The relationship between the degree of diabetic retinopathy and advanced chronic kidney disease in elderly type 2 diabetic patients

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Objectives: Although with the recent trend of increasing prevalence in elderly diabetic patients, the relationship between diabetic retinopathy (DMR) and chronic kidney disease (CKD) in elderly type 2 diabetic patients is unclear. This study aimed to investigate renal function and advanced CKD in elderly type 2 diabetic patients according to the degree of diabetic retinopathy.

Methods: We screened a total of 116 diabetic patients with chronic kidney disease stage ≥ 3 who visited both nephrology and ophthalmology outpatient department from October 2021 to January 2022. All of 116 patients were classified into 53 no DMR group, 20 non-proliferative diabetic retinopathy (NPDR) group, and 43 proliferative diabetic retinopathy (PDR) group.

Results: As diabetic retinopathy progressed, the deterioration of renal function was correlated (r_s=0.531 in creatinine, $p<0.001$, and r_s=-0.522 in estimated glomerular filtration rate, $p<0.001$). And, the proportion of advanced CKD increased significantly as diabetic retinopathy progressed (p for trend <0.001). In multivariate regression model adjusted with very old (≥80years), male, poorly controlled diabetes, macroalbuminuria, insulin use, diabetes duration ≥10years, old cerebrovascular accident, hypertension, hyperlipidemia, and cardiovascular disease history, the odds ratio compared to the no DMR group was about 4.6 for the NPDR group and about 11.8 for the PDR group, which was statistically significant (p=0.025 in NPDR group, and $p<0.001$ in PDR group).

Conclusions: The progression of diabetic retinopathy in elderly type 2 diabetic patients may be associated with deterioration of renal function and high proportion of advanced CKD. Therefore, periodic examination for diabetic retinopathy in elderly type 2 diabetic patients is important to predict the prognosis of renal function deterioration and progression of chronic kidney disease. In addition, the attention and effort of a nephrologist is required so that the ophthalmic examination can be performed properly.

Table 1. Univariate binary logistic regression analysis for advanced CKD.

Table 2. Univariate binary logistic regression analysis for advanced CKD.

	Univariate regression model		
	OR	95% CI	P-value
No DMR		reference	
NPDR	4.175	1.377 - 12.657	0.012
PDR	11.035	3.943 - 30.885	<0.001
Very old	2.308	0.809 - 6.347	0.105
Male	0.591	0.278 - 1.256	0.172
Hb A1c ≥8%	1.500	0.671 - 3.353	0.323
Macroalbuminuria [a]	4.430	1.987 - 9.878	<0.001
Insulin use	1.740	0.802 - 3.779	0.161
DM duration ≥10years	5.454	2.127 - 13.984	<0.001
HTN	2.965	1.158 - 7.594	0.023
Hyperlipidemia	0.721	0.316 - 1.647	0.438
old CVA	1.295	0.500 - 3.358	0.594
CVD	1.421	0.671 - 3.011	0.359
MI	5.500	1.187 - 25.484	0.029
ACS	2.667	0.978 - 7.268	0.055
CHF	2.252	1.002 - 5.061	0.049
Arrhythmia	1.357	0.435 - 4.293	0.593
VHD	1.103	0.250 - 4.855	0.897
CABG history	1.692	0.314 - 9.115	0.54

Abbreviations: CKD, chronic kidney disease; OR, odds ratio; CI, confidence interval; DMR, diabetic mellitus retinopathy; NPDR, non-proliferative diabetic retinopathy; PDR, proliferative diabetic retinopathy; DM, diabetes mellitus; HTN, hypertension; CVA, cerebrovascular accident; CVD, cardiovascular disease; MI, myocardial infarction; ACS, acute coronary syndrome; CHF, congestive heart failure; VHD, valvular heart disease; CABG, coronary artery bypass graft surgery.
[a] Macroalbuminuria was defined as random urine albumin/creatinine ratio ≥ 300 mg/g Cr.

Table 2. Multivariate binary logistic regression analysis for advanced CKD.

Table 3. Multivariate binary logistic regression analysis for advanced CKD.

	OR	95% CI	P-value
Multivariate regression model 1 [a]			
No DMR		reference	
NPDR	4.643	1.211 - 17.792	0.025
PDR	11.479	3.294 - 40.001	<0.001
Multivariate regression model 2 [b]			
No DMR		reference	
NPDR	9.375	1.514 - 58.048	0.016
PDR	25.668	5.339 - 123.414	<0.001
Multivariate regression model 3 [c]			
No DMR		reference	
NPDR	5.461	1.313 - 22.718	0.020
PDR	20.228	5.332 - 76.737	<0.001

Abbreviations: CKD, chronic kidney disease; OR, odds ratio; CI, confidence interval; DMR, diabetic mellitus retinopathy; NPDR, non-proliferative diabetic retinopathy; PDR, proliferative diabetic retinopathy; DM, diabetes mellitus; HTN, hypertension; CVA, cerebrovascular accident; CVD, cardiovascular disease; MI, myocardial infarction; ACS, acute coronary syndrome; CHF, congestive heart failure; VHD, valvular heart disease.
[a] Multivariate regression model 1 was adjusted by degree of DMR, very old, male, poorly controlled DM, macroalbuminuria, insulin use, DM duration ≥10years, old CVA history, HTN, hyperlipidemia, and CVD history.
[b] Multivariate regression model 2 was adjusted by degree of DMR, very old, male, poorly controlled DM, macroalbuminuria, insulin use, DM duration ≥10years, old CVA history, HTN, hyperlipidemia, MI, CHF, arrhythmia, and VHD history.
[c] Multivariate regression model 3 was adjusted by degree of DMR, very old, male, poorly controlled DM, macroalbuminuria, insulin use, DM duration ≥10years, old CVA history, HTN, hyperlipidemia, ACS, CHF, arrhythmia, and VHD history.
Poorly controlled DM was defined as Hb A1c ≥8.0%.
Macroalbuminuria was defined as random urine albumin/creatinine ratio ≥ 300 mg/g Cr.