

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 computed tomography

Structure of the Department

Professorship: 1

Personnel: 228

- Doctors (of Medicine): 54
- Scientists: 4 (thereof funded externally: 2)
- Graduate students: 45

Clinical focus areas

- Interventional cardiology
- Electrophysiology
- Intensive care medicine
- Cardiac imaging

Research

The Department of Medicine 2 - Cardiology and Angiology conducts clinically oriented research with three special areas of focus. The working group for molecular cardiology, located in the „Translational Research Center“, explores the development and progression of atherosclerosis and in particular the mechanisms by which shear stress influences atherosclerotic lesions. In the field of interventional cardiology, coronary and structural interventions, their optimization, and predictors of outcome constitute the major areas of research. Finally, in cardiac imaging, methodological and clinical aspects of cardiac computed tomography, in particular in connection to risk prediction and the optimization of cardiac interventions, constitute a major focus. 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, pacemaker and ICD therapy.

Molecular and experimental cardiology

PI: Dr. B. Dietel, Dr. M. Tauchi-Brück

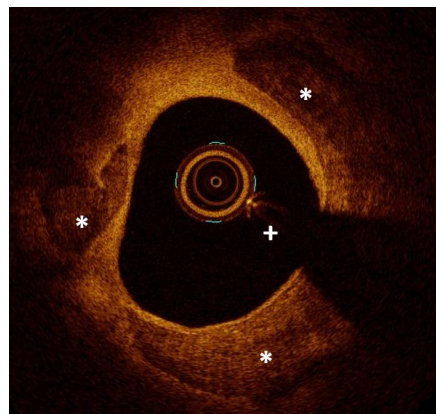
In the “Translational Research Center”, researchers explore the role of wall shear stress in atherosclerosis development and the

mechanisms by which it influences atherogenesis. One of the main interests is the investigation of cellular signaling cascades mechanically activated by blood flow. Specific glycocalyx proteins, which build a surface layer on endothelial cells and are involved in mechanosensing of shear stress, affect atherosclerotic plaque progression. The respective mechanisms are being explored. To translate basic knowledge into clinical practice, the laboratory works in close collaboration with medical and basic researchers in various disciplines.

Interventional cardiology

PI: Dr. L. Gaede

The working group focuses on the optimization of intravascular coronary diagnostics and coronary intervention. Single and multi-center studies include patients with acute as well as chronic coronary syndrome, to evaluate the benefit of new techniques. This includes, for example, OCT (optical coherence tomography) guided stent implantation or intravascular coronary lithoplasty for the treatment of calcified lesions. Additionally, pressure wire assessment of coronary lesion hemodynamics represents an important topic. Conventional pressure wire measurements are on the one hand evaluated in specific anatomic lesion subsets and on the other hand compared to new invasive (angiography-based FFR) and non-invasive imaging-based approaches (CT-based FFR).



Calcified stenosis visualized in OCT.

*calcified plaque, +vessel lumen

Interventional valve treatment

PI: PD Dr. M. Arnold

In addition to the 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. This prominently includes interventional and imaging aspects of catheter-based tricuspid annuloplasty. The Department of Medicine 2 has a leading role in several national and international registries.

Electrophysiology

PI: PD Dr. M. Arnold, Dr. L. Anneken

Scientific activities include the evaluation of new ablation techniques in patients with atrial fibrillation in the framework of international multicenter studies. New approaches to cardiac resynchronization therapy encompass the use of two separate left ventricular stimulation leads for cardiac resynchronization therapy in order to obviate the need for a lead in the right ventricle. This is particularly relevant for patients with tricuspid valve regurgitation. New techniques for holter ECG documentation, including textile-based approaches and algorithms for automated ECG analyses, are being investigated.

