

The aim of our study is **to find mechanisms playing a role in onset and development of arterial hypertension in children** and to search for links connecting genetic background of this disease with organ damage in humans.

According to WOBASZ II study **arterial hypertension affects 42% of** adult Poles. High blood pressure is increasingly more common among children of school age and teenagers too. Vast majority of patients with hypertension are asymptomatic, and the disease manifest at the time of already developed complications – such as stroke, heart failure, heart attack, renal or vision impairment. They are **the cause of 13 % death** worldwide per year. To find people who are at risk of such organ damage early enough, the intensive research is performed to discover a marker, determination of which at early stage of the disease would allow to implement appropriate medical treatment and stop adverse cascade of changes in human body.

It is considered that many factors are involved in development of arterial hypertension. **Genetic and environmental factors**, sympathetic nervous system, **hormone-enzymatic renin-angiotensin-aldosterone system** and substances produced by internal layer of blood vessels – **nitric oxide** and endothelins play important role in this process. **However, the exact course of arterial hypertension development is not fully explained**, and molecular pathways still have blank spaces. Having analysed data coming from research on animals and few clinical studies we noticed that not so long-ago discovered particles of non-coding ribonucleic acid - **microRNA** briefly called miRNA, could have a role in the process.

MiRNA are molecules containing about 20-25 nucleotides (subdivisions), which bind to mRNA (transmitter of genetic information coding protein structure) and cause its degradation or inhibit process of protein synthesis called translation. As a consequence, there is a decrease in production of different proteins inside body cells. In this way MiRNA can have an impact on concentration of substances which participate in changes – adverse or beneficial – in tissues and organs. Physical activity is one of the protective factors against development of hypertension, proved to lower blood pressure. Considering what was said above, **the aim of our study is to find, which miRNA particles and in what way they influence substances essential to development of arterial hypertension, how they concentration changes after physical exercise in young patients and what role they have in early target organ damage**. Having analysed available literature in the field of genetics, molecular studies, animal, and adult studies we selected 5 particles – **miRNA-21, miRNA-27a/b, miRNA-133a and miRNA-145**, which can play significant role in development of arterial hypertension in humans.

Research will be performed in patients with arterial hypertension admitted to the ward and in healthy children. **In the first stage** we will examine patients collecting basic information about their health condition. Next, in conjunction with compulsory hospital tests, we will draw to additional test tube small amount of blood, which will be used for laboratory tests, that include determining miRNA expression levels. After that we will implement 24h ambulatory blood pressure monitoring and measure by non-invasive methods early arterial and heart damage in all examined children. **In the second stage** we will subject all children to a short non-pharmacological intervention – standardized exercise on a stationary bicycle, and after 24 hours we will collect small amount of blood for further investigations and repeat non-invasive examinations of the first stage. **In the third** stage we will determine concentration of substances, which can be a hypothetical link between miRNA and development of arterial hypertension and organ damage. These substances are – nitric oxide producing enzyme and elements of renin-angiotensin-aldosterone system. We will measure miRNA expression levels by its isolation from blood samples and then using polymerase chain reaction (PCR).

Revealing roles of each individual microRNA will allow us **to enrich current knowledge** about them and will reveal influence of physical activity on pathways related to these molecules and help **to better understand regulations of processes occurring in development of hypertension**. Looking further ahead, it can help to earlier detect patients who are at high risk of organ damage and may be applied in creating more effective forms of treatment (including gene therapy) for patients with hypertension in the future.