The effect of Renin Aldosterone Angiotensin II System on adrenal glands and glomerular filtration rate in renal failure patients

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Abstract

Renin Aldosterone Angiotensin-2 Systems: Among the most important hormone structures, it controls blood sugar levels, potassium and salt equilibrium, the amount of fluid, and the activities of the urinary tract, the adrenals, and the heart and arteries. The purpose of this investigation is to look at how Renin Aldosterone Angiotensin II affects the glands that produce adrenaline and how it relates to the rate of glomerular filtration in people with persistent kidney disease. The Ibn Sina Centre at Baquba University Hospital is home to 100 Iraqi patients with chronic kidney failure, ranging in age from 35 to 67. The formula was used to get a glomerular filtration rate (GFR). All individuals' blood levels of the hormones renin, testosterone, and angiotensin-2 are measured using a readily accessible ELISA Micro water sources kit from LDN, Germany. The findings demonstrate the relationship among variations in GFR and activity a hormone called ; in the cautious category, the average GFR was substantially inversely correlated with the average activity a hormone called ($r=-0.40$, $p<0.01$). The findings demonstrated a relationship among ANGII, aldosterone, and cortisol variations in serum-activated renin, or The average blood activated a hormone called level and the average aldosterone level exhibited an important positive connection in the control group ($r=0.33$, $p<0.05$). In contrast, the hemodialysis group ($r=-0.12$, $p>0.05$) and the two categories ($r=-0.02$, $p>0.05$) showed insignificant negative correlations. In the more cautious group, there was a strong positive correlation ($r=0.55$, $p<0.01$) between the mean blood angiotensin level and mean cortisone. In individuals with chronic renal failure, glomerular filtration rate has a detrimental impact on active renin, which in turn has an impact on the adrenal cortex function.

Keywords: Active renin, adrenal glands, Angiotensin II

1. Introduction

Renin testosterone Angiotensin-2 Systems (RAAS): among the most important hormone system; it regulates blood sugar levels, potassium and sodium equilibrium, and fluid volume, which in turn affects kidney and glandular functioning (1). Over a century has passed since the discovery of the traditional RAAS. In 1934, Goldblatt et al. demonstrated a renin-mediated relationship between blood pressure and the condition of the kidneys. Angiotensinogen, that is generated in the hepatocytes and split by renin published from the kidneys cells called juxtaglomerular cells, is the typical hormonal system associated with the RAAS. Angiotensin I (ANGI) is subsequently produced, and this is further split by the the lung's Angiotensin Enzyme (ACE) activity into the active type of Angiotensin-2 (ANGII). Next, ANGII bind to certain adrenal cortex the receptors, which results in an increase in cortisone. According to this conventional route, the major job of the RAAS is to control arterial pressure by inducing vasoconstriction in response to ANGII and preventing the retention of salt in the duct that collects blood by the action of cortisol (3). The RAAS is a well-known cardiovascular regulator and damage to target organs predictor. Through

concerted actions on the circulatory system, arteries, and kidneys, it controls the level of electrolytes and fluids (4). This clarification demonstrates the significance of RAAS in the progression of persistent kidney disease. ANGII is the elementary the effector of the RAAS and exerts its blood vessels impact primarily on the post-glomerular arteries, increasing glomerular fluid pressure and causing the ultrafiltration of plasma protein levels. These consequences may lead to the beginning and progression of chronic renal failure (5).

2. Materials and Methods

The research project was carried out from the 21st of February to May 25, 2022, at the Ibn Sina Centre in the Baquba Research Hospital, on 100 Iraqi patients, ages 35 to 67, which had chronic kidney disease. 50 orthodox patients—25 men and 25 women—and 50 hemodialysis individuals—25 men and 25 women—were the subjects of the present investigation. Using the equation, the glomerular filtration rate (GFR) was determined.

$$GFR = 141 \times \min\left(\frac{Scr}{\kappa}, 1\right)\alpha \times \max\left(\frac{Scr}{\kappa}, 1\right) -1.209 \times 0.993^{Age} \times 1.018[\text{if female}] \times 1.159[\text{if black}]$$

Utilizing a readily accessible ELISA Micro wells kit from LDN, Germany, the amounts of testosterone, active renin, and angiotensin II, among others, are measured in all subjects' patients. An automatic statistical COBAS e411 test (from Roche, Germany) is used to assess cortisol levels in all participants' blood.

Analytical statistics

The statistical evaluation system-SAS (2012) programmer is used to determine the coefficient of correlation between various variables in the present investigation, with a p-value for each parameter <0.05 being deemed meaningful.

3. Results

The data indicates a relationship among the variations in GFR and indicates engaged renin. Specifically, in the cautious category, the average GFR had a substantial negative correlation with indicate active renin (r=-0.40, p<0.01), while in the dialysis treatment category, the relationship was insignificantly negative (r=-0.13, p>0.05) and non-significantly optimistic (r=0.08, p>0.05). Figure 1 (1). Table 1 (1).

