

The objective of the project

The excess of aldosterone, a hormone produced by the adrenal glands, causes a number of adverse consequences in the heart, blood vessels and kidneys. Increased production of aldosterone occurs in patients with adrenal adenoma or adrenal hyperplasia resulting in a disease called primary aldosteronism. Primary aldosteronism is an important cause of hypertension. Elevated levels of aldosterone can cause hypertrophy and fibrosis of the heart that is disproportionately more significant than could be explained solely by the increase in blood pressure and its effects on the cardiovascular system. It has been documented that aldosterone increases inflammation and fibrosis in the affected tissues. Available data on the severity and nature of these phenomena in humans are limited by the capabilities of diagnostic procedures to evaluate the fibrotic lesions (difficulties and limitations in assessing fibrosis with the use of biochemical markers, limitations of echocardiography in identifying the characteristics of the underlying abnormalities), which is a problem for the assessment of the consequences of aldosterone action on the heart and kidneys, as well as for the assessment of the evolution and reversibility of these alternations. Treatment of primary aldosteronism encompasses either surgical removal of the adrenal adenoma producing large amounts of aldosterone, or the administration of medications that block the action of aldosterone to the receptors (pharmacological treatment).

Cardiac magnetic resonance imaging (MRI) provides unique capabilities to evaluate various structural changes in the heart, kidneys and other organs, including identification of focal and diffuse fibrosis and inflammation within the myocardium and kidneys. These alternations may depend on the variety of factors including aldosterone levels and the causes of aldosterone excess, genetic mutations and the influence of various factors and substances on the heart and kidneys. Therefore, the objective of the study is to assess the impact of aldosterone excess on structural and functional alternations in the heart and kidneys along with the assessment how the treatment (either surgical or pharmacological) affects the alternations present prior to the surgical or pharmacological therapy.

The research to be carried out

It is planned to perform precise and comprehensive assessment of the structure and function of the heart and kidneys with the use of both MRI, as well as with the echocardiography for additional heart evaluation. Additionally, biochemical markers in blood and urine will be analyzed, some of which may be markers of the heart and/or kidney injury, and the others may influence the development of such lesions. Since it has been demonstrated that specific genes are involved in the overproduction of aldosterone, we will also assess the presence of genetic mutations in the study group.

Reasons for choosing the research topic

Primary aldosteronism is one of the leading causes of the secondary hypertension – the form of hypertension in which the cause for elevated blood pressure levels can be found and adequately treated enabling in selected cases even the “cure” of hypertension (no need for taking antihypertensive medications). In Poland, the diagnosis of primary aldosteronism in patients with resistant (difficult-to-treat) hypertension was made in up to 16% of subjects. It is estimated that primary aldosteronism is responsible for approx. 10% of all cases of hypertension. In Poland, with 10.5 million population with hypertension aged over 18 years, it gives more than one million people with primary aldosteronism. Many studies indicate the presence of greater prevalence of cardiovascular complications in patients with primary aldosteronism, compared with those with essential hypertension including higher rate of myocardial infarction, stroke, heart failure, atrial fibrillation and other arrhythmias. Aldosterone excess leads also to renal failure. Thus, it is crucial to study if it is feasible to detect adverse aldosterone-induced changes in the myocardium and kidneys with the use of modern diagnostic procedures including MRI, biochemical and genetic analyses offered by the modern medicine and science.

The most important effects expected

The conclusions from the research will increase the knowledge on mechanisms responsible for the impact of aldosterone excess on the heart and kidneys. Moreover, the project will enhance knowledge on the ability of non-invasive imaging techniques and biochemical tests to detect adverse changes in the myocardium and kidneys. The results of the project will increase the knowledge on mechanisms responsible for the impact of aldosterone excess on the heart and kidneys. Moreover, the project will enhance knowledge on the ability of non-invasive imaging techniques and biochemical tests to detect adverse changes within the myocardium and kidneys. The results will lead to improved and more precise cardiovascular risk assessment in patients with PA – risk assessment could be extended on the parameters which are the scope of the project. Additionally, the results will lead to better understanding of the impact of abnormalities regression on patient outcomes.