

Medical aspects of the CEBE Project P3: Total Peripheral Resistance

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CEBE Project P3

Total Peripheral Resistance

Coordinator: K.Meigas

Cooperative partners:

TM Cardiology Group (Leader: K.Meigas; Team: K.Pilt, M.Viigimaa, K.Temitski).

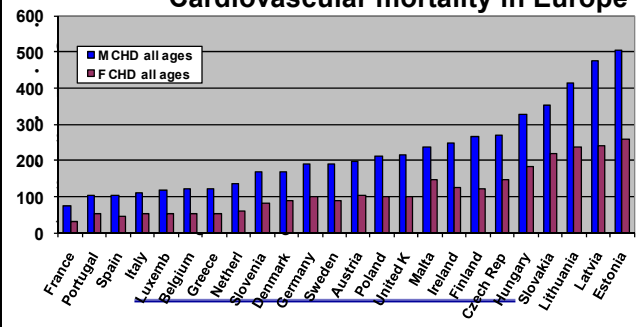
ELIN Signal Processing Group (Leader: M.Min; Team: A.Krivoshei)

Clinic of Cardiology of North Estonian Regional Hospital (Leader: M.Viigimaa; Team: medical doctors of Clinic of Cardiology).

Background

- It is well known that the heart-vascular diseases are the main cause for deaths in Europe
- Early preventive actions are very important as Estonia has the highest mortality level for CVD in Europe
- Improvement of non-invasive methods for diagnostics in very early stage is extremely important
- Pulse Wave Velocity (PWV) is an important parameter of arterial stiffness and it has been recognised in the European Hypertension Guidelines (2007) as a diagnostic method to search for subclinical organ damage

Cardiovascular mortality in Europe



Background (2)

- Total peripheral resistance (TPR) is another important parameter of cardiovascular system
- TPR depends from on the capacitance of the blood vessel in through of which the blood travels and is also affected by the viscosity of the blood
- TPR gives an important complex information about the condition of the heart and arteries
- This parameter is important to diagnose and evaluate different heart diseases as example hypertension or and heart failure

Goal:

To develop a method and prototype of device to monitor arterial stiffness and total peripheral resistance noninvasively and continuously using optical and electrical methods in parallel.



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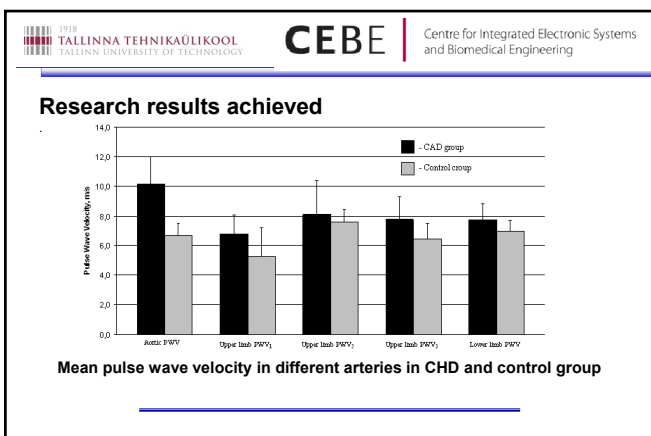
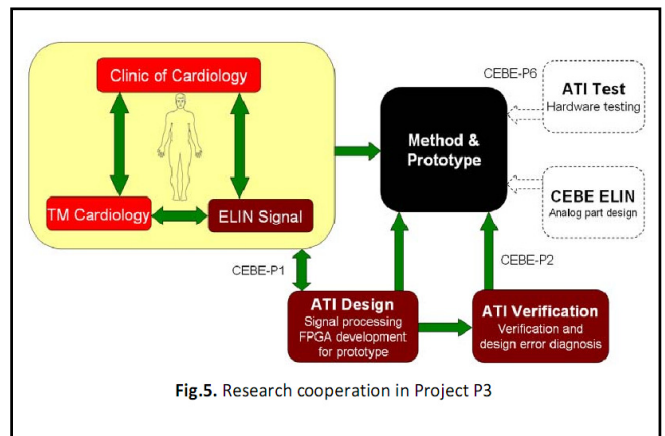
Developing a new method

- The method will be based on the optical monitoring of arterial stiffness using the PWV measurement from one side and on the monitoring of Cardiac Output (CO) using electrical impedance method measurement from another side.
- Combining two methods gives us possibility to monitor the total resistance of peripheral arteries noninvasively and continuously, which characterise the dynamics of changes of in mechanical properties of arteries and heart capacity.

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Research objectives:

- The first research objective (TM Cardiology Group) is responsible for the further development of optical monitoring of arterial stiffness using a PWV method.
- The third research objective (Clinic of Cardiology of North Estonian Regional Hospital) is the patient study.
- The hospital is responsible for the clinical evaluation and the patient studies. We plan to study patients with hypertension to get information about the efficiency of the therapy and used drugs.
- This method gives also possibility to optimise the control of medical treatment of the hypertensive patients especially in the treatment resistance cases of the disease.



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K. Pilt, K. Meigas, M. Viigimaa, K. Temitski and J. Kaik "An Experimental Measurement Complex for Probable Estimation of Arterial Stiffness", In Proc. IEEE Eng. Med. Biol. Soc. Conference, 2010, pp. 194-197

Novel collaboration within CEBE: uremic toxins as risk markers for atherosclerosis

In HPLC analysis the following uremic toxins-potential CVD markers-UV absorbing compounds will be detected:

creatinine, uric acid, hypoxanthine inoxtyl sulphate, hippuric acid and indole-3-acetic acid.

Applications:

The monitoring device of the total resistance of peripheral arteries is aimed to be applied in medicine for non-invasive diagnostics of heart-vascular diseases. It is also aimed to be used in research in the related area by TM.

Working Plan:

September 2010. Proofing of concept of optical monitoring of arterial stiffness using PWV and monitoring of CO using electrical impedance method.

March 2011. Patient studies in Clinic of Cardiology of North Estonian Regional Hospital.

December 2011. Development of the algorithms and optimization.

May 2012. Development of the specific signal processor methodology, optimizations for algorithms implementation and verification methodology.

October 2012. Practical application of the prototype. Next iterations of the calculation algorithm and development of related optical and electrical methods. Decision on the further project development steps.

Future activities:

To carry out patient studies in Clinic of Cardiology of North Estonian Regional Hospital. Experiments will be carried out on patients with coronary heart disease and diabetes.

Thank you very much!
