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Eindhoven researchers develop patient-friendly method to determine severity of heart failure

December 2, 2016

Methods currently employed to determine the severity of a heart failure are very limited. Researchers at Eindhoven University of Technology and the Catharina Hospital in Eindhoven have therefore developed a method that is very quick, non-invasive, cost-effective and can be performed at the hospital bedside. Moreover, this method appears to have a predictive value for whether or not a double pacemaker will be successful. Researchers Ingeborg Herold and Salvatore Saporito received their doctorates last month for their study.

Heart failure - when the heart is no longer able to pump enough blood through the body - is a very common problem. To get the right treatment, it is important to measure how well the heart is still able to do its job. There are currently various methods for doing this, but all have their limitations. Sensors often need to be placed in the large arteries, via the shoulder or neck, and that is quite an invasive procedure. MRI is a possibility, but not for patients that are seriously ill. Patients that are short of breath nearly always undergo blood analysis, a method that examines the concentration of a particular protein in the blood and provides a very good, patient-friendly indicator, but it takes several hours before the outcome is known.

The Eindhoven researchers have developed a patient-friendly method that uses an echo scanner, which is known mainly for echoes performed during pregnancy, to determine the severity of heart failure. To do this, they measure the time it takes for the blood to travel from the heart's right ventricle through the lungs to the left ventricle, which is responsible for pumping oxygenated blood through the body. In order to measure this pulmonary transit time (PTT), they inject harmless microbubbles that can be seen clearly by the echo scanner. They then look at the heart and see how long it takes for the bubbles to get from the right to the left ventricle.

It may seem simple enough but there was a significant scientific challenge in calculating an unequivocal PTT for the observed microbubbles that get dispersed in the blood flow. But once that had been solved, they compared the

transit time with a number of existing indicators, developing a similar method on the basis of MRI. Comparisons revealed that the PTT measured with the echo scanner provides an excellent indicator for the severity of a heart failure. A healthy heart pumps the blood quickly through the lungs. The longer the PTT, the less well the heart performs. They examined subjects whose heart muscle no longer contracted well, which is the most common type of heart failure. Before the method can be used, there is still work to be done. For example, if it is to be both practical and fast, the analysis will have to be automated.

Another aspect being studied is the extent to which the PTT is able to predict the success of a double pacemaker, whose primary objective is to restore the synchronicity of the two ventricles of the heart. Herold indeed found that there was a fairly firm relationship between the transit time and the success rate. The breaking point is 12.5 seconds; above that, the chance of the pacemaker enabling the heart to perform better reduces. But any application of this indicator requires more research, says Herold. Because the method does not appear to be completely accurate in the prediction, she expects it to be useful in combination with other indicators.

The method is founded on the work of TU/e researcher Massimo Mischi, who has spent a decade working on the development of 'contrast enhanced ultrasound (CEUS)' for analyzing the blood flow using microbubbles as a contrast medium. He has already done this successfully to detect prostate cancer.

Ingeborg Herold gained her doctorate on Thursday 17 November for her thesis 'Assessment of cardiopulmonary function by contrast enhanced echocardiography' while Salvatore Saporito received his PhD the same day for his thesis 'Cardiovascular MRI quantifications in heart failure'.

Source:

Eindhoven University of Technology
