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ULTRASOUND BLOOD FLOW MONITORING AS ONE OF THE ELEMENTS OF ASSESSING THE ABILITY FOR PILOTS TO FLY – PRELIMINARY STUDY

Keywords: carotid Doppler ultrasound, non-invasive hemodynamic monitoring, orthostatic test

The principle of Doppler ultrasound is based on the Doppler effect, which involves changing the detected frequency of a sinusoidal wave when there is movement between the transmitter and receiver. In recent decades, carotid Doppler ultrasound has been investigated as a non-invasive alternative to invasive hemodynamic monitoring techniques used.

The main purpose of the paper was to discuss the architecture of various Doppler systems, as well as to present how this architecture has changed over the years in the context of the possibility of using the measurement method such as Doppler ultrasound of carotid arteries for example in the ability for pilots. The evolution of electronic and semiconductor technology in recent years can provide fast and high-quality signal processing with low cost, small size and low power consumption. The most promising solutions are wireless wearable bands, which, when applied to the neck, will not be a burden during measurements. This is important when measurements are to be taken on people performing certain extreme activities, such as pilots during an orthostatic test with Low Body Negative Pressure (LBNP), a test used to assess the state of the cardiovascular system when changing from lying to standing position.

The methodology of the study consisted in searching the PubMed database and Internet resources for literature related to the examination of carotid artery blood flows by ultrasonography, in particular in extreme conditions or during various types of additional interventions. The following keywords were used to search for literature: "carotid Doppler ultrasound", "ultrasound blood flow monitoring", "carotid artery blood flow", "orthostatic test" linked by Boolean logic operators. A number of interesting publications were obtained, for which a tabular summary comparing their main features was created.

As a result of the work carried out, information was obtained that the carotid Doppler ultrasound method has great potential in supporting activities related to pilot testing, in particular under simulated overload conditions. Carotid Doppler ultrasound measurement with the participation of flying personnel will make it possible to determine the expected changes in carotid arteries blood flow as a result of LBNP test, as well as will allow to determine the qualification thresholds for assessing the ability of blood flow in the carotid arteries. Doppler ultrasound can be a useful non-invasive tool in the diagnosis of pilot performance, while also acting as a warning function, so-called alerts, against impending overload loss of consciousness.