Department of Medicine 2 – Cardiology and Angiology

Chair of Internal Medicine II

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Research focus
- Molecular and experimental cardiology
- Interventional cardiology
- Interventional valve therapy
- Electrophysiology
- Cardiac magnetic resonance (CMR)
- Cardiac computed tomography

Structure of the Department

Professorship: 1
Personnel: 215
- Doctors (of Medicine): 46
- Scientists: 3 (thereof funded externally: 2)
- Graduate students: 24

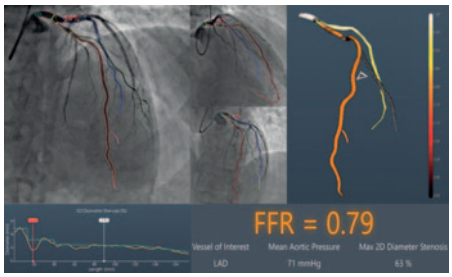
Clinical focus areas
- Interventional cardiology
- Electrophysiology
- Intensive care medicine
- Cardiac imaging

Research

The Department of Medicine 2 - Cardiology and Angiology conducts clinically oriented research in the field of cardiovascular diseases with three special areas of focus. One area of focus consists of fundamental scientific research on the development and progression of atherosclerosis conducted by the working group for molecular cardiology, which is located in the „Translational Research Center". Other areas of research focus are related to everyday clinical practice in the field of interventional cardiology and in the field of cardiac imaging. In addition, the Department of Medicine 2 is involved in a large number of national and international multicenter trials, primarily in the fields of interventional cardiology, invasive electrophysiology, as well as pacemaker and ICD therapy.

Molecular and experimental cardiology
PI: Dr. B. Dietel, Dr. M. Tauchi-Brück
The Department of Medicine 2 operates two large-scale laboratories in the 'Translational Research Center' (TRC; compare own report). The focus of the scientific work of this working group is the investigation of basic mechanisms, which contribute to the development and progression of atherosclerotic vascular deposits.
In addition to genotyping studies, cell culture-based analytical methods as well as experimental animal studies are conducted by the working group. Based on the molecular biological findings, therapeutic approaches are developed and tested for their suitability for prevention and treatment of atherosclerosis.

Interventional cardiology
PI: Dr. L. Gaede
In addition to single and multi-center studies on the analysis of coronary physiology by means of pressure wire measurement (FFR), the integration of non-invasive imaging (echocardiography and CT) for guidance of interventional therapy in the cardiac catheterization laboratory is a special focus of the scientific activity. This includes complex coronary interventions such as the recanalization of chronic vascular occlusions, transcatheter treatment of different valvular pathologies, the closure of paravalvular leaks as well as structural defects ASD and VSD, and the implantation of atrial appendage occluders.
Another intensive research focus is the simulation of FFR data from anatomical models based on invasive coronary angiography.



Simulation of Fractional Flow Reserve (FFR), based on coronary anatomy obtained from invasive coronary angiography

Interventional valve treatment
PI: PD Dr. M. Arnold
In addition to analysis of procedural parameters and outcome after transcatheter aortic valve implantation (TAVI), the treatment of mitral and tricuspid valve regurgitation with transcatheter techniques is a particularly intensive field of research.
Furthermore, the Department of Medicine 2 participates in several national and international registries, including a registry concerning treatment of tricuspid valve regurgitation with the use of the „Cardioband".

Electrophysiology
PI: PD Dr. M. Arnold
The focus of the scientific activity is the development and evaluation of procedures for cardiac resynchronization therapy. A recent area of research is the evaluation of an intracardiac left ventricular stimulation system for cardiac resynchronization therapy without the need for placing a lead in coronary veins.
Another focus is the evaluation of laser ablation in patients with atrial fibrillation within the context of international multicenter studies.
Likewise, the utility of esophageal cooling techniques to avoid complications in cases of complex left atrial ablation treatments is being systematically investigated.

Cardiac magnetic resonance (CMR)
PI: PD Dr. M. Marwan
This working group within the Department of Medicine 2 works in close cooperation with the Institute of Radiology.
One focus of the working group is the optimization of image acquisition protocols in patients with cardiac arrhythmias and on late gadolinium enhancement (LGE) for the prediction of tissue viability in patients with chronically occluded coronary arteries.
In addition, the use and applicability of T1-mapping techniques for tissue characterization is an important area of research that allows contrast-free scar and fibrosis imaging in patients with a history of infarction, hypertrophic or dilated cardiomyopathy, peri-myocarditis, or cardiac amyloidosis.

