Using body noise to improve cancer detection

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Elastography, sometimes referred as seismology of the human body, is an emerging technology used to enhance medical ultrasound imaging. It does this by measuring the elasticity of biological tissue to diagnose cancer or liver and thyroid disease more accurately and at the earliest stages.

In passive elastography, the elasticity of tissue is measured using the body's own propagation of shear waves, which enables more effective imaging deeper inside the body in an even more noninvasive way than traditional elastography.

"Passive elastography is foreseen as a viable technique for cancer detection in organs deep in the body, such as the prostate or liver, for well-protected organs such as the brain, and for fragile organs such as the eye," said Stefan Catheline, research director of the INSERM LabTAU Unit 1032 at the University of Lyon, France.

Catheline will discuss this and other elastography advances during Acoustics '17 Boston, the third joint meeting of the Acoustical Society of America and the European Acoustics Association being held June 25-29, in Boston, Massachusetts.

Shear waves, which penetrate through an object, are generated when pressure on an object causes it to deform, such as during an earthquake or explosion. In medical science, shear waves are produced by vibrational devices to measure the stiffness of tissue.

A cancerous tumor and other tissue dysfunction exhibit much higher stiffness than in healthy tissue or even in benign tumors. This difference in stiffness cannot be felt or seen in conventional ways or through other imaging methods.

Typically, a medical technician places a probe with a vibrating mechanism on the area for testing and presses down to produce the shear waves, which then interact with the tissue in question. The waves are tracked at ultrafast imaging rates. The shear waves can be difficult to produce in hard-to-reach organs, such as the liver that is located deep in the body behind the ribcage.

Catheline and his research colleagues have developed a new approach to remedy this problem: Analyze the noise of natural shear waves that are produced biologically. Just as in earthquakes, shear waves constantly move through organs and other soft tissue of a person during the everyday functionalities of these bodily systems, such as the beating of a heart or the liver performing everyday metabolic processes.

"The idea, as in seismology, is to take advantage of shear waves naturally present in the human body due to muscles activities to construct a shear elasticity map of soft tissues," Catheline said. "It is thus a passive elastography approach since no shear wave sources are used."

Passive elastography is compatible with slow imaging devices, such as standard echographs and MRI scanners, as well as with optical coherent tomography.

More information: Main meeting website: acousticalsociety.org/content/acoustics-17-boston