

RENAL FUNCTION IN PREHYPERTENSION



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OBJECTIVES

So far only few studies regarding the association between prehypertension and renal disease/function have been performed.

AIM:

to analyse kidney function in prehypertensives comparing to subjects with optimal blood pressure and patients with untreated stage 1 hypertension.

METHODS

- Out of 2489 subjects enrolled in cross-sectional study conducted between 2008 and 2010 in Croatian rural area (door-to-door based enrollment), 693 subjects were eligible for further analysis.
- Exclusion criteria were antihypertensive treatment, hypertension stage 2,3 and isolated systolic hypertension, diabetes mellitus, pregnancy, chronic terminal diseases, dementia, immobility and missing data.
- Clinical examination was performed including body height, weight, waist circumference (WC), blood pressure (BP) heart rate measurements. Epidemiological questionnaire and medical history were taken.
- BP and heart rate (HR) were measured 3 times on right arm in the sitting position after at least 5 minutes of rest using digital Omron M3 and M6 devices.
- Fasting blood was drawn for serum creatinine.
- Urine was analysed for alpha1microglobulin, albumin, creatinine, sodium and potassium.
- abbreviated MDRD formula was used to estimate glomerular filtration rate (eGFR).
- Urine albumin to creatinine ratio (ACR), alpha1 microglobulin to creatinine ratio (alpha1CR) and sodium to potassium ratio (S/P ratio) were determined.
- Renal ultrasound was performed assessing longitudinal and transversal diameters and parenchymal thickness.

Subjects were classified according to their BP values into **3 groups** (Table 1):

OPTIMAL BP (OBP) (<=120/80),
PREHYPERTENSIVES (PHT)(130-139/85-89)
HYPERTENSION stage 1 (HT) (140-159/90-99)

Table 1. Number of participants within the two BP groups

| | N % | N male | N female |
|----------------------|------------|--------|----------|
| Optimal BP | 316 (45.6) | 88 | 228 |
| Prehypertension | 210 (30.3) | 116 | 94 |
| Hypertension stage 1 | 167 (24.1) | 80 | 87 |

RESULTS

Significant differences were found between the three groups in alpha1CR and eGFR (p=0.001; p<0.012, respectively).

Optimal BP group showed to have significantly lower alpha1CR values than prehypertensives and hypertensives (4.2 vs. 4.7 vs. 5.3, p=0.001), as well as serum creatinine (79 vs. 83 vs. 83, p=0.0001); while differed significantly only from hypertensives in eGFR (82.1 vs. 80.1 vs. 77.8, p=0.0122).

No differences between prehypertensives and hypertensives were observed either in those parameters or kidney size determined by ultrasound, urine potassium and urine sodium, and ACR, although a trend of increment in ACR related to BP was observed (4.0 vs. 4.5 vs. 4.6).

| | Whole group summary | Optimal | Prehypertension | Hypertension stage 1 | p | Posthoc tests |
|-----------------------------|----------------------|---------------------|----------------------|----------------------|---------|---------------|
| Age | 40 18-86 | 34 18-85 | 43 19-84 | 48 19-86 | <0.0001 | A,b,c |
| Height | 170 142-200 | 168 150-200 | 172 152-196 | 170 142-196 | 0.0001 | A,b |
| Weight | 74 40-167 | 67 42-124 | 79 47-167 | 80 40-137 | <0.0001 | A,b |
| Systolic RR | 119.25 83.0-159.5 | 83-119.5 110.0 | 133.0 112.0-139.5 | 141.0 96.0-159.5 | <0.0001 | A,b,c |
| Diastolic RR | 77.5 48.5-99.5 | 71.5 48.5-79.5 | 55.0-89.5 82.75 | 92.5 80.0-99.5 | <0.0001 | A,b,c |
| Heart rate | 76.5 49.5-140.0 | 76.0 53.0-140.0 | 75.0 49.5-110.0 | 80.5 59.0-110.5 | 0.0086 | B,c |
| Creatinine serum | 81 38-131 | 79 51-126 | 83 38-131 | 83 61-126 | 0.0001 | A,b |
| eGFR IDMS | 80.8 48.5-226.9 | 82.1 49.3-157.2 | 80.9 48.5-226.9 | 77.8 53.4-112.9 | 0.0122 | C |
| Alpha1MCR mg/g | 4.5 1.1-77.3 | 4.2 1.2-27.2 | 4.7 1.1-77.3 | 1.3-42.1 5.3 | 0.0010 | A,b |
| ACR mg/g | 4.3 0.5-484.8 | 4.0 0.5-364.3 | 4.5 0.6-484.8 | 4.6 1.3-161.2 | 0.0624 | |
| Diameter long left | 110 67-140 | 110 67-132 | 109 75-135 | 113 84-140 | 0.5563 | |
| Diameter long right | 110 11-144 | 110 67-131 | 110 11-144 | 112 78-130 | 0.5456 | |
| Diam. transf. left | 52.7+6.7 | 51.8+6.3 | 53.4+7.3 | 53.5+6.7 | 0.0735* | |
| Diam. transf. right | 50 30-76 | 49 30-68 | 51 30-76 | 50 35-74 | 0.0444 | |
| Parenchymal thickness left | 19 11-32 | 19 12-31 | 19 11-28 | 19 11-32 | 0.7275 | |
| Parenchymal thickness right | 19.0 11.0-40.0 | 18.0 13.0-28.0 | 19.0 11.0-40.0 | 19.0 12.0-29.0 | 0.0830 | |
| Sodium (urine) | 146.0 30.0-332.0 | 144.0 42.0-297.0 | 159.5 30.0-332.0 | 138.5 42.0-312.0 | 0.0905 | |
| Potassium urine | 41.0 8.0-152.0 | 41.0 8.0-152.0 | 43.0 8.0-123.0 | 38.0 8.0-146.0 | 0.8024 | |
| Sodium/potassium ratio | 3.64 0.57-17.06 | 3.72 0.80-14.00 | 3.55 0.57-17.10 | 3.55 0.77-11.83 | 0.6547 | |

Table 2. Median (min-max) values of the measured variables between subjects with optimal BP, prehypertensives and subjects with hypertension stage 1

Legend: *parametric distribution of population, otherwise nonparametric
A – significant difference between optimal and prehypertension; B – optimal and hypertension; C – prehypertension and hypertension

CONCLUSIONS

No differences were found in markers of kidney function between prehypertensives and untreated hypertensives stage 1. As we have already reported higher values of alpha1microglobulin excretion observed in prehypertension might point on early proximal tubule damage present in high normal BP stage.