Cardiac computed tomography
PI: PD Dr. M. Marwan
The working group pursues several projects in the field of non-invasive coronary imaging using CT, for example the non-invasive determination of the fractional flow reserve from CT coronary angiography data sets.
A new area of interest is the analysis of myocardial „strain" from CT, i.e. deformation of the myocardium during contraction and relaxation using dynamic CT data sets.
In collaboration with international partners, the group is involved in research projects regarding the role of epicardial adipose tissue as a marker of the extent and activity of coronary atherosclerosis with the aim of predicting future car-

diac events. Innovative, complex software algorithms are used for the analysis of fatty tissue.
A further key focus is the planning and optimization of cardiac interventions using computed tomography in the sense of „therapeutic imaging“ (complex coronary interventions, transcatheter aortic valve replacement, left atrial appendage occlusion, and other interventions in structural heart disease).

Teaching

The Department of Medicine 2 participates with compulsory and elective subjects in the curricular teaching of Medicine, with a special emphasis on bedside and interactive teaching.
We supervise MD theses.

Selected publications

Achenbach S, Paul JF, Laurent F, Becker HC, Rengo M, Caudron J, Leschka S, Vignaux O, Knobloch G, Benea G, Schlosser T, Andreu J, Cabeza B, Jacquier A, Souto M, Revel D, Qanadli SD, Cademartiri F; X-ACT Study Group. Comparative assessment of image quality for coronary CT angiography with iobitridol and two contrast agents with higher iodine concentrations: iopromide and iomeprol. A multicentre randomized double-blind trial. Eur Radiol. 2017;27(2):821-830

Gaede L, Liebetrau C, Dörr O, Blumenstein J, Elsässer A, Hamm CW, Möllmann H, Schlundt C, Nef HM, Achenbach S. Long-term clinical outcome after implantation of the self-expandable STENTYS stent in a large, multicenter cohort. Coron Artery Dis. 2017;28(7):588-596

Hell MM, Achenbach S, Yoo IS, Franke J, Blachutzik F, Roether J, Graf V, Raaz-Schrauder D, Marwan M, Schlundt C. 3D printing for sizing left atrial appendage closure device: Head-to-head comparison with computed tomography and transesophageal echocardiography. EuroIntervention. 2017;13(10):1234-1241

Bittner DO, Mayrhofer T, Puchner SB, Lu MT, Maurovich-Horvat P, Ghemigian K, Kitslaar PH, Broersen A, Bamberg F, Truong QA, Schlett CL, Hoffmann U, Ferencik M. Coronary Computed Tomography Angiography-Specific Definitions of High-Risk Plaque Features Improve Detection of Acute Coronary Syndrome. Circ Cardiovasc Imaging. 2018 Aug;11(8):e007657

Goeller M, Achenbach S, Cadet S, Kwan AC, Commandeur F, Slomka PJ, Gransar H, Albrecht MH, Tamarappoo BK, Berman DS, Marwan M, Dey D. Pericoronary Adipose Tissue Computed Tomography Attenuation and High-Risk Plaque Characteristics in Acute Coronary Syndrome Compared With Stable Coronary Artery Disease. JAMA Cardiol. 2018 Sep 1;3(9):858-863

Marwan M, Ammon F, Bittner D, Röther J, Mekkhala N, Hell M, Schuhbaeck A, Gitsioudis G, Feyrer R, Schlundt C, Achenbach S, Arnold M. CT-derived left ventricular global strain in aortic valve stenosis patients: A comparative analysis pre and post transcatheter aortic valve implantation. J Cardiovasc Comput Tomogr. 2018 May - Jun;12(3):240-244

International cooperations

Dr. U. Hoffmann, Massachusetts General Hospital, Boston: USA

Dr. D. Berman, Damini Dey, Cedars Sinai Medical Center, Los Angeles: USA

Prof. Dr. S. Neubauer, University of Oxford, Oxford: UK

Dr. P. Maurovich-Horvat, Semmelweis University, Budapest: Hungary

Prof. Dr. P. Smits, Maasstad Hospital, Rotterdam: The Netherlands