S10: MiDAS Microcirculation Meeting (3M)

S10-1 Dynamic Contrast Enhanced Ultrasound (CEUS) of Tissue transplants

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Early detection of reduced microvascularization of the tissue transplants is the mean diagnostic point for the survival rate of the tissue transplants. CEUS is the only imaging method for evaluation of dynamic changes of microvascularization of soft tissue transplants monitoring during surgery and for the postoperative follow up.
Preoperative panning of tissue transplants: Capillary micro vascularization of the margins of the free flaps visualized by CEUS is important for early detection of critical microvascularization. Evaluation by perfusion software enables determination of time to peak (TTP), relative blood flow (rBF) and relative blood volume (rBV) and evaluation the critical micro vascularization in the different layers of the free flaps with rBV less than 200 rU. The main limitation for evaluation of flap perfusion is the fact that CEUS does not allow the continuous monitoring of the whole flap after one bolus injection by time intensity curve analysis. But perfusion imaging in the center from early arterial phase (15-45 sec) up to venous phase (1 min) in combination with sweep technology from the center to the margins in the venous and late venous phase (2-5 min) allows the evaluation of particularly necrosis after one bolus injection up to capillary microvascularization.
Recommended use for CEUS are the post-operative monitoring with TIC analysis and color coded perfusion imaging for evaluation critical perfusion by evaluation relative blood volume, early detection of partial necrosis and as only dynamic imaging tool for monitoring osteocutaneous flaps with metal reconstructions and planning, monitoring and realization of new kinds of soft tissue reconstructions, tissue transfer for wound healing processes and new kinds of bone tissue transfer.

S10-2 Assessment of glycocalyx

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The endothelial glycocalyx (EG) lining the endoluminal surface of the capillaries has been proposed as a key component of the microcirculation and a major player in microvascular pathology. Recent advances in the understanding of its physiological role and clinical significance have been made upon the development of methods allowing EG assessment in clinical medicine. Laboratory methods can assess the amount of EG damage by measuring levels of its degradation products (e.g. syndecan-1, heparan sulphate and hyaluronan sulphate), mostly in the plasma, however, their physiological turnover disqualifies them from being the reliable index of EG damage. At the bedside, in vivo video microscopy tools technologies (e.g. Side-stream Dark Field imaging technology) allow indirect assessment of EG thickness in sublingual microcirculation by measuring the penetration extent (called Perfused Boundary Region) of flowing red blood cells into the EG.

S10-3 Automated vs. visual video analyses - where is the future?

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Microcirculatory alterations are a common etiologic factor in many acute and chronic disorders with significant morbidity and mortality. Due to the small dimensions of the microcirculation, it can only be studied by microscopy or similarly sophisticated techniques. At present, monitoring of the microcirculation in patients is not standard practice, even though technology exists that allows clinicians the ability to observe the microvasculature at the bedside in real time. To quantify microvascular changes, the microcirculatory video recordings need to be analyzed manually, automatically with the help of imaging software, or using recently developed visual scores. Initially, there was only complex, time-consuming, and semi-automated software available to analyze the microcirculation. More recently, software has become available for automated analysis of the microcirculation. However, few studies comparing the accuracy of the automated software with the standard, semi-automated software have been conducted. As a result, the automated method of analysis has not gained traction as the new standard of microcirculation video analysis. Therefore, semi-automated analysis using software remains the gold standard of microcirculation analysis. Multiple barriers to clinical use exist with using software analysis (i.e., cost, delayed results, and expertise with using the software). Alternative, more practical approaches to microcirculation video analysis are needed to overcome these barriers. Visual analysis offers a solution to these barriers by providing a fast and inexpensive method to quantify certain microcirculatory parameters.

S10-4 Is sodium a link between endothelial glycocalyx and microcirculation?

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Sodium is closely related to fluid homeostasis of the body that can be divided into body compartments. One of these compartments is newly established and so far, only slightly understood endothelial glycocalyx (EG). EG represents intravascular sugar based endothelial lining creating three-dimensional mesh. Due to its nature it is fragile structure degrading in critically ill. Beside albumin and many other molecules, the EG binds significant amount of sodium (up to 7g) which is responsible for its correct conformation and optimal rheologic properties of the blood in the microcirculation. Plasmatic concentration of sodium, dietary intake and binding to the EG determines correct function of the microcirculation. Between EG and endothelial cells there is a tiny space called subglycocalyx. This area is occupied by solute free serum and directs the filtration forces across the capillary barrier (revised Starling principle). Hypervolemia and hypernatremia are one of the etiologies of EG damage. By releasing of atrial natriuretic peptide, the EG is degraded and the filtration equilibrium is distracted. Hypernatremia leads to inhomogeneous and stiff EG compromising release of NO and smooth muscle cell relaxation within the vascular wall. This is the reason high dietary intake of sodium has impact on arterial hypertension. Moreover, the red blood cell glycocalyx is also influenced by natremia and in case of hypernatremia its glycocalyx gets disrupted as well leading to compromise

in microcirculation. Giving intravenous fluids with high sodium content is inherent to our clinical practice. The impact of our daily clinical practice has yet to be determined. For now, it is more than obvious that sodium is a link between microcirculation and EG.