Symposium Translational Imaging

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Center for Translational Imaging (MoMAN)

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Cardiovascular Molecular Imaging

Cardiovascular events most frequently stem from vascular diseases, namely atherosclerosis, with the clinical sequelae myocardial infarction or stroke. These clinical scenarios result from complex inflammatory changes in the vascular wall (atherosclerotic plaques). If these plaques are mechanically unstable ("vulnerable") a rupture or erosion of the plaque surface may eventually lead to thrombosis with partial or complete occlusion of the respective vessel. The organs such as the heart or the brain thus suffer from severe acute ischemia followed by induction of high-amplitude inflammatory responses. Despite optimized therapy regimes (Acute PCI, thrombolytic therapies, anti-ischemic medical strategies, etc.) the complex immune response is accompanied by a significant loss of cells due to apoptosis and necrosis that often leads to adverse remodeling of the ventricle with clinical consequences ranging from dysfunction

to disability to death. The armamentarium of established diagnostic clinical tools (ECG, angiography, perfusion SPECT and other stress tests etc.) together with recently emerging improvements in imaging technologies such as three-dimensional echocardiography, multislice/dual source computed tomography (MSCT) or magnetic resonance imaging (MRI) allow for a detailed characterization of the cardiovascular system not only in men but also in preclinical research. However, these imaging modalities mainly provide insight into the morphological and/or functional consequences of cardiovascular diseases (coronary artery stenoses, cardiac dilation and hypertrophy, arrhythmias, perfusion deficits, impaired contractile function etc.) and do not assess the underlying pathophysiology of the respective diseases. Molecular imaging using SPECT and PET allow visualisation of molecular processes with a very high sensitivity and are therefore well suited to provide complementary information, ideally in a hybrid imaging fashion such as SPECT/CT or PET/MRI. In recent years, hybrid camera systems have been established and are well accepted as powerful diagnostic tools. Novel radiopharmaceuticals are emerging to visualize e.g. inflammatory activity, local and systemic immune response, or tissue remodeling. Imaging of such processes at the molecular level provides additional insight into pathophysiology of cardiovascular diseases in general and potentially enable risk stratification of patients in the context of vulnerable plaque and/or myocardial infarction. Strategies towards new radiopharmaceuticals addressing relevant molecular targets in cardiovascular diseases and their future use in hybrid imaging approaches (e.g. PET/CT) will be discussed.