Target organs lesion in adolescents with essential arterial hypertension.

Plotnikova I.V\textsuperscript{1}, Sokolov A.A.\textsuperscript{1}, Usov V.Yu.\textsuperscript{1}, Plotnikov M.P.\textsuperscript{1}, Suslova T.E.\textsuperscript{1}, Kovalev I.A.\textsuperscript{2}

\textsuperscript{1}Federal State Budgetary Scientific Institution «Research Institute for Cardiology», Tomsk, Russia

\textsuperscript{2}Research and Clinical Institute for Pediatrics at the Pirogov Russian National Research Medical University, Moscow, Russia
• According to Russian investigators prevalence of increased pressure in children and adolescents varies from 2.4 to 18%.

• Relevance of this study is defined by the so-called age BP tracking, i.e. preservation of its level in the following years in 33-42% of adolescents.

• Cardiologists pay much attention to target organs that are mostly influenced by high blood pressure. The main target organs are heart, brain, kidneys, eyes and blood vessels.
Aim of the study:

• To assess the state of target organs in adolescents with essential arterial hypertension (EAH) at different stages of its formation.
326 adolescents at the age of 12 - 18 years old. The average age was 14,9± 2,0 лет

Note: WCH – “white coat hypertension”; LAH – liable arterial hypertension; st.AH – stable arterial hypertension
Entry criteria

- Adolescents at the age of 12-18 years old;
- BP higher than 95 percentile of distribution for corresponding sex, height and age, reported thrice in 10-14 days at a pediatrician’s

Exclusion criteria

- Adolescents younger 12 years old and older 18 years old;
  - Adolescents with symptomatic AH;
- Adolescents taken antihypertensive medication during the study
Study methods

- **24-hour blood pressure monitoring**
- **Echocardiography** (LV hypertrophy in adolescents was diagnosed in the case when ILVMM (LVMM/height$^{2.7}$) exceeded 95°/oo of distribution for corresponding sex)
- **Brain MRI** (Hypertensive encephalopathy (HE) was treated as minimal with isolated dilatation of lateral ventricles or arachnoid cavity and/or periventricular oedema. Moderate HE degree was diagnosed with lateral ventricles dilatation in combination with arachnoid cavity enlargement and periventricular oedema.)
- **Assessment of Von Willebrand factor level in blood plasma**
Types of structural and geometrical LV myocardium change in adolescents with essential AH

- Normal geometry: 77%
- Eccentric hypertrophy: 15%
- Concentric remodelling: 6%
- Concentric hypertrophy: 2%

23.1%
Frequency of structural and geometrical change of left ventricle myocardium at different stages of essential AH formation in adolescents

- Normal geometry: 14.3%
- Concentric hypertrophy: 20.4%
- Concentric remodelling: 35.5%
Formation opportunity of eccentric hypertrophy of LV myocardium in adolescents with stable AH

Eccentric hypertrophy of LV myocardium
Correlation of indices of pulse pressure level (PPL) and LV hypertrophy (LVH)

According to 24-hour blood pressure monitoring higher indices of PP level at all time intervals were marked at all time intervals in the group of patients with LV hypertrophy in correlation with adolescents without changes of LV geometry.
Mean values of von Willebrand Factor level in study group and control group and its clinical difference in the given groups in relation to control with adjusted sex and age

Note: vWF – von Willebrand Factor

* - p=0.005, statistical significance in relation to control

Clinical difference, %

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>WCH</th>
<th>LAH</th>
<th>st. AH</th>
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</thead>
<tbody>
<tr>
<td>vWF LAH/control</td>
<td>29.3</td>
<td></td>
<td>40</td>
<td>32.7</td>
</tr>
<tr>
<td>vWF st. AH/control</td>
<td></td>
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</table>
Correlation of risk factors of cardio-vascular diseases and pulse pressure level with vWF level considering sex and age

- Pulse pressure increase of 0.36 mm Hg CI (0.01:0.68), p=0.048 is marked at night with vWF increase of 1 unit (%).

Note: vWF – von Willebrand Factor
Model of stable AH prediction

If $P > 0.5$, upper probability of st. AH. If $P < 0.5$, low probability of st. AH.
Cut-off value 0.5. Sensibility of model 92.3%, peculiarity -82.3%.

\[ P = \frac{e^F}{1 + e^F} \]

Note: TG – triglycerides; vWF – von Willebrand Factor; Std SBP – systolic BP variability per day; DI – daily index; F - discriminant function; e – base logarithm.
Standard visual MRI display of hypertensive encephalopathy

Patient P, 17 years old
Stable AH,
Moderate HE manifestations

Patient C, 16 years old
Liable AH,
Minimal HE manifestations

Note: HE – hypertensive encephalopathy
Prevalence of structural brain changes in adolescents with essential arterial hypertension (N=150)

![Bar chart showing prevalence of structural brain changes in adolescents with different types of hypertension.](chart.png)

- **WCH**: 70%
- **LAH**: 40%
- **st. AH**: 30%

Legend:
- **Orange**: norm
- **Pink**: minimal
- **Blue**: moderate

**HE** – hypertensive encephalopathy
Correlation of BP level, index of LV myocardial mass and von Willebrand Factor with structural brain disturbances in adolescents with essential AH

Arachnoid cavity of postcranial fossa

Average BP day

TI SBP night

0.14 mm (0.02:0.46) \( p=0.032 \)

0.09 mm (0.01:0.16) \( p=0.028 \)

Note: TI – time index; SBP - Systolic BP

Note: HE – hypertensive encephalopathy; vWF – von Willebrand Factor; LVMM – LV myocardial mass
Correlation of CVD risk factors with target organs lesion in adolescents with essential AH

Family history of idiopathic hypertension

- Overweight
- Smoking
- Pulse pressure level
- Vessels endothelium damage - endothelium dysfunction?
- Heart change of LV myocardium geometry
- Insulin resistance
- Average BP per day
- SBP time index per nigh
- Triglycerides level
- Brain structural changes

Overweight
Conclusion

• Smoking, overweight and family history of IH favour formation of target organs lesion in adolescents with essential AH
• Preventive measures in all adolescents with essential AH allow stopping the progression of the disease and favour involution of disease symptoms.