On the move: Medical imaging goes mobile for better health care

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Researchers are developing portable ultrasound devices that promise improved treatments for millions of patients.

When someone suffers a stroke, the timing of medical help is crucial. The faster treatment is given, the greater the chance the person will fully recover.

But doctors need to know what kind of stroke to treat.

60-minute window

For example, thrombolytic drugs, which break up blood clots, would help in the case of a stroke that blocks blood flow to the brain. The same drugs would have catastrophic consequences in the event of a stroke that involves bleeding in the brain.

"There's a huge timing problem," said Dr. Olivier Couture, research director at the Biomedical Imaging Laboratory in the French capital Paris. "If you treat people within the first hour—the golden hour—the stroke has a reduced impact on their life."

The Biomedical Imaging Laboratory is run jointly by the French National Center for Scientific Research, or CNRS, Sorbonne University and the French National Institute of Health and Medical Research, also known as Inserm.

Couture leads a project to help doctors determine the appropriate treatment for a stroke faster. Named ResolveStroke, the project is due to end in February 2024 after five and a half years.

The stakes are high.

Strokes permanently disable about 5 million people a year globally—in addition to killing 6 million worldwide annually.

In Europe, an estimated 1.5 million people have a stroke each year, with

a third remaining dependent on outside help.

New view

The ResolveStroke researchers are counting on ultrasound imaging instead of conventional diagnostic techniques—mainly CT and MRI scans—to treat strokes.

While they provide clear pictures, CT and MRI scans require specialized centers and highly trained operators, involve cumbersome machines and, above all, take time.

Ultrasound uses sound waves to generate images and, because it's more portable, offers the prospect of faster diagnoses—even from ambulances. But ultrasound images tend to be less precise because the scattering of waves in tissue limits resolution.

The project team has built on an idea known as super-resolution ultrasound. This technique maps out the blood vessels by using a contrast agent, namely clinically approved microbubbles, to track the blood flowing through them rather than the vessels themselves as in traditional ultrasound. This gives a clearer picture of blood flow.

Scanner on wheels

After initially testing the technology by scanning the brains of rats, the researchers progressed to sheep and eventually developed a scanner that received the go-ahead for tests on human patients in November 2023. The team is preparing for trials at the Bichat-Claude Bernard Hospital in Paris.

"The dream is to reduce the cost and improve the portability and the

access of it—basically put it in ambulances," Couture said.

The researchers have set up a company, also called ResolveStroke, to push forward commercialization. They hope to have European approval for the scanner by 2025.

Faster and better stroke treatment has the potential to reduce health care expenditure substantially.

The total cost of stroke care in Europe was €60 billion in 2017 and, with the continent's population aging, could rise to €86 billion in 2040 without better prevention, treatment and rehabilitation, according to a European advocacy organization.

Handheld help

As Couture and his team press ahead with their goal of getting ultrasound scanners into ambulances, researchers in neighboring Belgium are seeking to deploy ultrasound imaging more widely for a broader number of health uses.

This group of experts is developing a handheld ultrasound probe that should facilitate diagnoses by doctors and improve everything from maternity care to the treatment of sports injuries.

The project is called LucidWave and runs for three years until mid-2025. The portable machines being developed are around 20 centimeters in length and rectangular in shape.

The LucidWave team wants to make them available not just in radiology departments but also elsewhere in hospitals such as surgery rooms and even in care homes for the elderly.

"We want to offer ultrasound medical imaging that is handheld and wireless," said Bart van Duffel, a project member who is innovation manager for membrane, surface and thin film technology at university KU Leuven in the Belgian region of Flanders.

User friendly

To do that, the team has brought a different transducer technology to the probe using micro-electromechanical systems, or MEMS, which are comparable to the chips found in smartphones.

The alternative technology is based on piezoelectric micromachined ultrasonic transducers, or PMUTs—tiny silicone film "drums" that vibrate when exposed to a voltage and produce the ultrasound waves needed for imaging that can cover various parts of the human body.

The images generated are analyzed by LucidWave software, including artificial intelligence, which can swiftly process the data and provide a pre-diagnosis for medical experts.

"The project prototype is straightforward to use so medical and health care professionals of all kinds—not only ultrasound specialists—can make use of it," said Dr. Sina Sadeghpour, research manager at KU Leuven and leader of LucidWave.

The team is testing the prototype on cadavers with the aim of improving the image quality—an important step towards applying for permission to undertake trials with living people and eventually bring the device to market.

The researchers estimate the device could be fully approved and commercially available in around five years.

"We want to make ultrasound imaging widely available and affordable without compromising on functionality and performance," van Duffel said. "We see this new ultrasound technology as a kind of stethoscope of the future."

More information:

- ResolveStroke
- LucidWave

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