UNIVERISTY OF MEDICINE, PHARMACY, SCIENCES AND TECHNOLOGY TARGU-MURES
Abstract of PhD thesis

Tridimensional imaging models used in the assessment of high risk coronary plaques

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Atherosclerosis represents the underlying condition leading to myocardial ischemia, ultimately resulting in acute coronary syndromes (ACS) and having devastating consequences on public health. The vast majority of ACSs are the consequence of a sudden modification in coronary plaque morphology leading to plaque rupture or erosion, the two main mechanisms triggering an acute coronary event. Atheromatous plaques that are prone to rupture or erosion following a complex process of transformation and alteration of plaque composition are known as vulnerable coronary plaques and can be identified nowadays with the help of modern imaging techniques.

Coronary computed tomography angiography (CCTA) has emerged as a valuable noninvasive imaging tool for assessing atheromatous plaque morphology and composition, and several CCTA features have been validated as reliable indicators of the plaque-associated risk. Regarding the structure of the plaques vulnerable lesions present some specific imaging features identified by the studies as being associated with higher incidence of MACE: low attenuation plaque, positive remodeling, spotty calcification and napkin-ring sign. However, the role of lesion geometry as a CCTA feature of plaque vulnerability has not been investigated so far.

This research aimed to study tridimensional imaging models, obtained after coronary computed tomography angiography data postprocessing and their correlations with coronary plaque vulnerability.

In the *first study* of this thesis we aimed to study the relationship between three-dimensional imaging models which characterize coronary lesions geometry and their implications in atherosclerotic plaque vulnerability.

Our study showed that the tridimensional model based on the cross-sectional plaque eccentricity is associated with a more vulnerable phenotype of the atheromatous plaques. However, the longitudinal eccentricity model did not present any significant correlations with plaque morphological or vulnerable features.

Incorporating cross-sectional plaque eccentricity into CT-based plaque assessment algorithms may contribute to non-invasive identification of vulnerable coronary plaques.

In the second part of the study we extended the evaluation on the cardiovascular patient evaluating also the thoracic structures included in the field of view of coronary computed tomography angiography. We aimed to study tridimensional models which characterize the distribution of coronary fat in the thoracic compartments. Our results showed that the volume of pericoronary fat is correlated with the eccentric geometric phenotype and also with the descendent one. This model also presented a significant correlation with the presence of more vulnerable characters in the adjacent coronary plaques.

In conclusion a complex evaluation of the cardiovascular patient regarding coronary pathology by using tridimensional models which assess both local geometry of the plaque and the pericoronary fat tissue bring extra information, useful in the evaluation of coronary lesions vulnerability.

We propose the tridimensional imaging models which characterize the cross-sectional eccentricity of coronary plaques and also the tridimensional imaging models which characterize the distribution of pericoronary and thoracic fat as new imaging markers of vulnerability additional to the already known ones.