

Evaluating the kidney of hypertensive patients through renal ultrasound

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Abstract

The authors evaluated patients subject to renal ultrasound due to high blood pressure, seen in the Abdominal Ultrasound Sector of the Medicine I Service of the HSM, from April 1987 to December 1993.

In a total of 641 patients examined, 364 (56,8%) were of female gender and 277 (43,2%) of the male gender. In 364 (56,8%) of the patients observed were found renal morphologic changes in the ultrasound and in 209 (32,6%) these changes were eventually related with the hypertensive disease.

In 355 of these observed patients when it was possible to check the clinical files, 93 (26,1%) presented deterioration of the renal function and only 14 (15%) of these had kidneys with

a normal morphology.

Then the authors were verifying the association of kidney morphological changes found with the cardiac dysfunction of the patients observed and comparing the patients group with pathologic kidneys (136) with the group without renal morphologic changes (219) by the test of the χ^2 and did not find a significantly statistic difference ($\chi^2 = 2,97$ $p=0,40 > 0,05$) among the cardiac changes of both studied populations.

At the end, are made considerations on the importance of the information supplied by the renal ultrasound and the harmlessness and quickness of this supplementary means of diagnosis.

Key words: renal ultrasound, arterial hypertension.

Introduction

The Medicine I Service of Santa Maria Hospital has been focusing for a long time in the study of the hypertensive disease, with an outpatient consultation on hypertension; patients are referred for study, evaluation and control, being the most serious those raising more problems of etiology diagnosis, proposed to admission in our wards.

The Service has an abdominal ultrasound sector, which enables us the morphologic evaluation of the observed patients' kidneys. Our admitted hypertensive patients admitted undergo routine renal ultrasound, as well as many who are followed in the outpatients' consultations.

The ultrasound is an easy exam both in accessing and carrying it out, innocuous, and does not imply a discomfort to the patient and it has given us informa-

tion enough to evaluate the repercussion or the renal involvement, considering the ambivalent role of this organ, both as cause as consequence of hypertensive disease and referring the patient to more complex studies, that can guide for an eventual curative therapy of the present etiology process.

It was our intention with this work to evaluate the results regarding the usefulness of renal ultrasound in the hypertensive patient, generally yet not very detailed, that will be our departing point for subsequent studies more developed and specific on the subject, being a contribution to enrich the existing bibliography, which is virtually non-existent in the last few years and only approaches general notions.

Casuistic and methods

The abdominal ultrasound sector of the Medicine I Service of HSM has available, since April 1987 a probe with a 3,5 mHz frequency, adapted to an Aloka SSD 710 ultrasound scanner, enable to perform exams with real time exploration.

From April 1987 to December 1993, 641 renal ultrasound scans were made being requested due to high blood pressure.

From the 641 observed patients 349 (54,4%) were followed up as outpatients at the high blood pressure consultation and 292 (45,6%) were admitted, 364 (56,8%) were female gender and 277 (43,2%) males

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TABLE I

Admitted – 292 (45,6%)	Women – 364 (56.8%)
Outpatients – 394 (54.4%)	Men – 277 (43.2%)
Total – 641	Total – 641

TABLE II

Kidneys without morphologic changes	277 (43.2%)
Kidneys with morphologic changes	364 (56.8%)
Total	641

TABLE III

Total of observed patients	641	
Total of changes	364	56.8%
Changes related with HTA	209	32.6%
Small kidneys	121	
Kidney asymmetry	75	
Polycystic kidneys	11	
One kidney only	2	
Other changes	155	24.2%
Lithiasis	72	
Cortical cysts	52	
Changes on the excretion tree	31	

(Table 1) It was our objective to evaluate the renal morphologic changes seen in hypertensive patients as a whole, changes which besides the hypertension had deteriorating effects on the renal function and to verify the association of the existing cardiac dysfunction with renal abnormality.

Evaluation of renal ultrasound scans made due to hypertension

In the 641 hypertensive patients subject to kidney ultrasound, in 277 (43,2%) kidneys were considered normal and 364 (56.8%) showed the morphological changes we will describe (Table II).

The morphologic changes found with a probable link to a hypertensive disease were in 121, the existence of small size kidneys, suggesting renal parenchymatous disease, in 75 significant asymmetry in renal dimensions, suggesting vascular disease, 11 cases of polycystic kidneys and 2 tests with one only kidney

seen on the screen.

The other abnormalities found without any regard with high blood pressure were 72 with lithiasis signs, in 52 the existence of cortical cysts and 31 with changes in the excretory tree. Some of these patients presented simultaneously multiple alterations as lithiasis and cortical cysts or others, having been classified according to the predominant pathology seen while doing the ultrasound (Table III).

