

# Targeted approach in microcirculation research

Microcirculation and its disorders form a complex area that continues to gain in significance. The broadly based indication lies at the interface between curative and secondary prevention measures.

The micro blood vessels and their conditions are increasingly moving into the focus of medical interest, which among others affects the increasing number of publications in this area. No other indication area intervenes so far into almost every area of the organism. Also, hardly any other indication offers a more exact representation of the interfaces between curative and secondary prevention medicine.<sup>1</sup>

Even from the health-political and economical viewpoints, microcirculation and its disorders have become of far-reaching significance since the costs for diagnostic and therapeutic measures sum up to a considerable factor in healthcare. A number of organizations, institutions and companies currently find themselves in this environment. This is opposed to the still considerable lack of evidence-based processes for the diagnosis and therapy. Medication for the targeted improvement of microcirculation disorders is currently not available.

## **Concerted action**

In the past few years, the demand has increased to structure the complex material in a way relevant for the future and to define diagnosis and therapeutic recommendations. Against this background, the initiative of the neutral network IMIN met in February 2017 along with representatives of renowned medical specialist associations in the Hungarian Bad Sárvár. The opinion-leaders from the sciences, clinics and practices examined the subject "Microcirculation and its Disorders" from pathophysiological, diagnostic and therapeutic points of view. The goal was to discuss the facts presented in interdisciplinary cooperation, to sort them into the overall context and to provide stimulation for future projects. On the basis of the facts collected, a catalogue of guidelines in the form of a curriculum will be developed. This catalogue will then also serve as the basis for a discussion with the medical organizations and the ethics commission.

## **Scientific advisory board established**

In line with the expert conference, an interdisciplinary, scientific advisory board consisting of four reputable opinion-leaders was established:

- Professor Uwe Lange, medical director of the Department for Internal Rheumatology, Osteology and Physical Medicine at Giessen University and the Kerckhoff-Klinik in Bad Nauheim
- Professor Ralf Uwe Peter, medical director at the Capio Blausteinklinik and member of the board of the German Vein League (DVL)
- Professor Ulrich C. Smolenski, director of the Institute for Physiotherapy, University Hospital in Jena
- Professor Karl Werdan, scientific secretary of the German Society of Cardiology, Heart and Circulation Research.

This scientific advisory board will firmly drive the total concept forward, supported by additional experts from the group of participants. "The target for the future is to research and develop a robust evaluation of microcirculatory health achievement as well as effective evidence-based diagnosis and therapy processes. The earlier work begins, the more suffering can be prevented and costs can be saved," stated conference chair Professor Uwe Lange, who is also the president of the German Society of Physical Medicine and Rehabilitation Medicine (DGPMR).

The conference participants agreed that scientists, clinicians and practitioners will need to pull together to develop a consensus on strategic concepts and to initiate the necessary measures. "Up to now, microcirculation has not been

appreciated so much in scientific and health-political respects as much as it deserves“, explained moderator Eitel J. Vida, executive director of the International Prevention Organization (IPO).

### **Enormous challenges**

A disorder of the microcirculation can cause illnesses such as high blood pressure, type 2 diabetes, stroke, heart attack, scleroderma and dementia. Conversely, limited microcirculation can also be a side effect or result of conditions such as high blood pressure and diabetes “Germany has the second-oldest population in the world. Based on the demographic development, vascular disorders will cause similarly high costs in about 20 years – just as much as the total health system. This shows that vascular conditions including microvessel diseases have dramatic medical and economical effects,” emphasized Professor Fred Harms, director of the Institute of Health Care Communication and Translational Research at the Sigmund-Freud-Private-University, Vienna, and vice-president of the European Health Care Foundation. He pointed out a current publication of both US-American expert societies, the American Heart Association and the American Stroke Association.<sup>2</sup> The authors emphasized the growing significance of the microvessels and their conditions on the health system and demanded the quick development of new diagnostic and therapeutic processes in this area.

### **<Translation of diagram:>**

#### **The most important consequences of microcirculation disorder**

Microcirculation disorders  
(especially regulation disorders of the arterial vasomotion)

Distribution disorders of the plasma-blood cell mixture in the capillary networks

Diffusion disorders  
Restriction of all intracellular transport paths

Hindered transport of plasmic and cellular factors in immune defenses

Limitations on the cell metabolism,  
Restrictions or disorders of organ function, necroses

Obstructions in the first steps of immuno-reactions, limited infection, defenses, increased tendency of infection

---

# **An indication area with many facets**

The spectrum of pathologies where microcirculation disorders play a role is large and the diagnostic and therapeutic options are still very restricted up to now.

The smallest blood vessels with a diameter of 100µm (capillaries, arterioles and venules) compose approx. 75 percent of the vascular system. They form the most important part of circulation: this where the mass and heat exchange as well as the transfer of cells from the blood into the tissue takes place. “Rheological properties, blood pressure and the diameter of vessels influence microcirculation,” explained Professor Uwe Lange, MD, Bad Nauheim. He reported that in 90 percent of patients with scleroderma suffering from secondary Raynaud syndrome with ulcerations on the fingers, hand bathing therapy in carbonated water is superior to pharmacotherapy.

