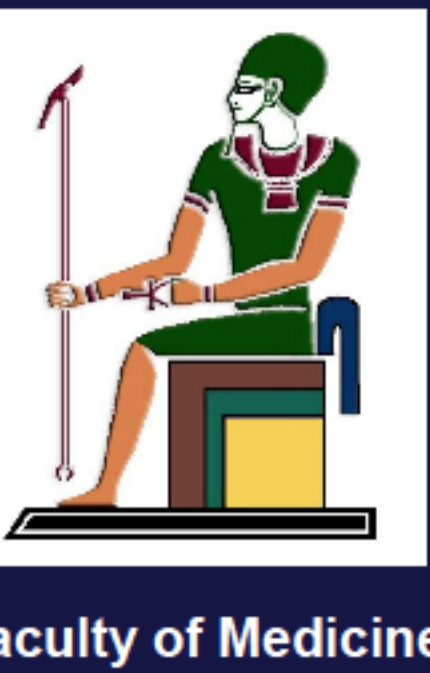




Relation Between Resistivity and Pulsatility Indices of Renal and Intrarenal Arteries and Degree of Albuminuria in Type 2 Diabetic Patients



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Introduction & objectives

Renal biopsy lesions in type II diabetes showed arteriosclerotic glomerulosclerosis in addition to usual changes of diabetic nephropathy. Hemodynamic alterations including intraglomerular hypertension, raised renal vascular resistance and the so called ischemic nephropathy are responsible for the discrepancy of various stages of diabetic nephropathy. Pulsatility index (PI) and resistivity index (RI) of renal arteries were found to correlate significantly with effective renal plasma flow, renal vascular resistance and the filtration fraction in patients with chronic renal failure. In patients with renal dysfunction secondary to type 2 DM PI and RI were significantly increased compared to patients with non-diabetic renal disease. Resistivity index was significantly higher in patients with type 2 diabetes and albuminuria than patient without albuminuria. **This work aimed to study the relation between resistivity index (RI) and pulsatility index (PI) of the main renal and intrarenal arteries and the degree of albuminurea in diabetic patients.**

Methods

Selected patients were 60 type 2 diabetic patients with duration of diabetes more than 5 years. Patients were divided according to albumin/creatinine (ACR) in the first morning voiding urine sample into 3 groups each consisted of twenty (20) patients as follows;

Group I: Patients who have normal ACR < 30mg/gm creatinine;

Group II: Patients with microalbuminuria (ACR: 30-300 mg/gm creatinine);

Group III: Patients with macroalbuminuria (ACR > 300mg/gm creatinine).

The following patients were excluded; Patients with uncontrolled hypertension, cardiac failure, smokers, patients receiving non-Steroidal anti-inflammatory drugs (NSAID), patients suffering from acute or chronic urinary tract infections, patients suffering any febrile illness, critically ill patients and patients with non-diabetic renal disease.

All patients were submitted to measurement of serum creatinine, estimated GFR using *Cockcroft-Gault formula*

Renal Duplex Doppler Ultrasonography (DDU) was done for all patients for estimation of Resistivity & Pulsatility indices of renal and intrarenal arteries in both kidneys by ultrasound machine (HDI 5000). The transducer used is 3.5 MHZ.

Statistical methods: ANOVA test was used for comparison between groups. Non-parametric tests were used when appropriate. Pearson's correlation was used to study the relations between variables. P < 0.05 is considered significant.

Results

All of the three groups of patients were matched regarding age, sex and BMI (Table 1).

Group III patients showed significantly higher RI and PI of all arteries studied than group II and I respectively. Also, all studied indices were found to be significantly higher in group II than group I (Table 2).

Urinary albumin/creatinine was found to be positively correlated with RI and PI of all arteries studied in a significant relation (figure 1 & 2)

Table (1): Demographic and laboratory data of studied groups.