Table 1 shows the association coefficients among activated renin and GFR.

Parameters	Correlation coefficients –r		
	Conservative Group	Hemodialysis Group	Conservative & Hemodialysis
GFR & Active renin	-0.40 **	-0.13 NS	0.08 NS

**** (P<0.01), NS: Non-Significant.**

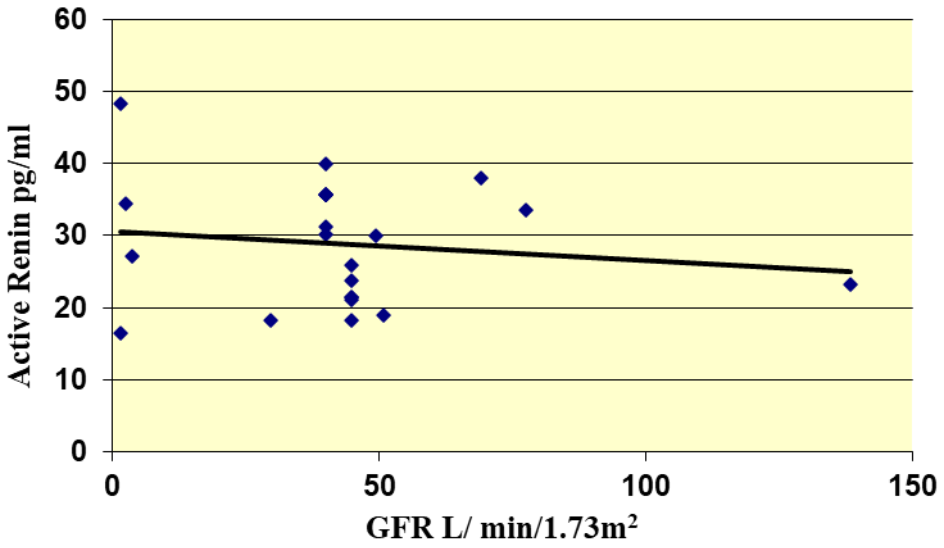

Figure 2: GFR and activated a hormone called in dialysis are related.

The findings demonstrated a relationship between variations in blood activity renin and ANGII, hormone cortisol and angiotensin. In the more conservative group, there was an insignificant positive relationship (r=0.19) among the average serum activity a hormone called level, and mean ANGII. However, there was an insignificant negative relationship (r=-0.14, p>0.05) among the two categories (r=-0.06, p>0.05) when hemodialysis was included.

In the control category, the average serum activity renin concentration had a strong positive correlation (r=0.33, p<0.05) with average aldosterone (Figure 2), but in the hemodialysis sample (r=-0.12, p>0.05) as well as between the two categories (r=-0.02, p>0.05), there was an insignificant opposite relationship. Figure (3) shows a substantial positive correlation among the mean blood aldosterone level and mean cortisol in the group of conservatives (r=0.55, p<0.01), whereas Table (2) shows a non-significant positive correlation in the hemodialysis group (r=0.01, p>0.05) as well as among the two categories (r=0.07, p>0.05).

Table 2 shows the association values between cortisone and angiotensin II, aldosterone, and activated renin.

Parameters	Correlation coefficients –r		
	Conservative Group	Hemodialysis Group	Conservative & Hemodialysis
Active renin & Angiotensin II	0.19 NS	-0.14 NS	-0.06 NS
Active renin & Aldosterone	0.33 *	-0.12 NS	-0.02 NS
Cortisol & Aldosterone	0.55 **	0.01 NS	0.07 NS
*** (P<0.05), ** (P<0.01), NS: Non-Significant.**			

