

DIFFERENT KIDNEY AGEING, SCINTIGRAPHIC COMPARISON OF LEFT AND RIGHT RENAL FUNCTION

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INTRODUCTION AND AIMS

Along the last decade the interest in **renal vascular diseases**, in all its forms (hypertensive, nephroangiosclerotic and ischemic) has become critical, in relationship to the progressive age increase of the nephropathic patients, the higher incidence of related uremia and the subsequent prognostic and therapeutic implications. The aim of this study was researching a functional asymmetry between the left and the right kidney that could reflect the organ aging both in physiological and pathological conditions.

MATERIALS AND METHODS

600 patients (pts) (313 males, 287 females) mean age 61.2 ± 18.3 (years \pm SD) were studied with ^{99m}Tc-MAG3 dynamic renography (table 1). In 132 cases the examination was carried out with the Captopril test in order to increase the diagnostic sensitivity to ischemia. Renal function was measuring creatinine and glomerular filtration rate (eGFR), calculated using the CKD-EPI formula. The kidney size has been analyzed using renal scintigraphy integrated, in 132 cases, by ultrasonography. A group of patients (53), whose renography suggested the presence of renal artery stenosis, has been studied with doppler ultrasound too.

RESULTS

In the enrolled patients resulted: serum creatinine levels (1.7 ± 0.8 mg/dl), eGFR (45.9 ± 24.9 ml/min), right Longitudinal Diameter (LD) (101.4 ± 12.3 mm – Normal Value (NV): 109 ± 12 mm) and left LD (98.9 ± 12.6 mm – NV: 112 ± 12 mm).

- 465 patients (77.5%) had **bilateral functional kidneys**, of these 248 (53.3%) had a **symmetric right/left functionality** ($50 \pm 5\%$), versus (vs) 217 (46.7%) with **asymmetric functionality** (of these: **right** Functional Contribute (FC) $53.4 \pm 15.4\%$ vs **left** FC $46.6 \pm 15.4\%$, $p < 0.0001$).
- In the cases with **asymmetric functionality**, 131 (60.4%) showed a **prevalent right** FC Vs 86 (39.6%) with **prevalent left** FC ($p < 0.001$).
- 135 patients, were **Solitary Functional Kidney** (SFK) 79 (58.5%) **right** SFK, 56 (41.5%) **left** SFK, $p < 0.001$). In these subgroups, eGFR of the right solitary kidney was of 50.4 ± 22.3 ml/min compared to eGFR of 33.8 ± 7.2 ml/min of the left SFK ($p < 0.04$). (table 2)

Overall, in the total amount of 600 pts, the functional scintigraphic contribution of the **right kidney was superior to the left kidney** ($53.1 \pm 21.4\%$ vs $46.9 \pm 21.4\%$ $p < 0.0001$). An even greater evidence of the functional asymmetry with right renal prevalence was detected in the **male population** (**Right: $53.8 \pm 22.2\%$ Vs Left: $46.2 \pm 22.3\%$**) The analysis by age showed that the functional asymmetry is particularly incident **at an age higher than 50 years**; in these patients the right vs left FC was $53.6 \pm 21.8\%$ vs $46.4 \pm 21.9\%$ $p < 0.0001$. The percentage of solitary functional kidney equal to 24% (in **61.8%** was solitary functioning **right** kidney vs **39.2%** of **left** SFK, $p < 0.001$). (figure 1)

Concerning the patients with functional asymmetry, a subsequent **doppler ultrasound**, performed in 53 cases, showed **14 cases of renal artery stenosis** with lumen reduction $>50\%$ (in these 14 stenosis, **57.1%** interested the **left** renal artery, **28.6%** the **right** renal artery, **14.3%** both renal arteries). (figure 2)

Total number of patients	600	%
Males pts	313	52.2%
Females pts	287	47.8%
Mean age	61.2 ± 18.3	
Pts < 50 years	175	29.2%
Pts > 50 years	425	70.8%

