Significance
Urine Alb	Absence of Protein	31(67.39)	14(22.95)	45(42.06)	<0.001	Significant
	Presence of Protein	15(32.61)	47(77.05)	62(57.94)		
Total		46(100)	61(100)	107(100)		

Table 10: Association between presence of proteinuria and severity of diabetic retinopathy (Fisher's Exact Test)

		DR					Total	p Value	Significance
		No Retinopathy	Mild NPDR	Moderate NPDR	Severe NPDR	PDR			
Urine Alb	Absence of Protein	31(67.39)	5(41.67)	8(24.24)	1(7.69)	0(0)	45(42.06)	0.001	Significant
	Presence of Protein	15(32.61)	7(58.33)	25(75.76)	12(92.31)	3(100)	62(57.94)		
Total		46(100)	12(100)	33(100)	13(100)	3(100)	107(100)		

Table 11: Association between different VitD status and presence or absence of proteinuria among diabetic patients with and without retinopathy(Fisher's Exact Test)

DR			Urine Alb		Total	p Value	Significance
			Absence of Protein	Presence of Protein			
NO DR	VitD	Deficient	5(16.13)	10(66.67)	15(32.61)	0.002	Significant
		Insufficient	19(61.29)	5(33.33)	24(52.17)		
		Sufficient	7(22.58)	0(0)	7(15.22)		
	Total		31(100)	15(100)	46(100)		
DR	VitD	Deficient	6(42.86)	34(72.34)	40(65.57)	0.081	Not Significant
		Insufficient	8(57.14)	12(25.53)	20(32.79)		
		Sufficient	0(0)	1(2.13)	1(1.64)		
	Total		14(100)	47(100)	61(100)		
otal	VitD	Deficient	11(24.44)	44(70.97)	55(51.4)	<0.001	Significant

Table 12: Association between different VitD status and presence or absence of proteinuria among different grading or severity of DR (Fisher's Exact Test)

DR			Urine Alb		Total	p Value	Significance
			Absence of Protein	Presence of Protein			
NO DR	VitD	Deficient	5(16.13)	10(66.67)	15(32.61)	0.002	Significant
		Insufficient	19(61.29)	5(33.33)	24(52.17)		
		Sufficient	7(22.58)	0(0)	7(15.22)		
		Total	31(100)	15(100)	46(100)		
Mild NPDR	VitD	Deficient	2(40)	3(42.86)	5(41.67)	0.640	NotSignificant
		Insufficient	3(60)	3(42.86)	6(50)		
		Sufficient	0(0)	1(14.29)	1(8.33)		
	Total		5(100)	7(100)	12(100)		
Moderate NPDR	VitD	Deficient	4(50)	16(64)	20(60.61)	0.481	NotSignificant
		Insufficient	4(50)	9(36)	13(39.39)		
	Total		8(100)	25(100)	33(100)		
Severe NPDR	VitD	Deficient	0(0)	12(100)	12(92.31)	<0.001	Significant
		Insufficient	1(100)	0(0)	1(7.69)		
	Total		1(100)	12(100)	13(100)		
PDR	VitD	Deficient	0(0)	3(100)	3(100)	NA	NA
	Total		0(0)	3(100)	3(100)		
Total	VitD	Deficient	11(24.44)	44(70.97)	55(51.4)	<0.001	Significant
		Insufficient	27(60)	17(27.42)	44(41.12)		
		Sufficient	7(15.56)	1(1.61)	8(7.48)		
	Total		45(100)	62(100)	107(100)		

Table13: Association of serum VitD level with presence or absence of Diabetic retinopathy in presence of Proteinuria(Fisher's Exact Test)

		DR				
		NO DR	DR	Total	p Value	Significance
VitD	Deficient	10(66.67)	34(72.34)	44(70.97)	0.732	Not Significant
	Insufficient	5(33.33)	12(25.53)	17(27.42)		
	Sufficient	0(0)	1(2.13)	1(1.61)		
Total		15(100)	47(100)	62(100)		

Table 14: Association of VitD status with severity of Diabetic retinopathy in presence of Proteinuria(Fisher's ExactTest)

		DR GRADING					Total		
		No Retinopathy	Mild NPDR	Moderate NPDR	Severe NPDR	PDR		p Value	Significance
VitD	Deficient	10(66.67)	3(42.86)	16(64)	12(100)	3(100)	44(70.97)	0.039	Significant
	Insufficient	5(33.33)	3(42.86)	9(36)	0(0)	0(0)	17(27.42)		
	Sufficient	0(0)	1(14.29)	0(0)	0(0)	0(0)	1(1.61)		
Total		15(100)	7(100)	25(100)	12(100)	3(100)	62(100)		