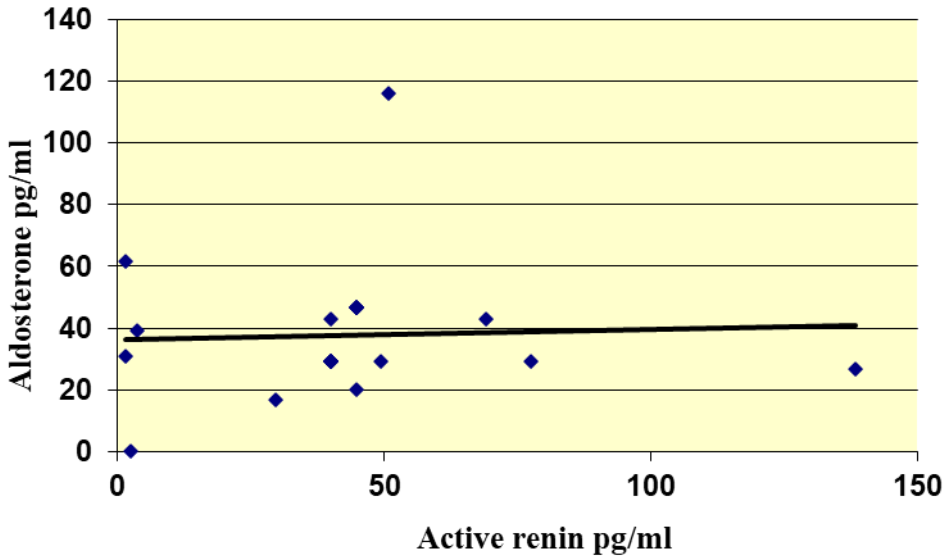

Figure 2: Aldosterone and Activated Renin in Conservatives in Relationship to Each Other

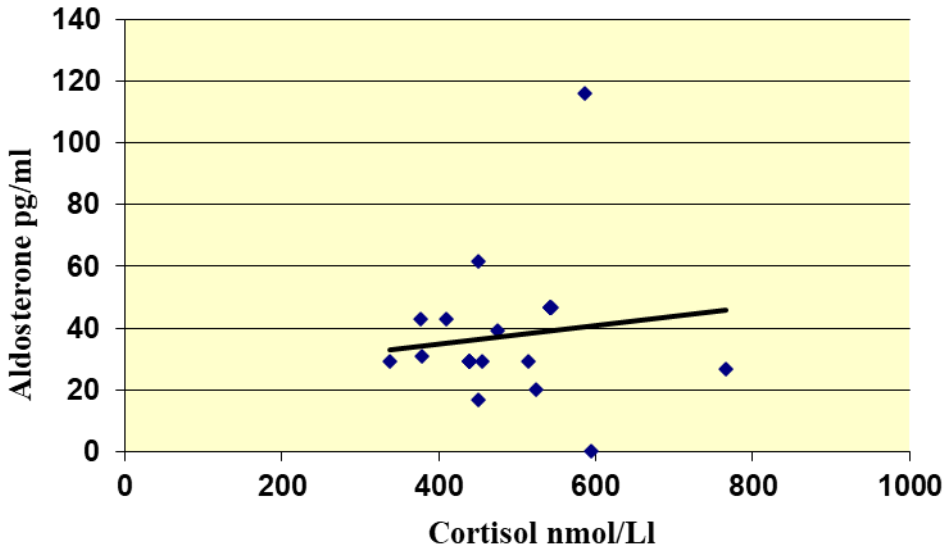

Figure 3: Cortisol and Aldosterone's Correlation in Conservatives.

4. Discussion

Persistent kidney damage one of the chronic illnesses that results in a permanent decrease in GFR and an increase in urea nitrogen in the blood and creatinine levels in the blood (7,8). The research found a strong negative correlation between GFR and urea in both the dialysis and conservative groups of patients. Elevated levels of creatine signify a decreased glomerular filtering rate, which therefore diminishes the kidneys' capacity to discharge toxins (9). Additionally, GFR had a significant association with urea in the dialysis treatment group and a much lower correlation with urea in the less aggressive control. This is the reason why GFRs in CRF patients have declined.

Serum concentrations of both creatinine and urea increase with decreasing GFR because these substances are removed by renal secretion and glomerular filtration rate (10). Reduced blood flow to the kidneys has been shown to be related to CDK. It is thought that when CKD worsens, the blood supply to the kidneys decreases (11). In the more cautious group, there was a substantial

negative correlation between GFR and active renin. Perhaps as a result of decreased blood flow. Elevated RAS activation is also a major role in many diseases since ANGII directly affects cardiac, arterial, and kidney tissues, raising blood pressure and aldosterone and causing damage to the end-organs.

Application of recombinant ANGII decreases independently retinal circulation, GFR, efferent arterioles, and narrows presynaptic (12), Consequently, ANGII raises the afferent and efferent arteriolar resistances and decreases the glomerular filtering rate, which decreases GFR (13). As the main site of renin production in the kidneys, the juxtaglomerular epithelioid cells of the afferent arterioles cause a decrease in extracellular blood and fluid volume, a drop in blood pressure, and a rise in sympathetic impulses. (14).

The mean cortisol in the conventional group was significantly positively correlated with the activated renin level. Showed renin sensors are expressed in human abdominal and superficial fat cells (15). Human fat cells have been found to produce aldosterone. (16)The relationship between average cortisol and aldosterone level was significantly favorable in the orthodox category. The hypothesis that cortisol and mineralocorticoid hormone receptors have particular combinations of amino acids that allow cortisone to bind to them with the same great selectivity that angiotensin does to receptors for mineralocorticoid hormones may explain this association (17).