Table 1

Functional asymmetry between left and right kidney

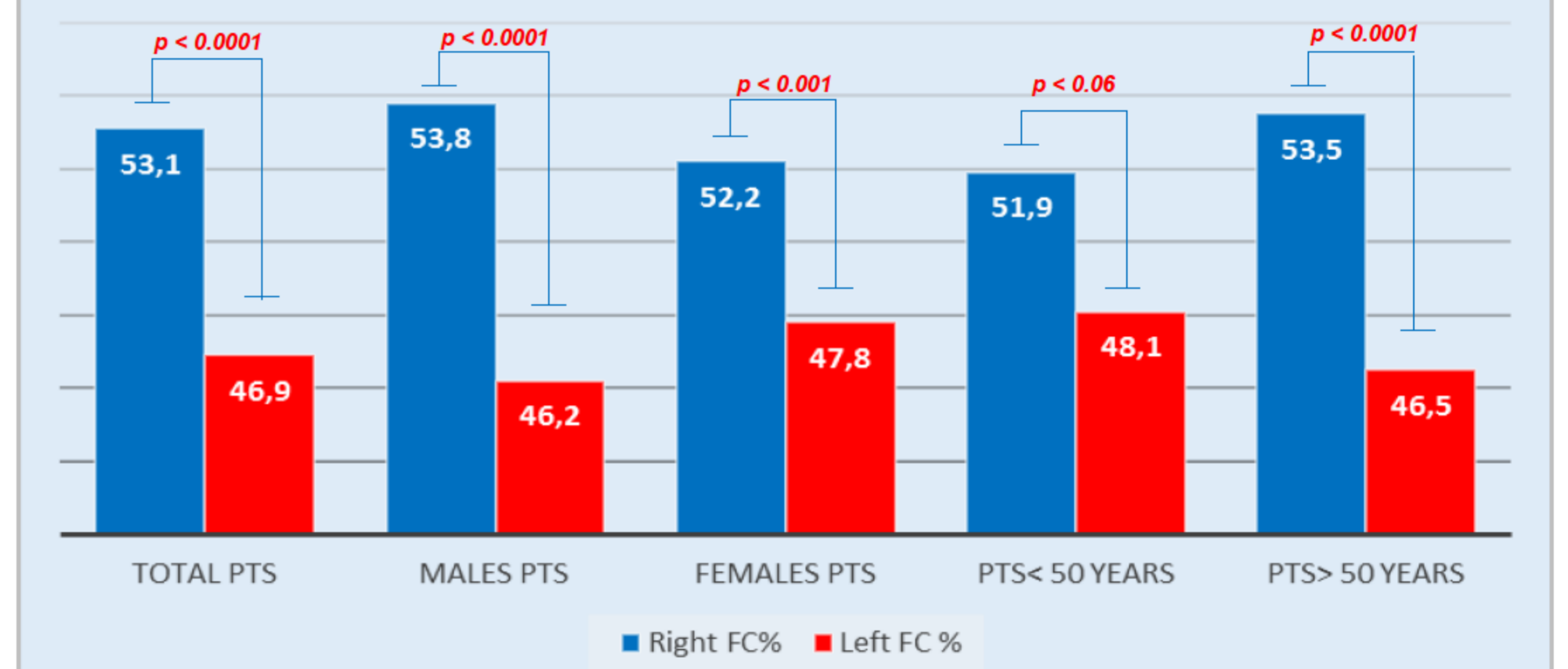


Figure 1

Renal artery stenosis (RAS)

