ANALYSIS OF ABDOMINAL AORTIC HIGH-DENSITY COMPONENT AT CT ANGIOGRAPHY

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Computed tomographic angiography (CTA) is the gold standard for diagnosis and preoperative planning of abdominal aorta's pathologies [1]. Currently, the data of CTA studies of the aorta are used mainly to determine the features of its geometry. However, CTA-image contains much more detailed information on a set of textural features, which has potentially high diagnostic value. Our purpose is to analyze the possibility of isolating the deterministic component of X-ray absorption from CT-angiography data.

The data presented in the public domain were used [2]. Using 3D Slicer software we carried out semi-automatic expert marking of abdominal aortic lumen and wall. Data was processed using R Studio tool (version 4.2.1). We proposed a mathematical model that represents a deterministic component of signal (F_{det}) as a trend (F_0, A, b, c, d, e - coefficients corresponding to physiological processes):

$$F_{det} = F_0 - A * ((1 + \exp(b, c, x))^{-1} - (1 + \exp(d, e, x))^{-1}) \quad (1)$$

We analyzed 4 studies (normal/pathological balance was 1:1, median number of slices in the study was 144, IQR [134; 158.5]). The hypothesis of a trend in the data was confirmed (p-value < 0.05). The presence of a harmonic trend - pulse pressure wave (p-value < 0.05) and the difference of coefficients describing the behavior of the frontal curves for different intensity of contrast outflow into the wall were confirmed. The limitations of the study include small sample size, absence of ECG synchronization, and integral assessment of local hemodynamic processes.

Obtained results can be useful for the hemodynamic models development as well as for the improvement of CTA image processing.

References

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