As Professor Karl Werden, MD, from Halle reported, a disturbed microcirculation decisively contributes to the development of the multi-organ dysfunction syndrome (MODS) in intensive patients. “We can measure and quantify the blood circulation in small blood vessels sublingually, an important factor in solid quality management,” according to Werden. In the meantime, it has been shown that microcirculation disorder correlates to the extent of multi-organ dysfunction and with mortality – and is reversible.

Assoc. Professor Friedhart Raschke, PhD in engineering, Staatsbad Norderney, explained the principle of pulsed magnetic field therapy (PEMF). In this case, the deficient vasomotion of the tiniest blood vessels can be optimized depending on the situation by using special, patented stimulation signals whereby the oxygen supply, calcium transport, migration of white blood cells and lymphocytes as well as the angiogenesis, are improved. The NO concentration as a building block for the formation of growth factors increases. The efficacy of PEMF in therapy and prevention has been proven in a series of clinical pictures and symptoms in the meantime. An in-vitro study recently showed that PEMF can sensitize human cancer cells for subsequent radiation therapy.<sup>2</sup> However, Raschke has also had positive experience with the traditional thalasso therapy for decades. Both processes are important factors in the instrument set of influencing microcirculation.

Monika Pirllet-Gottwald, MD and vice-president of the Central Association of Physicians for Natural Medicine and Regulation Medicine (ZAEN) confirms the good effectiveness of PEMF that not only improves the supply to the tissue but also the removal. She uses certified equipment for physical vascular therapy in her general medicine practice in Munich to treat new injuries, orthopedic pain, post-operative wound healing, headache and migraine attacks, among others. The synergistic application along with other proven techniques such as medicinal therapy, infusion therapy, acupuncture, massage or nutritional medicine are important for treatment success.

The role of microcirculation in the wound-healing processes was described by Professor Ralf Uwe Peter from Blaustein. The skin is a complex immune organ with micro blood vessels as important communicators. "The function of microcirculation is a decisive factor. In the case of pathophysiological changes, these would lead to local ischemias as a building block to ulcer cruris, sclerodermia and to necrosis." An effective remedy in ulcers is low-frequency pulsed electricity.

Especially in the area of microcirculation, more transparency has recently been demanded. In the meantime, initial highly sensitive methods have become available with which processes in the tissue perfusion can be measured, for example, a laser Doppler unit in which two glass fiber probes measure the blood flow speed, the relative blood flow, the relative amount of hemoglobin as well as the oxygen saturation of the hemoglobin. Another non-invasive method to represent the macro blood vessels is the arteriograph, which is also offered at the Spirit "Medic" Hotel, the venue of the expert conference in Bad Sárvár. "The primary area of application for the arteriograph is to illustrate the arterial stiffness," explained Dr. Ákos Tatár, head of the medical department at the Spirit "Medic" Hotel. Arterial stiffness describes the structural as well as the functional characteristics of the arterial system.

## Better supply and removal from the tissues

- The pulsed magnetic field therapy (PEMF) increases vasomotion in the micro blood vessels whereby the supply and removal in the tissue is improved and the healing process is supported.
- PEMF is a "team player", i.e. as an adjuvant therapy measure, it can trigger other measures and medications to become more effective.
- The spectrum of indications for PEMF is broad: it reaches from chronic metabolic diseases and pain syndromes to wound healing disorders and peripheral arterial occlusive disease.
- Only one unit reached ca. 30 percent improvements in important parameters for microcirculation. (see AerzteZeitung of May 7, 2014).

**EVENT:** Expert conference "Physical Medicine and Microcirculation: Between Tradition and High-Tech Medicine", Bad Sárvár, Hungary, February 15, 2017

**EVENT ORGANIZER:**

DGPMR – German Association for Physical Medicine and Rehabilitation

DVL - German Vein League

EUHCF – European Health Care Foundation, IMIN – International Microvascular Net,

IPO – International Prevention Organization

**Literature:** (1) J Am Heart Assoc 2016;5:e004389 doi: 10.1161/JAHA.116.004389; (2) PLoS One 2016; 11 (12): e0167931;

**PUBLISHER'S DETAILS**

Springer Medizin Verlag GmbH, Corporate Publishing, Heidelberger Platz 3, 14197 Berlin, Germany

› Managing directors: Joachim Krieger › Fabian Kaufmann

› Responsible: Ulrike Hafner › Report: Gudrun Girschbach, Hilden › Editor: Inge Kunzenbacher

© Springer Medizin Verlag GmbH

Springer Medizin Verlag GmbH a member of the Fachverlagsgruppe Springer Nature

Printer: ColdsetInnovation Fulda GmbH & Co. KG, Eichenzell

Published with the friendly support of the International Microvascular Net (IMIN), Lossburg