

THE BRAIN IN HYPERTENSION

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The association between early morning hypertension and stroke related dementia in the elderly

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Background: Hypertension (HT) in the elderly is associated with increase occurrence rate of dementia.

Purpose: We evaluated the prevalence of the pattern of high blood pressure and effects of arterial stiffness, pulse wave velocity (PWV) and wave reflections on central aortic pressure (CAP) in hypertensive patients with dementia.

Methods: We analyzed a total 450 hypertensive patients with dementia, investigated using 24hr ambulatory blood pressure monitoring (ABPM). Among the HT, classified as early morning hypertension (EMHT) (early morning BP: above 135/85 mmHg and night-time BP: below 120/70 mmHg), Night HT (NHT) (Day-time BP: below 135/85 mmHg and night-time BP: above 120/70 mmHg). And using radial artery applanation tonometry, aortic pulse analysis was performed.

Results: 128 patients was observed HT with stroke related dementia. EMHT was found in 55.6% of patients (n=71). Compared with patients with both EMHT and NHT, EMHT had higher aortic pulse wave velocity (PWV) and augmentation index (AI) and AI75 (AI to HR 75 beat/min), ASP (Central aortic systolic pressure) and pulse pressure were also higher in the EMHT.

Conclusion: Our study showed that EMHT could have increased stroke related dementia and especial, early morning systolic BP, might be risk factor for cognitive decline. Hence active anti-hypertension treatment benefits in dementia prevention.

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Is acoustocerebrography a new noninvasive method for early detection of the brain changes in patients with hypertension?

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Background: Hypertension (HT) is the leading cause of global disease burden and overall health loss. The brain is one of the main target organs affected by HT. HT is a potentially modifiable risk factor that leads to the formation of large vessel macroangiopathy, small vessel disease, microangiopathy, and microhemorrhages. Early detection of the brain changes (BC) gives a chance to receive appropriate treatment and protection from irreversible damage. Acoustocerebrography (ACG) is a set of techniques to capture the states of human brain tissue, and its changes on its molecular and cellular level. It is based on noninvasive measurements of various parameters obtained by analyzing an ultrasound pulse emitted across the human's skull. The main idea of this method relies in the relation between the tissue density, bulk modulus, and speed of propagation, for ultrasound waves in this medium. In our previous studies we showed that ACG is an effective method for detecting white matter lesions compared to the Magnetic Resonance Imaging. Additionally we showed that ACG allows to obtain a differentiated signal originates from atrial fibrillation (AF) patients and high-risk patients with AF and HT.

Aim: The aim of the study was early detection of the BC in patients with HT using ACG.

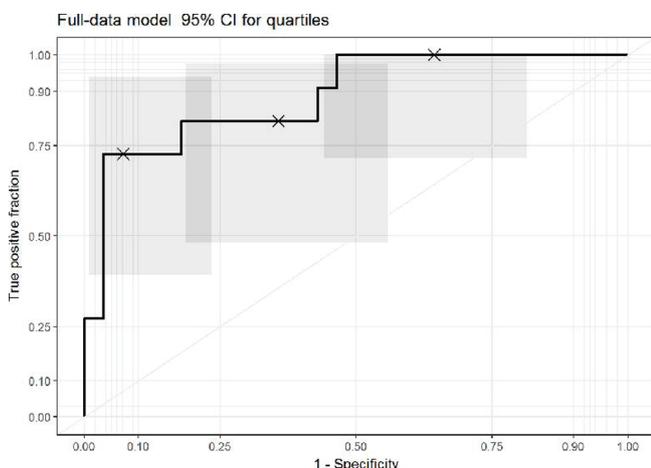


Figure 1. ROC plot for the discrimination HT patients with 95% confidence intervals for quartiles of 1-specificity and sensitivity.

