

## Intravascular Ultrasound-guided Electrochemical Impedance Spectroscopy (IVUS-EIS) to Assess Lipid-Laden Plaques

Tech ID: 30049 / UC Case 2016-589-0

### SUMMARY

UCLA researchers in the Department of Medicine have developed a novel intravascular ultrasound-guided electrochemical impedance spectroscopy (IVUS-EIS) system for the detection of oxLDL-laden plaques in arteries.

### BACKGROUND

Carotid artery disease refers to the narrowing of the carotid arteries which occurs due to the buildup of fatty substances and cholesterol deposits known as plaques. Blocked carotid arteries significantly increase the risk of stroke as blood flow to the brain can be interrupted. Current methods of determining if a patient has carotid artery disease include Doppler ultrasound, ankle-brachial index, and ECG. The drawback to these methods is that they only provide structural information, whereas electrical and chemical information would be extremely useful in obtaining measurements of the plaques.

### INNOVATION

Researchers at UCLA have developed an intravascular ultrasound-guided electrochemical impedance spectroscopy sensor to enhance the detection reproducibility of plaques. The oxidation of low-density lipoproteins (oxLDL) has been found to play a pathogenic role in plaque formation. The level of oxLDL in plaques is significantly higher compared to circulating levels. This invention has been demonstrated to detect intraplaque oxLDL with reduced standard deviation and increased statistical significance in both impedance and phase delay.

### APPLICATIONS

- ▶ Enhanced detection of oxidized low density lipoprotein-laden plaques
- ▶ Detect lesions prone to rupture, reducing the risk of acute coronary syndromes and stroke
- ▶ Can used during diagnostic angiogram or primary coronary intervention

### ADVANTAGES

- ▶ Integration of both intravascular ultrasound imaging and electrochemical impedance spectroscopy measurements

### STATE OF DEVELOPMENT

Development is ongoing. A prototype has been successfully tested in both animal models and human explant models.

### RELATED MATERIALS

- ▶ Packard, René R. Sevag, et al. "Two-Point Stretchable Electrode Array for Endoluminal Electrochemical Impedance Spectroscopy Measurements of Lipid-Laden Atherosclerotic Plaques." *Annals of biomedical engineering*(2016): 1-12.
- ▶ Ma, Jianguo, et al. "Ultrasonic transducer-guided electrochemical impedance spectroscopy to assess lipid-laden plaques." *Sensors and Actuators B: Chemical* 235 (2016): 154-161.
- ▶ Packard, Rene R., et al. "The Next Generation of Stretchable Sensors for Intravascular Electrochemical Impedance Spectroscopy of Varying Levels of Lipid Burden and Atherosclerosis." *Circulation* 132.Suppl 3 (2015): A18004-A18004.
- ▶ Li, Yang, et al. "An Integrated System for Super-Harmonic Contrast-Enhanced Ultrasound Imaging: Design and Intravascular Phantom Imaging Study." (2015).

### PATENT STATUS

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### OTHER INFORMATION

#### KEYWORDS

Cardiac, ultrasonic transducer, flexible 2-point electrodes, electrochemical impedance spectroscopy, dual sensor-based intravascular catheter, plaque assessment

#### CATEGORIZED AS

- ▶ **Imaging**
  - ▶ Medical
- ▶ **Medical**
  - ▶ Devices
  - ▶ Disease: Cardiovascular and Circulatory System
  - ▶ Imaging
- ▶ **Sensors & Instrumentation**
  - ▶ Biosensors

#### RELATED CASES

2016-589-0

| Country                  | Type          | Number     | Dated      | Case     |
|--------------------------|---------------|------------|------------|----------|
| United States Of America | Issued Patent | 11,857,318 | 01/02/2024 | 2016-589 |

#### ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

► [Flexible Balloon-Inflatable Electrochemical Impedance Spectroscopy To Assess Endoluminal Lipid-Rich Lesions](#)

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