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**Talk topics**

**1. Novel ultrasound imaging markers of vascular function for prediction of cardiovascular events**

Vascular function is commonly assessed with ultrasound imaging; however targeted patient stratification remains a major clinical challenge. Coupled with advanced image analysis methods, conventional ultrasound imaging can yield novel markers of vascular function and thus address such challenge. Image-based morphological, textural, and mechanical indices can describe the complex physiological phenomena taking place in arteries and veins. Morphology and texture describe different patterns of tissue allocation, presumably as the result of exerted stresses, while mechanical features characterise tissue elasticity and are more sensitive to early tissue changes due to ageing or disease. Going one step further, the combination of such markers with machine learning can predict and justify adverse cardiovascular events, towards an in-depth understanding of vascular physiology and pathophysiology and a personalised patient stratification.

*Keywords*: ultrasound imaging, image analysis, arteries, imaging markers, disease prediction, morphology, texture, elasticity

**2. Exploring cardiovascular mechanics with ultrasound**

Cardiovascular mechanics investigates the movement of the heart and of peripheral and central arteries, resulting from the pressure and flow of blood. Mechanical properties of cardiovascular tissue are the result of the interplay between tissue composition and the forces exerted on it. Ultrasound technology allows assessment of cardiovascular motion and of tissue stiffness. Cardiovascular tissue motion can be calculated from conventional ultrasound videos if coupled with image analysis methods, while tissue stiffness can be assessed with ultrasound elastography. The clinical usefulness of cardiovascular mechanics lies in the fact that it is more sensitive to early tissue changes due to ageing or disease, compared to anatomical tissue properties.

*Keywords*: ultrasound, mechanics, motion, elastic properties, heart, vessels, stiffness

**3. Using sound to hear, image, and treat cardiovascular function**

Cardiovascular structures, including the heart and vessels, are sources of sound. Blood flow in arteries, as well as around heart valves, has unique acoustic features, which are altered in the presence of disease. Such features can be assessed with acoustic sensors (microphones and accelerometers), which, going beyond the stethoscope, the conventional method for assessing heart sounds, allow mapping of the acoustic phenomena of extended tissue areas. In addition to this passive approach of hearing cardiovascular sounds, ultrasound, i.e. sound with frequencies higher than the upper audible limit of human hearing, can be used to image cardiovascular tissues. Ultrasound images represent the result of the interaction (i.e. the echoes) of ultrasound beams directed to tissues, and are widely used in clinical diagnosis and image-guided therapy.

*Keywords*: sound, acoustics, ultrasound, heart, arteries, vascular haemodynamics, arterial stiffness