Improved method for 3D reconstruction of coronary arteries using 3D IVUS.

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Atherosclerosis and its complication are on of the major causes of heart disease and mortality. Up till now several diagnostic methods have been developed, including angiography. The main disadvantage of angiography is that it provides limited diagnostic value in incipient lesions. The effort to minimize the disadvantages of angiography and other subsequent methods lead to the development of real 3D IVUS.

The real 3D IVUS technique performs computational reconstruction using data from angiography and IVUS in order to reconstruct the true 3D geometry of a coronary vessel in space. Particularly, using angiography data from 2 perpendicular planes we acquire the true 3D trajectory of the vessel, while using IVUS we acquire cross-sections of the vessel that are positioned appropriately along the path of the vessel and provide information about the vessel morphology.

Main goal of this study is the automation of the coronary vessel reconstruction using real 3D IVUS and the improvement of already existing methods mainly focusing on the orientation of vessel cross-sections along the 3D vessel path. An additional goal is to use the 3D reconstructed vessels for morphologic and volumetric analysis, as well as for simulations of blood flow and internal conditions of the vessel. The purpose of these analyses is to explore the correlation between morphologic parameters of the vessel and the hemodynamic parameters that affect atherogenesis.

The results of our study show that the 3D reconstruction of coronary arteries using real 3D IVUS is a highly accurate and easily reproducible method that enables the observation and acquisition of reliable measurements on the arterial wall, while also provides an accurate 3D representation of the vessel wall and lumen, thus facilitating morphological analysis of arterial plaque and enabling the reliable simulation of arterial flow.