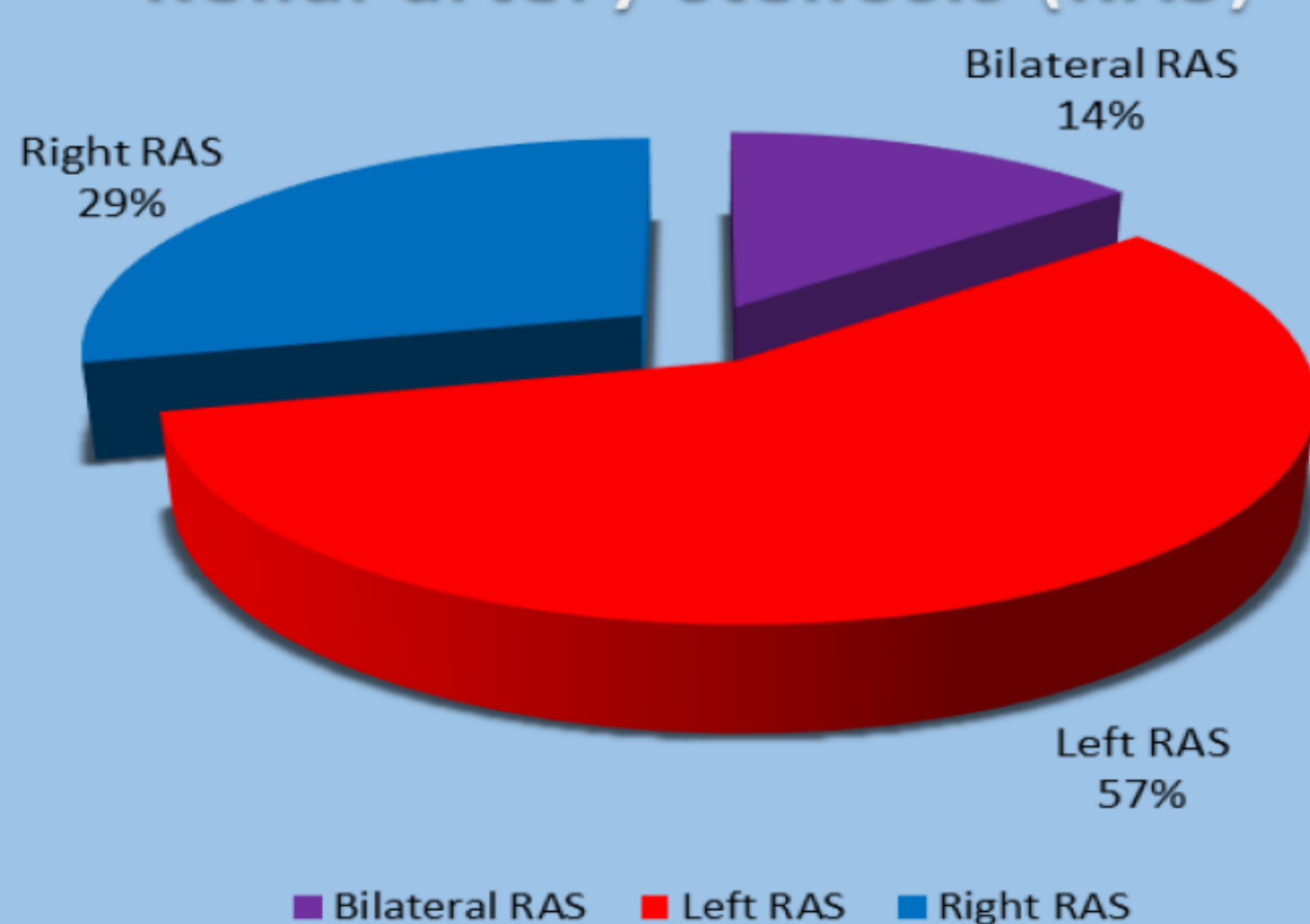


Figure 2

Total number of patients	600
Number of pts with bilateral functional kidneys	465
Number of patients with solitary functional kidney	135
Number of pts with symmetric functionality	248
Number of pts with asymmetric functionality	217

Table 2

CONCLUSIONS

Our study demonstrates that the **left kidney is more susceptible to deterioration on vascular basis**, this is probably due to a greater involvement in ageing process both for physiological and pathological reasons (hypertension, dyslipidemia, etc.). Along the life course, the left kidney, indeed, is at greater risk of partial or total functional loss and, anyway, at higher risk of progressive declining function for vascular ageing. Even the incidence of stenosis is superior in the left kidney. To justify this behavior we can assume anatomical and hemodynamic factors. **The anatomical main factor** is the largest angle of the **emergency** of the right renal artery (about 120°) compared to the left renal artery (very close to an angle of 90°). **The hemorheologic main factor** is represented by the function of the **renal artery ostium flow diverter** on the caudal side of the renal branch point, such structure possesses a thinner internal elastic lamina in the cranial surface, and a thick proteoglycan-collagen cap, which retains Low Density Lipoprotein (LDL). This renal artery anatomy makes easier the deposition of atherosclerotic plaque in the upper side of the renal ostium.

The presence of **renal functional asymmetry suggests further investigations** (doppler- ultrasound in particular) regardless of the presence of signs of activation of the Renin-Angiotensin System, because the processes of atherosclerosis, especially if the patient is not adequately treated for hypertension and dyslipidemia, can be progressive, as demonstrated by the frequent asymptomatic functional loss for renal vascular causes. The greater susceptibility of the left kidney in this kind of pathology should be considered for further aspects, such as the indication for a strict follow up, the angioplasty timing and the **nephrectomy choice for organ donation**.

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