Enhanced Imaging Using Vibrational Photoacoustic Tomography Improves Diagnosis of Atherosclerosis

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Technology description

Background

Atherosclerosis is a degenerative disease that causes plaque accumulation in the arterial wall that can eventually inhibit blood flow to various tissues and organs. Patients may experience pain when walking and decreased wound healing, which can lead to amputation. In more serious conditions, plaques can rupture, leading to a blood clot that can induce a stroke or heart attack. Aneurysms, on the other hand, occur when the artery wall weakens causing the vessel to bulge. Aneurysms may remain silent or rupture, causing internal bleeding and even death. Diagnosing, treating, and managing atherosclerotic-related diseases represent a significant cost to society. Established methods of diagnosing and monitoring atherosclerosis have limitations such has high cost, long imaging times, and may be minimally invasive. Atherosclerosis-related diseases also have high recurrence rate of between 10 and 20 percent during the first 12 months after treatment. Taken together, these unmet clinical problems suggest that better imaging techniques are needed to cost effectively monitor atherosclerosis progression before, during, and after therapeutic and surgical interventions.

Vibrational Photoacoustic Tomography (VPAT) is an emerging imaging method that utilizes pulsed laser light to induce acoustic waves and obtain tissue-specific compositional information. When used in combination with ultrasound, VPAT has the potential to identify the location, size, and distribution of lipids in vivo. This is especially important in atherosclerosis diagnosis, as better techniques are needed

to identify and characterize plaques in high-risk and asymptomatic patients.

Technology Summary

Researchers from Purdue University have developed a photoacoustic probe that allows for improved imaging of tissue. This technology has the ability to rapidly, non-invasively, and cost effectively locate and quantify plaque composition in vivo. VPAT has the potential to be used in the clinic to study atherosclerosis plaque development, evaluate the effectiveness of prospective therapeutics, and improve the diagnosis of atherosclerosis or related vascular diseases.

Application area

Therapeutic research
Diagnosis of atherosclerosis or related vascular diseases
Determine treatment options

Advantages

Disease tracking
Does not require contrast agents
Rapid in vivo imaging capabilities
Potential for 3D imaging
Estimated cost is lower than conventional imaging techniques

Institution

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