The study result in Table 2 shows that maximum patients were in the age group of 50-59 yrs(44.9%) followed by age group of 60- 69 yrs(26.2%). 20.6% patients were in the age group of 40 – 49 yrs& 7.5% patients were in the age group of 70 – 79 yrs. Only 0.9% patients were in the age group of 80 – 89 yrs.Minimum age was 40 yrs, maximum age was 82 yrs,mean age was 56.19 yrs, median was 56 yrs and standard deviation was 8.51 yrs. we have also seen that in respect to sex, 59.8% patients were female & 40.2% patients were male i.e. most of the patients are females.Table 3 shows that 43% had no apparent retinopathy, 11.2% had mild NPDR; 30.8% had moderate NPDR; 12.1% had Severe NPDR and only 2.8% had PDR.Table 4 finds out that most patients are Vitamin D deficient(51.45%); 41.1% patients had insufficient VitD level and only 7.5% Patients had sufficient VitD level in our study.Table 5 shows that proteinuria is present in highest percentage of patients (57.9%) in comparison to absence of proteinuria in patients(42.1%). Analysis of Table 6 shows that minimum FBS was 72mg/dl, maximum FBS was 351mg/dl, mean FBS was 149.09mg/dl, median was 138mg/dl & standard deviation was 54.38mg/dl; minimum PPBS was 88mg/dl, maximum PPBS was 584 mg/dl, mean PPBS was 214.45mg/dl, median was 190mg/dl & standard deviation was 95.59 mg/dl; minimum level of HbA_{1C} was 6%, maximum HbA_{1C} was 15%, mean value was 8.30%,median value was 8.10% & standard deviation was 1.77% in respect to HbA_{1C}level;minimum VitD level 7.60ng/ml, maximum VitD level was 98.83ng/ml, mean value was 21.20ng/ml, median value was 19.80ng/ml & standard deviation was 11.40ng/ml in respect to serum VitD level;.Table 7 shows that high HbA_{1C}level(p<0.001) &low VitaminD level(p=0.001) are significantly associated with presence diabetic retinopathy.Table 8 finds out that in respect of different grades of diabetic retinopathy, p-value is significant in cases of HbA_{1C}& VitD level i.e. high value of HbA_{1C} is associated with more severity of diabetic retinopathy(p=< 0.001) & less concentration of VitD level or more hypovitaminosis D, there is increased severity of diabetic retinopathy(p=0.004) If we see the mean value of VitD level of different grades or severity of diabetic retinopathy, then it is seen that there is gradual decrease in mean VitDlevel from 'No Retinopathy' group to 'Proliferative Diabetic Retinopathy'.Table9 shows that proteinuria is more in "Diabetic Retinopathy" (77.05%) in comparison to "No Diabetic Retinopathy" group(32.61%) and presence of proteinuria is significantly associated with presence of diabetic retinopathy(p<0.001). Table 10 shows that severity of diabetic retinopathy is significantly associated with presence of proteinuria(p=0.001); 100% of "PDR" group presents with proteinuria in comparison to other groups.Table11 shows that presence of proteinuria is significantly associated

with “No DR” group and total patients.Table 12 shows that in the group of “No Retinopathy”, “Severe NPDR”&
“Total diabetic retinopathy” patients,deficientVitD level is significantly associated with presence ofproteinuria.Table13 shows that there is no significant association between different VitD status and presence or absence of Diabetic retinopathy in presence of proteinuria.Table 14 shows that there is significant association of low serum VitD level with severity of Diabetic retinopathy in presence of proteinuria i.e. more severe diabetic retinopathy is associated with more hypovitaminosisD status in presence of proteinuria.
Number and percentage of patients are compared across the groups using Fisher's Exact Test / Pearson’s Chi Squaretest as appropriate. Mean, Median and StandardDeviation are compared across the groups using Mann-Whitney U test/Kruskal Wallis Testasappropriate.Thestatistical software SPSS version 20 has been used for the analysis &p value < 0.05has been considered as significant.

Discussion

Most of the subjects in our study are VitD deficient. Proteinuria was present in highest percentage of total patients. Presence of proteinuria is significantly associated with presence and severity of diabetic retinopathy. In our study, one novel finding is that the presence of proteinuria is significantly associated with deficiency of VitD level in diabetics without retinopathy group, patients with ‘Severe NPDR’ &in both group of patients or total patients i.e patients with or without DR. The association between different VitD status and presence or absence of diabetic retinopathy in presence of proteinuria is not statistically significant but the association between dificient VitD status and severity of diabetic retinopathy with presence of proteinuria is statistically significant.