Methods: The study included 136 female and 98 male patients (age 43.6±15.7 years) who were surveyed in the clinical research. The patients were divided into two groups: group I (patients with HT) n=33, and control group II (patients without HT) n=201. Phase and amplitude of all frequency components of the received signals from the brain path were extracted and compared to the phase and amplitude of the transmitted pulse. By doing so, the time of flight and the attenuation of each frequency component were calculated. Additionally, a fast Fourier transformation (FFT) was performed and its features were extracted.

Results: After introducing a machine learning technique, the ROC plot with an AUC of 0.929 with sensitivity 0.879 and specificity 0.831 was obtained (Fig. 1).

Conclusion: ACG is new promising method, which allows for early detection of change in the brain in the patients with HT.

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Are cerebrovascular variants causal in the development of hypertension?

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Background: Elevated resting blood pressure in the young is a strong risk factor for the development of hypertension in later life. This suggests mechanisms driving hypertension are present in early life. One proposed mechanism, termed the selfish brain hypothesis, is that as a consequence of impaired cerebral blood flow sympathetic activity is elevated to raise blood pressure (BP). Our data shows that variants in the anatomy of the posterior cerebral vasculature; an incomplete posterior circle of Willis (CoW) and vertebral artery hypoplasia (VAH), cause cerebral hypoperfusion in middle-aged adults with hypertension. However, whether these variants are present from a young age and are causal to the development of hypertension remains unknown.

Purpose: To examine whether young adults with hypertension have a higher prevalence of vertebral artery hypoplasia and/or an incomplete posterior circle of Willis compared to age-matched normotensives.

Methods: We performed a retrospective analysis of all patients under the age of 40 years seen in our specialist hypertension clinic between November 2011 and June 2016. Using Magnetic Resonance Imaging (MRI) 3D time-of-flight magnetic resonance angiography was completed at 1.5T. Images were reviewed by a single radiologist for the presence of incomplete posterior CoW and/or VAH. A control group of age matched normotensive individuals was identified from a previous study. Prevalence of variants in the two groups was compared using Fishers exact test. Data are reported as mean ± standard deviation.

Results: 53 hypertensive young adults (20 women) and 22 age-matched controls (11 women) were identified. The groups were well matched for age with a mean of 30±4.9 years in the normotensive group and 29±4.5 in the control group (p=0.5). BMI was lower in the control group, mean 24.1, compared to 28.9 in hypertensive group (p=0.0026). Mean clinic blood pressure was 144/91 mmHg (± 16.6/11) compared to 122/74 mmHg (± 10.6/6.4) in the control group (p=0.0001). VAH was identified in 18 (33%) patients in the hypertensive group compared to 4 (18.2%) in the control group (P=0.18). Incomplete posterior CoW was seen in 35 (66%) hypertensives and 9 (40.9%) normotensives (p=0.07). The overall prevalence of either variant was higher in the hypertensive group at 41 (77.4%) than the control group at 11 (50%) (P=0.028).

Conclusion: These data show a higher prevalence of cerebrovascular variants in young adults with hypertension. A longitudinal study is warranted to explore the significance of these abnormalities relative to development of hypertension. With recent studies pointing towards the benefits of lower blood pressure targets the findings herein could become an important consideration in view of their proposed effects on cerebral blood flow.

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Cognitive disorders in children and adolescents with hypertension

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Background: Today the problem of cognitive alterations is poorly studied in connection with hypertension onset in children and adolescents when no vascular and brain damages are present or damages are mild but there are signs of cognitive disorders we can detect.

Aim: To characterize peculiarities of cognitive disorders development in children and adolescents with hypertension.

Methods: We conducted neuropsychological research involving 195 people (15±1.4) who were divided into two groups – main and control. The main group included 98 patients with hypertension (59 boys and 39 girls, 15.1±1.5). The control group included 97 children (60 boys and 37 girls, 14.9±1.3) with normal level of blood pressure. We estimated the state of voluntary attention, speech, verbal and visuospatial memory with the help of A.R. Luria's test battery.

Results: Most of the children and adolescents with hypertension were noticed to