5. Conclusions

In individuals with chronic renal failure, glomerular filtration rate has a detrimental impact on active renin, which in turn has a negative impact on the functioning of the adrenal glands**.**

References

[1]. Ferrario, C. M. and Strawn, W. B. (2006). "Role of the renin-angiotensinaldosterone system and proinflammatory mediators in cardiovascular disease," American Journal of Cardiology, vol. 98, no. 1, pp. 121–128.

[2]. Goldblatt, H.; J. Lynch; R. F. Hanzal and Summerville, W. W. (1934). "Studies on experimental hypertension: I. The production of persistent elevation of systolic blood pressure bymeans of renal ischemia," The Journal of Experimental Medicine, vol. 59, no. 3, pp. 347–379.

[3]. Christiane, Ru,¨ ster and Gunter, Wolf. (2006). Renin-Angiotensin-Aldosterone System and Progression of Renal Disease, J Am Soc Nephrol 17: 2985–2991. doi: 10.1681/ASN.2006040356

[4]. Gankam, V.; Uehlinger, D. and Dick, B. (2002).Increased cortisol metabolites and reduced activity of 11β-hydroxysteroid dehydrogenase in patients on hemodialysis. Kidney Int; 61: 1859–1866

[5]. Giuseppe, Remuzzi; Norberto, perico; Manuel, nacia and Piero, reggenti. (2005). the role of renin-angiotensin-aldosterone system in the progression of chronic kidney disease. Kidney International, Vol. 68, Supplement 99, pp. S57–S65.

[6]. Gal-Moscovici, A. and Sprague, S.M. (2007). Bone health in chronic kidney diseasedmineral and bone disease. Adv Chronic Kidney Dis; 14:27–36.

[7]. Drechsler, C.; Ritz, E.; Tomaschitz, A.; Pilz, S.; Schönfeld, S.; Blouin, K.; Bidlingmaier, M.; Hammer, F.; Krane, V.; März, W.; Allolio, B.; Fassnacht, M. and Wanner, C. (2013). Aldosterone and cortisol affect the risk of sudden cardiac death in haemodialysis patients. Eur Heart J.; 34: 578-587.

[8]. Tomas, J.S. I. Marinho; Limeres, M.J. Antos and L. Araujo, P. (2008). Changes in salivary composition in patients with renal failure. Arch Oral Biol; 53:528–32.

[9]. Sneha, V. George; JoJo, K. Pullockara; Kumar, Sai, Sailesh and Mukkadan, J. K. (2015). A study to assess changes in the hematological profile in chronic kidney disease. The Pharma Innovation Journal; 4(6): 01-03.

[10]. Gonella, G.M. (2016). Effect of Dialysis on Certain Biochemical Parameters in Chronic Renal Failure Patients. International Journal of Contemporary Medical Research. 3; 77-83.

[11]. Lu- Pingli Gonella, M.; Bonaguidi, F.; Buzzigoli, G.; Bartolini, V. and Mariani, G. (1981a). On the effect of magnesium on the PTH secretion in uremic patients on maintenance hemodialysis. Nephron; 27(1):40–2.

[12]. Yamamoto Gonella, M.; Buzzigoli, G.; Bencivelli, W.; Bartolini, V. and Betti, G. (1981b). The determination of whole blood magnesium concentration in uremics on chronic dialysis. Nephron; 28: 88–89.pathology. Semin Immunopathol 33: 409-417.

[13]. Yim Gonigle, R.J.; Weston, M.J.; Keenan, J.; Jackson, D.B. and Parsons, V. (1984). Effect of hypermagnesemia on circulating plasma parathyroid

hormone in patients on regular hemodialysis therapy Magnesium; 3(1):1–7.

[14]. Gabriel, L. and Navar. (2014). Physiology: hemodynamics, endothelial function, renin–angiotensin–aldosterone system, sympathetic nervous system. Journal of the American Society of Hypertension; 8(7) 519–524.

[15]. Achard, V.; Boullu-Ciocca, S.; Desbriere, R.; Nguyen, G. and Grino, M. (2007). Renin receptor expression in human adipose tissue. Am J Physiol Regul Integr Comp Physiol; 292(1): R274–R282.

[16]. Briones, A.M.; Nguyen, Dinh, Cat, A.; Callera, G.E.; Yogi, A.; Burger, D. and He, Y. (2012). Adipocytes produce aldosterone through calcineurin-dependent signaling pathways: implications in diabetes mellitus-associated obesity and vascular dysfunction. Hypertension; 59(5): 1069–1078.

Fagart, J.; Huyet, J.G.; M. Pinon, G.M; M. Rochel, M.C.; Mayer, C. and M.E. Rafestin-Oblin. (2005). “Crystal structure of a mutant mineralocorticoid receptor responsible for hypertension,” Nature Structural and Molecular Biology, vol. 12, no. 6, pp. 554–555.