# Department of Angiology

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**Research Partners**

- ARTORG Center for Biomedical Engineering Research, University of Bern, Bern, Switzerland
- Clinical Trials Unit Bern, Department of Clinical Research, University of Bern, Bern, Switzerland
- Vorarlberg Institute for Vascular Investigation and Treatment (VIVIT), Feldkirch, Austria
- University Hospital Bern, Department of Visceral Surgery and Medicine, Bern, Switzerland
- University Hospital Bern, Department of Vascular Surgery, Bern, Switzerland
- University Hospital Bern, Department of General Internal Medicine, Bern, Switzerland
- University Hospital Basel, Department of Angiology, Basel, Switzerland
- University Hospital Zurich, Department of Angiology, Zurich, Switzerland
- University Hospital Frankfurt, Department of Hemostaseology, Frankfurt, Germany
- University Hospital Lübeck, Department of Dermatology, Lübeck, Germany
- University Hospital Mainz, Department of Cardiology/ Angiology, Mainz, Germany

**Research Profile**

The Division of Angiology is dedicated to a multitude of research projects to advance the field of vascular medicine. The spectrum of research ranges from fundamental research to clinical trials that comprise analysis, classification and computational hemodynamic modeling of congenital vascular malformations, stereotactic MRI-based imaging guidance techniques, risk factor analysis and risk factor modulating therapies in peripheral artery disease, endovascular treatment of peripheral artery disease, drug therapy and endovascular management of venous thromboembolism, and contrast-enhanced ultrasound imaging techniques for outcome prediction in atherosclerotic disease.

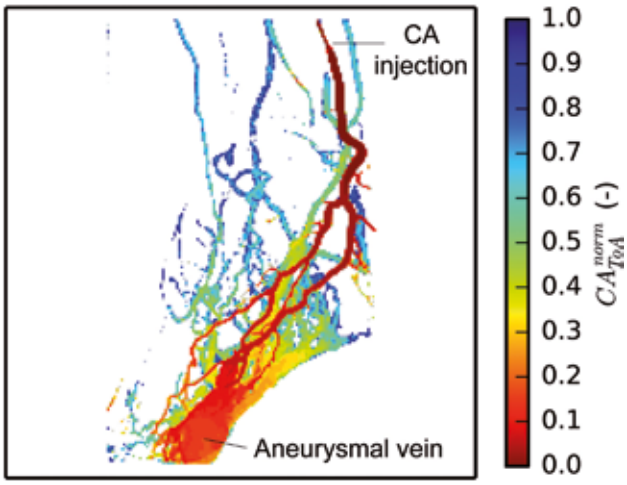
**Teaching Profile**

The Division of Angiology participates in University teaching programs for students of medicine and sports-/ physiotherapists. Further activities are regular student lectures and courses (clinical skills), weekly DHGE lectures, and weekly internal education in the field of vascular medicine.

**Highlights 2017**

*Hemodynamic Characterization of Peripheral Arterio-venous Malformations (pAVMs)*

In collaboration with ARTORG Center for Biomedical Engineering Research, University of Bern, Switzerland, a set of computational methods and prototype pAVM models were introduced that allow determining the hemodynamic consequences of different shunt morphologies on surrounding vascular components. The analysis of contrast agent (CA) transport through different malformation types revealed a set of diagnostic parameters (CA time of arrival, CAtoA) that show great potential in allowing an automated classification and characterization of peripheral arterio-venous malformations (pAVMs).




*Use of Fondaparinux Off-Label or Approved Anticoagulants for Management of Heparin-Induced Thrombocytopenia*

Heparin-induced thrombocytopenia (HIT) is a life-threatening prothrombotic adverse drug reaction. It is caused by an antibody formation triggering complex of heparin and the positively charged, tetrameric platelet factor 4 (PF4) and leads to platelet activation and aggregation. Due to venous and arterial thromboses, the mortality rate is up to 30%. Switching to a nonheparin anticoagulant (argatroban, danaparoid, lepirudin) is mandatory for patients with strongly suspected HIT. In this multi-centre registry study we demonstrate that off-label anticoagulation with the synthetic

anti-factor Xa-inhibitor fondaparinux is effective to prevent venous and arterial thromboembolic complications, and safe with regard to bleeding complications when compared with the approved anticoagulants.