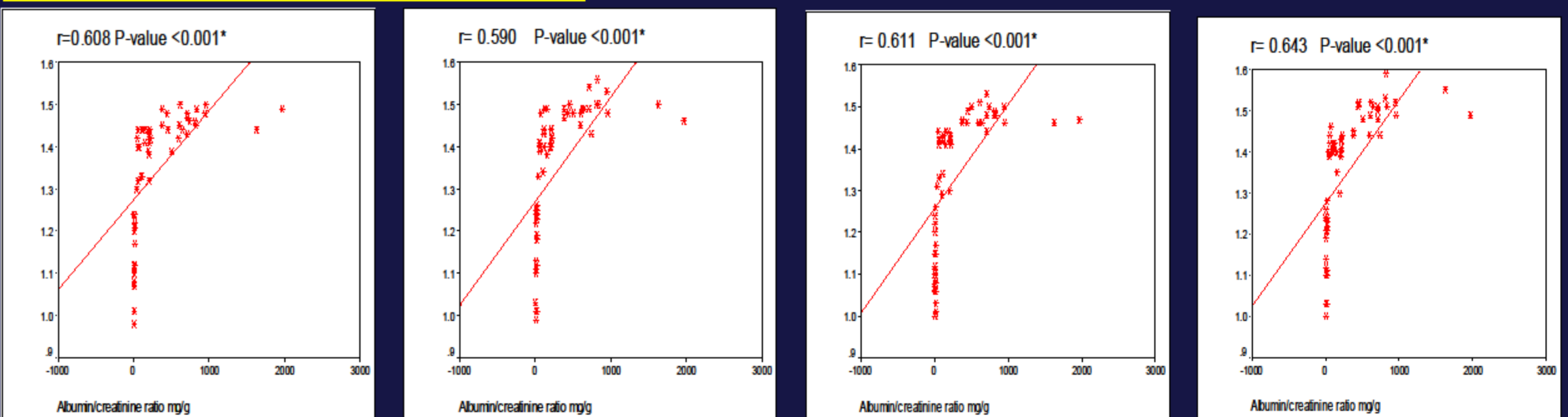
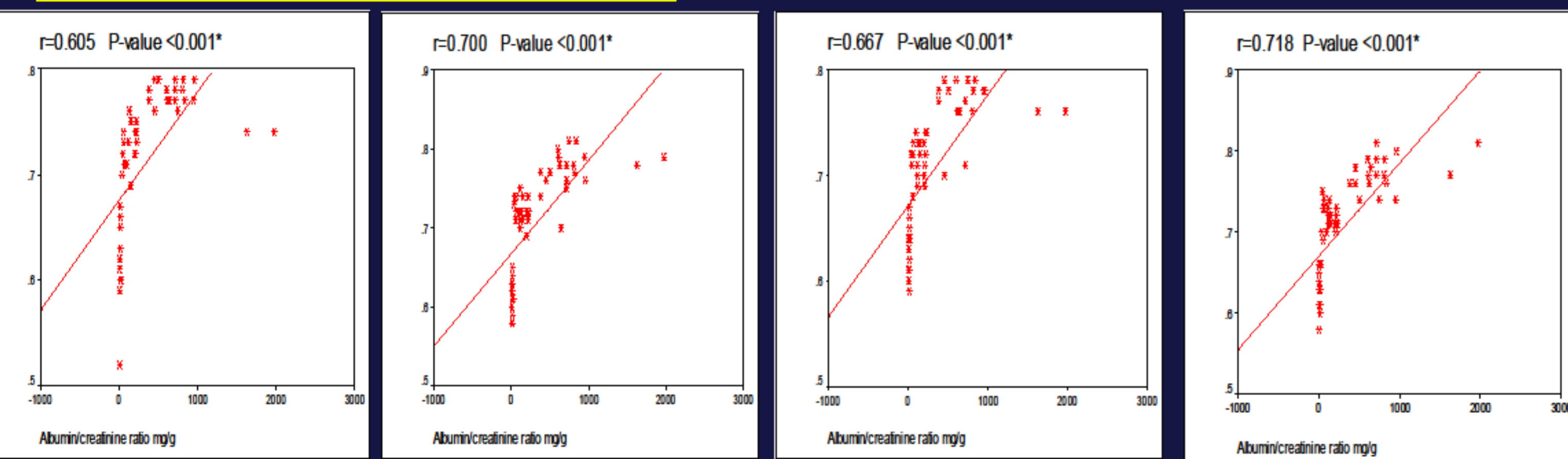
	Group I	Group II	Group III	P
Age (y)	51.8 ± 4.008	55.65 ± 7.2	54.15 ± 6.8	0.15
Sex Male no(%)	6 (30 %)	4 (20%)	4 (20 %)	0.7
Female no (%)	14 (70 %)	16 (80 %)	16 (80 %)	
BMI Kg/m ²	32.9 ± 5.0	32.3 ± 5.6	32.9 ± 5.6	0.92
HbA1C %	9.24 ± 1.6	9.6 ± 1.4	9.21 ± 1.2	0.6
Serum creatinine (mg/dl)	0.66 ± 0.14	0.67 ± 0.13	0.77 ± 0.45	0.4
eGFR (ml/min/ 1.72m ²)	117.85 ± 34.5	102.76 ± 28.9	75.9 ± 2.0	<0.001
Albumin /creatinine (mg/g)	13.335 ± 5.220	133.970 ± 64.784	775.370 ± 393.174	<0.001