VC Lima et al found that diabetic nephropathy showed higher chance for development of DR. (Odds ratio 3.32; 95% CI was within the range of 1.62-6.79). [12]PragatiGarg ,Smriti Misra & their colleagues provided a deep insight into the relationship of microalbuminuria and diabetic retinopathy among type 2 DM in their study. It was observed that higher grades of microalbuminuria are responsible for occurrence of diabetic retinopathy and have significant role in prediction of severity of diabetic retinopathy.[13]Anjum Sultana Khatoon, Raisa Faheem and others concluded that the incidence of proteinuria is significantly associated with the presence of retinopathy, peripheral neuropathy, ischaemic heart disease, hypertension and body mass index more than 25kg/m^2.[14]Ajin Cho, Hayne Cho Park et al found that prevalence of DR severity was associated with decreased e-GFR and albuminuria. Furthermore, decline in e-GFR was independently associated with progression of NPDR to PDR.[15]Sanyal D., Chatterjee S. et al conclusively established that there is a well recognised association between retinopathy and nephropathy, in which nephropathy without retinopathy is rare, but retinopathy without nephropathy is common. They identified a subset of patients with diabetic nephropathy, who underwent renal transplant but were protected from retinopathy. If an extreme rare phenotype i.e diabetic nephropathy patients with unaffected eyes are studied, then genes protecting DR may be identified even from a small number of patients.[16]The study of Mandal G. K. &JyothrimayiD. supports that strict glycaemic control can prevent microalbuminuria and thereby prevent progress on to diabetic nephropathy in patients with type 2 DM.[17]Roberto Trevisan, Monica Vedovato& their colleagues showed that the rate of progression of renal disease in proteinuric type 2 diabetic patients with retinopathy is faster than that observed in those without retinopathy. The screening for retinopathy identifies patients at higher risk for rapid deterioration of kidney function.[18] The findings of Masahiko Yamamoto, Kauya Fujihara and associates implied that the combination of overt proteinuria & moderately decreased eGFR had an additive association for the incidence of vision-threatening severe DR requiring ophthalmological intervention suggesting the necessity of considering moderately decreased eGFR in addition to proteinuria in strategies for preventing the future occurrence of severe retinopathy.[19]The study of Shovna Dash, Bhilash Chougule and their friends revealed that microalbuminuria was associated with all grades of retinopathy with skewing

towards the lower grades of diabetic retinopathy, a portion of diabetics without retinopathy also had microlbuminuria while macrolbuminuria was associated only with those patients who had either severe NPDR, very severe NPDR or PDR. However, it was found that the occurrence of macroalbuminuria is significantly higher in severe NPDR, very severe NPDR and PDR. Thus this study reinforces the observation that there is a strong association between albuminuriaand diabetic retinopathy in type 2 diabetes.[20]The study of Nooshin Ahmdi, Mojgan Mortvi and others demonstrated the effect of VitminD_3 therpy on reducing proteinuria in diabetic with concomitant diabetic nephropathy and VitaminD deficiency after controlling hypertension and use of Angiotensin Converting Enzyme Inhibitor(ACEI) or Angiotensin Receptor Blocker (ARB).[21]But D St O'Reilly, R. H. B. Grey and others concluded after completing their study that they were unable to show any clear relationship between proteinuria and diabetic retinopthy.[22]

Both the retina and the kidney are supplied by very small vessels. The anatomical similarities in the vascularisation of both retina and kidney give rise to similar complications of diabetes that appear in both organs. The microvascular changes in both organs are thought to be initiated by chronic hyperglycaemia, followed by the progressive narrowing and eventual occlusion of micro-vascular structure, subsequently leading to inadequate perfusion of affected tissues.[23,24]An optimal concentration of VitaminD is strongly proven to be necessary for efficient insulin secretion & function. VitD increases the number & affinity of insulin receptors over peripheral tissues. 1,25 di-hydroxyVitD directly activates the transcription of human insulin receptor gene, activates PPAR-γ,stimulates the expression of insulin receptor and enhances insulin mediated glucose transport of peripheral tissue in vitro.[25,26]VitD mediates its anti-angiogenic activity by inhibiting the transcription of hypoxia inducible factor(HIF-1)in retina.[27]In the pathogenesis of diabetic nephropathy, multiple pathways are engaged including activation of Renin- Angiotensin-Aldosterone System(RAAS).[28]Loss of podocytes is the hallmark of progressive kidney diseases including diabetic nephropathy. Podocytes are direct target for AngioteninII mediated injury by altered expression and distribution of podocyte proteins. Additionally AngiotensinII promotes podocyte injury indirectly by increasing calcium influx and production of reactive oxygen species.[29]VitD has inhibitory role on Renin in RAAS to protect from kidney injury.[30]

Strength & Limitation

The strength of our study is that the sample size was calculated scientifically. Robust sampling and use of appropriate inferential statistics were the key strength of this research.The privacy and confidentiality of the data has been restored. There are also some limitations in present study. As this study is cross-sectional, the design allows only for the identification of the association between study variables at a time.The findings of the study can not be generalized as it was an institution-based study.Peripheral retinal lesions may be missed by direct ophthalmoscopy as field of vision is less in direct ophthalmoscopy in comparison to that in indirect ophthalmoscopy.In this present study urine protein is detected by dip stick method.False positive results may be obtained with highly buffered or alkaline urine. Contamination of urine specimens with quaternary ammonium compounds or skin cleansers containing chlorhexidine may produce false positive results. The urine specimens with high specific gravity may give false negative results.

Conclusion

Proteinuria was present in highest percentage of total patients.There was statistically significant association between proteinuria and presence as well as severity of Diabetic retinopathy. In current study, the presence of proteinuria is significantly associated with deficiency of VitD level in diabetics without retinopathy group, patients with 'Severe NPDR' & total patients i.e patients with or without DR.Deficient VitD status is significantly associated with severity of Diabetic Retinopthy in presence of proteinuria.

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Conflict of Interest
None

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