We deem as normal size a bipolar diameter between 10 to 13 cm. It is quoted in the literature¹ that kidneys normal length (bipolar) it is between 11 and 14cm. Considering the Portuguese average build and the experience of what we usually see, we find as normal the size quoted at the beginning, a bit smaller than usually referred to.

A significant renal asymmetry and considering both observed kidneys, it should show a size difference bigger than 1.5 cm whilst the remaining structure was kept normal with regular contours.²

It seems important to highlight that more than half (56.8%) of the patients undergoing ultrasound by high blood pressure, have shown morphologic changes in their kidneys.

On the other hand, 1/3 of all patients observed (32.6% of the total of patients seen) had morphologic changes related with hypertensive disease, as kidney morphology suggesting a parenchymatous disease³, renal vascular disease, polycystic kidneys and only one kidney.

These numbers seem significant and considering the simplicity and harmlessness of such method we can suggest that hypertensive patients, to evaluate the repercussions and kidney involvement in the pathology, must undergo an ultrasound scan, apart of the usual laboratorial evaluation.

The knowledge of the clinic information by who makes the ultrasound is crucial to construe and evaluate correctly the observed patient, as well as the information conveyed to the assistant physician.

Patients sub-group with high blood pressure and laboratorial deterioration of the kidney function undergoing ultrasound scan

In the 641 patients undergoing renal ultrasound scan due to the existing high blood pressure, it was possible in 355 to consult the clinical files whether the admission or consultation ones. This way we get a better understanding of how serious this disease is

in 355 patients, from its evolution and repercussion over organs and systems namely in the retina, kidney, heart and central nervous system.

In these 355 hypertensive patients we selected those showing laboratorial deterioration of the renal function, considering to that purpose those whose creatinine values were 1.3 mg/dL or higher, in several determinations over time, considering that in the HSM Biochemistry Laboratory the normal value is 1,2 mg/dL or lower.

We found 93 (26.1%) patients in these conditions in the total of studied files and we verified that 79 (84.9%) of those having a deterioration of the renal function showing morphologic changes in the ultrasound we described as follows (Table IV and Table V).

The criteria used to determine the significant size and asymmetry between the kidneys are already described in the previous chapter.

Once again, it seems of importance to us, the information provided by the ultrasound in patients with high blood pressure and laboratorial deterioration in the renal function.

In 79 (85%) patients in this sub-group morphologic changes were described in the ultrasound and around 2/3 of such abnormalities were related with the existing pathologies – high blood pressure and kidney failure – as small dimensions kidneys, significant renal asymmetry and polycystic kidneys, irreversible changes and significant prognosis value.

Association of renal morphologic changes with heart dysfunction of the observed hypertensive patients

According to Kobrin at al⁴ the hemodynamic and pathophysiologic effects of essential hypertension in the heart precede the renal effects.

In the 355 patients undergoing renal ultrasound due to the existence of high blood pressure where it was possible to study the clinical files, we evaluated the heart dysfunction shown and its association to the morphologic changes seen in the renal ultrasound and eventually related with hypertensive disorder.

In these 355 hypertensive patients, in 136 (38.3%) were found the following renal abnormalities in the ultrasound : in 37 kidneys of small size were described, in 15 significant asymmetry of kidney dimensions, 8 cases of polycystic kidneys and in 2 the existence of only one kidney. The criteria used was the one already described (Table VI).

TABLE IV

Total of files studied	355
With deterioration of renal function	93 (26.1%)

TABLE V

Patients with a renal function deterioration	93	
Without morphologic changes	14	15%
With morphologic changes	79	85%
Small kidneys	39	
Asymmetric kidneys	14	
Renal lithiasis	10	
Cortical cysts	6	
Polycyst Kidneys	1	
One kidney only	1	
Excretory tree changes	1	

In the 136 patients with kidneys considered pathologic for high blood pressure, 99 (72.8%) showed a heart dysfunction.

Cardiac evaluation was made by the clinical description existing in the patient's file, by the electrocardiogram and by the heart ultrasound. It was ranked from C1 to C4, according to the RRCN table used in our group to the systemic repercussion of high blood pressure.⁵

C1 – normal

C2 – left ventricular hypertrophy (LVH)

C3 – repolarization changes; coronary disease

C4 – congestive cardiac failure, myocardial acute infarction (MAI), aorta dissecting aneurysm.

In 37 (27.2%) of these patients there were no heart changes.

With left ventricular hypertrophy (C2) we found 40 (29.5%) patients.