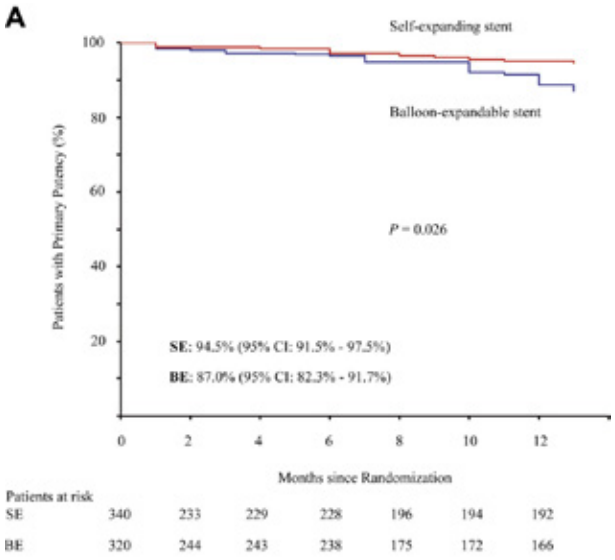
**TABLE 7 Complications of First-Line Alternative Anticoagulation per Treatment Day***

| | Argatroban | Danaparoid | Fondaparinux |
|---|---|---|---|
| Treatment duration, days | 7.5 (1.0-191.0) | 8.0 (1.0-61.0) | 4.0 (1.0-118.0) |
| Bleedings | | | |
| Bleeding complications | 6.5 | 6.6 | 4.8† |
| Bleeding risk per treatment day | 0.87 | 0.83 | 1.2 |
| Thromboembolic events, arterial and venous | | | |
| Thromboembolic complications | 8.7 | 8.2 | 0 |
| Thrombosis risk per treatment day | 1.16 | 1.03 | <1.0 |

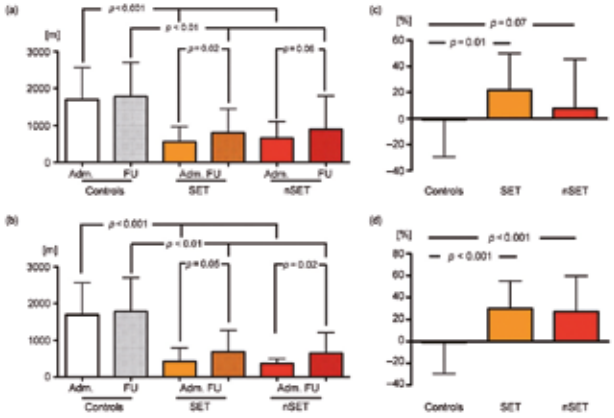
Values are median (range) or %. *Lepirudin was not analyzed due to the small first-line treatment group of only 4 patients. †Contains 1 bleeding event in a 92-year-old female patient with a minor nonclinically relevant bleeding from a rectal angiodysplasia with no drop in hemoglobin levels that occurred 17 days after single exposure with 1 × 5 mg of subcutaneously administered fondaparinux. No medical intervention was necessary.

*Self-Expanding Versus Balloon-Expandable Stents for Iliac Artery Occlusive Disease: The Randomized ICE Trial*

Iliac artery lesions are increasingly treated endovascular. Most commonly, stents are implanted. However, no treatment recommendation on balloon-expandable stents (BE) versus self-expanding stents (SE) has been issued to date. In our randomized study we assigned 1:1 either to BE or to SE. In our follow up we found a twelve-month incidence of restenosis of 6.1% after SE and 14.9% after BE (P=0.006). Kaplan-Meier estimate of primary patency was 94.5% and 87.0%, respectively (P=0.026).




*Supervised exercise training in peripheral arterial disease increases vascular shear stress and profunda femoral artery diameter*




Exercise training (ET) is known to promote arteriogenesis in peripheral arterial disease (PAD) patients. It remains unclear whether supervised ET (SET) promotes arteriogenesis more efficiently than non-SET (nSET). Walking distance increased in both SET and nSET patients. However, individual changes in walking distance were higher for SET patients ( p=0.01) than nSET patients ( p=0.07). Our results indicate that SET promotes arteriogenesis more efficiently than nSET.

**Selected Publications**


- Schindewolf M, Steindl J, Beyer-Westendorf J et al. Use of Fondaparinux Off-Label or Approved Anticoagulants for Management of Heparin-Induced Thrombocytopenia. Journal of the American College of Cardiology 2017;70:2636-2648
- Dopheide JF, Rubrech J, Trumpp A et al. Supervised exercise training in peripheral arterial disease increases vascular shear stress and profunda femoral artery diameter. European journal of preventive cardiology 2017;24:178-191
- Krankenberg H, Zeller T, Ingwersen M et al. Self-Expanding Versus Balloon-Expandable Stents for Iliac Artery Occlusive Disease: The Randomized ICE Trial. JACC Cardiovascular interventions 2017;10:1694-1704
- Frey S, Haine A, Kammer R et al. Hemodynamic Characterization of Peripheral Arterio-venous Malformations. Annals of biomedical engineering 2017;45:1449-1461