Figure (1): Correlation of albumin/creatinine (ACR) with resistivity indices (RI) of right and left main renal and intrarenal arteries.

Table (2): Doppler indices of studied groups.

Site	Doppler indices	Group I	Group II	Group III	P
Rt main artery	RI	0.62 ± 0.035	0.73 ± 0.018	0.773 ± 0.015	< 0.001
	PI	1.16 ± 0.08	1.4 ± 0.05	1.46 ± 0.03	< 0.001
Lt main artery	RI	0.62 ± 0.02	0.72 ± 0.02	0.77 ± 0.01	< 0.001
	PI	1.13 ± 0.10	1.42 ± 0.04	1.49 ± 0.03	< 0.001
Rt intrarenal arteries	RI	0.625 ± 0.024	0.717 ± 0.018	0.77 ± 0.024	< 0.001
	PI	1.12 ± 0.07	1.40 ± 0.05	1.48 ± 0.02	< 0.001
Lt intrarenal arteries	RI	0.62 ± 0.02	0.72 ± 0.02	0.77 ± 0.2	< 0.001
	PI	1.15 ± 0.09	1.41 ± 0.03	1.50 ± 0.04	< 0.001

Figure (2): Correlation of albumin/creatinine (ACR) with pulsatility indices (PI) of right and left main renal and intrarenal arteries.



Conclusion

Degree of albuminurea in type 2 diabetic patients could be an indicator of resistance in renal arteries with patients with a higher degree of proteinuria having a higher degree of resistance. This could add to the understanding of the mechanism of hypertension and progression of renal disease in those patients.

References

- Gambara V, Mecca G, Remuzzi G, Bertani T. Heterogeneous nature of renal lesions in type II diabetes. J Am Soc of Nephrol, 1993; 3(8): 1458-66.
- Kramer HJ, Nguyen QD, Curhan G, Hsu CY. Renal insufficiency in the absence of albuminuria and retinopathy among adults with type 2 diabetes mellitus. JAMA. 2003 ;289(24):3273-7
- Petersen LJ, Petersen JR, Ladefoged SD, Mehlsen J, Jensen HA. The pulsatility index and the resistive index in renal arteries in patients with hypertension and chronic renal failure. Nephrol Dial Transplant 1995; 10 (11): 2060-2064
- Matsumoto N, Ishimura E, Taniwaki H, Emoto M, Shoji T, Kawagishi T, Inaba M, Nishizawa Y. Diabetes mellitus worsens intrarenal hemodynamic abnormalities in nondialyzed patients with chronic renal failure. Nephron. 2000 ; 86(1):44-51.
- Hamano K, Nitta A, Ohtake T, Kobayashi S. Associations of renal vascular resistance with albuminuria and other macroangiopathy in type 2 diabetic patients. Diabetes Care. 2008 ;31(9):1853-7.