Cardiac computed tomography

PI: PD Dr. M. Marwan

CT angiography-based simulation of coronary flow and in particular its prognostic relevance is evaluated in a large cooperative project with Cleveland Clinic, USA. The potential influence of coronary plaque inflammation on fatty deposits around the coronary arteries as a marker of plaque instability, including its impact on long-term prognosis is explored in collaboration with the University of Oxford. In addition, the research group actively investigates the role of patient-specific CT findings to predict outcome and avoid complications in catheter-based aortic valve replacement.

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 45 MD theses.

Selected publications

Bittner DO, Mayrhofer T, Budoff M, Szilveszter B, Foldyna B, Hallett TR, Ivanov A, Janjua S, Meyersohn NM, Staziaki PV, Achenbach S, Ferencik M, Douglas PS, Hoffmann U, Lu MT; PROMISE investigators. Prognostic value of coronary CTA in stable chest pain: CAD-RADS, CAC, and cardiovascular events in PROMISE. *JACC Cardiovasc Imaging*. 2020, 13(7), 1534-1545

De Backer O, Dangas GD, Jilani H, Leipsic JA, Terkelsen CJ, Makkar R, Kini AS, Veien KT, Abdel-Wahab M, Kim WK, Balan P, Van Mieghem N, Mathiassen ON, Jeger RV, Arnold M, Mehran R, Guimarães AHC, Nørgaard BL, Kofoed KF, Blanke P, Windecker S, Søndergaard L; Reduced Leaflet Motion after Transcatheter Aortic-Valve Replacement. GALILEO-4D Investigators. *N Engl J Med*. 2020 Jan 9;382(2):130-139.

Fearon WF, Achenbach S, Engstrom T, Assali A, Shlofmitz R, Jeremias A, Fournier S, Kirtane AJ, Kornowski R, Greenberg G, Jubeh R, Kolansky DM, McAndrew T, Dressler O, Maehara A, Matsumura M, Leon MB, De Bruyne B; FAST-FFR study investigators. Accuracy of fractional flow reserve derived from coronary angiography. *Circulation*. 2019 Jan 22;139(4):477-484

Oikonomou EK, Desai MY, Marwan M, Kotanidis CP, Antonopoulos AS, Schottlander D, Channon KM, Neubauer S, Achenbach S, Antoniades C. Perivascular Fat Attenuation Index Stratifies Cardiac Risk Associated With High-Risk Plaques in the CRISP-CT Study. *J Am Coll Cardiol*. 2020 Aug 11;76(6):755-757.

Oikonomou EK, Williams MC, Kotanidis CP, Desai MY, Marwan M, Antonopoulos AS, Thomas KE, Thomas S, Akoumianakis I, Fan LM, Kesavan S, Herdman L, Alashi A, Centeno EH, Lyasheva M, Griffin BP, Flamm SD, Shirodaria C, Sabharwal N, Kelion A, Dweck MR, Van Beek EJR, Deanfield J, Hopewell JC, Neubauer S, Channon KM, Achenbach S, Newby DE, Antoniades C. A novel machine learning-derived radiotranscriptomic signature of perivascular fat improves cardiac risk prediction using coronary CT angiography. *Eur Heart J*. 2019 Nov 14;40(43):3529-3543

Smits PC, Chang CC, Chevalier B, West NEJ, Gori T, Barbato E, Tarantini G, Kocka V, Achenbach S, Dudek D, Escaned J, Wlodarczak A, Abdel-Wahab M, Esposito G, Tijssen JGP, Morice MC, Onuma Y, van Geuns RM. Bioresorbable vascular scaffold versus metallic drug-eluting stent in patients at high risk of restenosis: the COMPARE-ABSORB randomised clinical trial. *EuroIntervention*. 2020 Oct 23;16(8):645-653

International Cooperations

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

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

Prof. Dr. S. Neubauer, University of Oxford, Oxford: Great Britain

Prof. Dr. P. Smits, Maastad Hospital, Rotterdam: Netherlands

Prof. Dr. Milind Desai, Cleveland Clinic, Cleveland, OH: USA