With left ventricular hypertrophy and systolic overcharge and/or coronary disease (C3) we had 52 (38.2%) individuals and with acute heart disease (C4) 7 (5.1%) patients (Table VII).

As it was already described in Table VI in 219 (61.7%) among the 355 hypertensive patients in which was possible to access the clinical file, were not described in the ultrasound kidney morphologic changes related with high blood pressure.

In this patients group 77 (35.1%) did not show

TABLE VI

Files studied	355	
Morphologic changes related with HTA	136	38.3%
Small kidneys	83	
Renal asymmetry	43	
Polycystic kidneys	8	
Only one kidney	2	
Without morphologic changes related with HBP	219	61.7%

TABLE VII

Heart dysfunction in patients with kidney pathology

Without changes – C1	37	27.2%
LVH – C2	40	29.5%
Repolarization changes and/or Coronary disease – C3	52	38.2%
Congestive Cardiac Failure and/or MAI – C4	7	5.1%
Total	136	

TABLE VII

Heart dysfunction in patients without kidney pathology

Without Changes – C1	77	35.1%
LVH – C2	51	23.3%
Repolarization changes and/or coronary disorder	81	37.1%
Congestive cardiac failure and/or MAI – C4	10	4.5%
Total	219	

any heart dysfunction, 51 (23.3%) had left ventricular hypertrophy, in 81 (37,1%) we found changes in the repolarization and /or coronary disease and 10 (4.5%) were in an acute cardiac unbalanced condition (Table VIII).

Comparing both groups through the χ^2 test, the group of patients with ultrasound kidney pathology related with hypertensive disease and the group with normal ultrasound, related with the referred cardiac dysfunction, did not show a difference with statistical significance ($\chi^2=2.97$, $p=0.40 >0.05$)

Comments and conclusions

Our aim of assessing the usefulness of the kidney ultrasound scan in the hypertensive patient gave us important information as we verified that more than half of the observed hypertensive patients (56.8%) had kidney morphologic changes and in around a 1/3 (32.6% of the total of observed patients) these changes were virtually related with the hypertensive disease, as the renal morphology suggesting parenchymatous disease, vascular disease, polycystic kidneys and only one kidney.

In the patients seen with laboratorial deterioration of the renal function only 14 (15%) did not show kidney morphologic changes, what also shows how important it is to perform an ultrasound in this group of patients, to understand better the current pathologic process.

The attempt of linking the observed hypertensive patients' heart dysfunction with the kidney morphologic changes, was not, however, conclusive and it is not statistically significant among the considered subgroups.

The irreversible character and often progressive and evolving as in polycystic kidneys⁶ conditions, the prognostic significance and the supplied information over time by ultrasound, it seems crucial to us, also considering the harmlessness and quickness of performing this means of supplementary diagnosis, that might guide for other more specific exams in order to clarify the etiology and therapy guidelines.

We did not consider in this study the ultrasound observation of adrenal glands, of great importance in the hypertensive disease, as this is not the ideal means of screening for this organ. The information supplied is limited, and does not avoid the subsequent study by computerized axial tomography or image magnetic resonance.⁷

This issue has fascinated us as we have been focusing it for years to the study of the hypertensive disease and the abdominal ultrasound. We think that in no way this subject is finished and will keep on our work which will enrich the literature about the kidney evaluation of the hypertensive patient through ultrasound tests that we have verified to be non-existent in several researches. ■

References

1. Weill F, Bihl E, Rohmer P, Zeltner F. L'Ultrasonographie Renale. Ed. Vigot, Paris. 1985; 18-19.

2. Weill F, Bihr E, Rohmer P, Zeltner F. L'Ultrasonographie Renale. Ed. Vigot, Paris. 1985; 157-159.
3. Moreira M L e Ribeiro J M C. Atlas de Ultrassonografia Abdominal. Ed Império, Lisboa. 1988; 217-219.
4. Kobrin I, Frohlich E D, Ventura H O, Messerli F H. Renal Involvement Follows Cardiac Enlargement in Essential Hypertension. Arch Intern Méd. 1986; 272-276.
5. Costa J N. Introdução à Clínica da Hipertensão Arterial. Méd. Univ. 1974; 14:47.
6. Parfrey P S, Bear J. C., Morgan J et al. The diagnosis and Prognosis of Autosomal Dominant Polycystic Kidney Disease. N. Eng. J. Med. 1990; 323: 1085-1090.
- 7 – Bravo E. L. Clinical Aspects of Endocrine Hypertension. Med. CL. N. Am. 1987; 71(5): 907-920.

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