Postmortem evaluation of renal, coronary and cerebral vascular lesions in chronic kidney disease

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Abstract: Chronic kidney disease (CKD) is a complex disease in which renal damage is frequently associated with cardiovascular and cerebral complications. The aim of our study was to establish if kidney vascular lesions are accompanied by atherosclerotic lesions on the aorta, the coronary and cerebral arteries. Vascular lesions of 364 violent death cases were analyzed based on data provided by necropsy reports. Aortic, coronary and cerebral lesions were identified by macroscopic examination, while renal lesions were detected by light microscopy. The mean age of the subjects was 55.61 ± 10.57 (42, 86). Atherosclerotic lesions on the coronary arteries were present at 65.4% of the subjects, while 62.6% had atherosclerotic lesions on the aorta and 60.2% on the arteries of the circle of Willis. Renal vascular lesions were encountered in 95 cases, representing 26.09% of all subjects. The subjects with renal vascular lesions also presented coronary, cerebral and aortic vascular lesions in 89.5% of the cases. Thus, these subjects presented significantly more such lesions than the subjects without renal vascular lesions did (p<0.001).

Key words: chronic kidney disease, violent death, renal vascular lesions, microscopic examination

Chronic kidney disease (CKD) is a worldwide public health problem, being a complex disease in which renal damage is frequently accompanied by cardiovascular and cerebral complications. [1] They are responsible for the death of CKD patients in the early stages of the disease (I to III); consequently, a very small number of subjects in advanced stages (IV and V) are reported in populational studies. [2] This is why it is difficult to establish the real CKD prevalence. Various populational studies, relying on functional investigations (glomerular filtration rate decrease level), reported different results - 15.3% in the NHANES study and 27.1% in the KEEP study. [3, 4]

The microscopic examination of the kidneys is useful for diagnosing CKD, but difficult to be performed in populational studies, because renal biopsy is an invasive technique that cannot be performed in all cases. For this consideration, our approach aimed to evaluate CKD in a study group consisting of violent death cases, in order to contribute to the
CKD epidemiological investigations. Violent death is caused by an external (and usually sudden) action or force, thus the use of violent death cases has the advantage of involving no subject selection. It can reveal CKD prevalence in a populational group at a certain moment. The results of the study regarding the analysis of all renal lesions are published in another article.

The present paper aims to evaluate multiple organ vascular lesions in CKD, which can be determined by necroptic examinations.

**Material and methods**

The study group is represented by 364 violent death cases that were autopsied at the Timisoara Institute of Legal Medicine between 2003 and 2007. We used data from the necropsy reports.

Coronary arteries lesions, as well as those of the aorta and the arteries of the circle of Willis were identified by macroscopic examination, based on wall thickening and the presence of atheromatous plaques in the intima.

Renal vascular lesions were identified using light microscopic examination. Paraffin-embedded renal tissue samples that were obtained by standard autopsy methods were cut at a 4-5 µm thickness and stained with hematoxylin-eosin and periodic acid-Schiff (PAS). An average of 30 renal arterioles was examined for the evaluation of arteriolar hyalinosis and arteriolosclerosis. Larger renal vessels that appeared on some tissue specimens were also analyzed.

As far as the statistical analysis is concerned, for quantitative variables the mean value and standard deviation were determined; for the qualitative ones frequencies were calculated. Statistical significances were determined by unpaired t test for quantitative variables and by Chi square test ($\chi^2$) for qualitative variables. We used the specialized statistical software OpenEpi 2.3 and Epi 6.04.

**Results**

The gender distribution shows 70.3% (256) males and 29.7% (108) females. The mean age was 55.61± 10.57 (42,86).

Atherosclerotic lesions on the coronary arteries were present at 65.4% of the subjects, while 62.6% had atherosclerotic lesions on the aorta and 60.2% on the arteries of the circle of Willis.

Renal vascular lesions were encountered in 95 cases, representing 26.09% of all subjects. We found arterioles with hyalinized walls, as well as arterioles with thickened walls and colabated lumina. The arteriolar wall thickening can be caused by accumulating of PAS-positive material, which can be found within the whole wall.

The mean age of subjects with renal vascular lesions is significantly greater than the mean age of subjects without such lesions (p<0.001).

The subjects with renal vascular lesions also presented coronary, cerebral and aortic vascular lesions in 89.5% of the cases. Thus, these subjects presented significantly more such lesions than the subjects without renal vascular lesions did (p<0.001).

**Discussions**

It is well known that disease evaluation in general population is performed through epidemiological studies in order to improve public health. [5] These studies aim to find better ways to improve disease prevention and control. [6] Populational studies can be either observational, or experimental. [7] Their objective is to determine one of the following -
prevalence, incidence, cause, prognosis, or effect of treatment. [8] Their analysis is necessary for understanding a condition or disease. [9]

Although, traditionally, it is considered that the autopsy is performed with the purpose of confirming the accuracy of ante-mortem diagnosis, or in order to identify malpraxis or medical error [10], there are authors who acknowledged the epidemiological importance of necropsies. Mc Farlane introduced the term of epidemiological necropsy and applied his method for the epidemiological evaluation of diseases such as lung cancer or abdominal aortic aneurysm. [11,12]

On the other hand, with the availability of modern diagnostic techniques, the diagnosis accuracy increased and postmortem examinations were, in many cases, no longer necessary. The consequence was a continuous autopsy rate decrease [13] and, implicitly, a possible decrease of their epidemiological significance.

Our study identified, besides other types of renal lesions, vascular lesions, based on microscopic examinations performed during violent death cases autopsy.

The aim of this paper is to establish if these kidney vascular lesions are accompanied by atherosclerotic lesions on the aorta, coronary and cerebral arteries, since CKD patients frequently present vascular lesions with these multiple localizations. They can represent one of main death causes of patients in stages III and IV, who cannot benefit from renal substitution therapy in end stage renal disease (ESRD).

Based on light microscopic examinations, we encountered renal vascular lesions in 95 of the 364 subjects in our study, representing 26.09% of all cases. This prevalence might be related to the conclusions of the epidemiological studies regarding arterial hypertension (AH) prevalence in adult population. [14] The main target organs of hypertensive disease are the heart, brain, kidney and eye. [15] Secondary AH can be caused by renal damage, among other causes, for instance in chronic glomerulonephritis or chronic pyelonephritis.

Few published studies highlight the concomitant damage of two or, rarely, three organs in chronic diseases, most frequently those related to cardiovascular injury [16, 17].

The concept of multi-organ protection appeared in modern medicine, with emphasis on the concomitant protection of heart, kidneys and nervous system in various diseases. [18, 19]

Our study acknowledged the presence of significantly more lesions on the aorta, the coronary and cerebral vessels in subjects with renal vascular lesions than in those without this type of lesions (p<0.001).

We might conclude that our results may represent an addition to the conclusions of populational studies, pleading for a multi-organ approach in CKD and other chronic diseases.

References