AN ISCHEMIC DISEASE CLASSIFICATION OF LOWER LIMBS

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Abstract
An ischemic disease of lower limbs is a manifestation of general arteriosclerosis. Its early noninvasive diagnostic is possible using the approach of the Doppler measurement of the blood flow in the vessels with following classification by a neural network expert system.

Keywords
classification, biosignal, neural network, Doppler measurement, lower limbs

1. Introduction
The diagnostic of ischemic disease of lower limbs in its evolved stage is possible by invasive and also noninvasive approaches. The significiation or the goal of our project was the clinical verification of the classification algorithm evaluating the biosignals scanned exclusively through the noninvasive approach.

The clinical verification was performed on the patients by the method of digital subtraction angiography (DSA). The control group was created from probands in the age of 22 - 26 years.

2. Biosignal acquisition and processing
Scanning of all relevant biosignals was performed by the diagnostic system IMEXLAB 9000, which applies these diagnostic methods:
- ultrasound Doppler blood flow velocity measurement,
- plethysmographic measurement,
- systolic pressure measurement in specific spots of arterial system.

Digital thermometer YSI 4600 was used for the measurement of skin temperature. The measurements were performed in the Faculty Hospital Brno Bohunicie on the functional diagnostic clinic before surgery reconstruction by a competent angiologist.

Typical progress of arterial blood flow velocities obtained through ultrasound Doppler velocity measurement (AVG signal) is displayed in fig. 1.

Working frequencies were: f = 5 or 8 MHz

Fig. 1. Typical AVG signal

Analogue signals were digitized by A/D converter DASH - 8, averaged from 5 contiguous cardio cycles. Typical measurement spots were: AI (arteria iliaca), AF (arteria femoralis superficialis), AP (arteria poplitea), ATA (arteria tibialis anterior), ATP (arteria tibialis posterior), fig. 2.

Relevant parameters were screened in every measurement spot. Such as, [1]:
- pulsatility index PI

\[ PI = \frac{v_s - v_D}{v_m} \]

- damping factor DF

\[ DF = \frac{PI_{\text{prox}}}{PI_{\text{distal}}} \]
In overall view 124 people were tested and from among them 94 patients (in the age of 37 - 82 years) and 30 probands of the control group (22-26 years).Reached sensitivity and specification to DSA was 95,2% or respectively 70,6%.

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References


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