Treatment with a Push

Ultrasonic Propulsion to Treat Kidney Stone Disease: Prototype Demonstration

Narrator:
Detecting and pushing kidney stones or stone fragments without invasive surgery. Here an ultrasound probe provides the pushing power in this lab demonstration at the Center for Industrial and Medical Ultrasound – at the Applied Physics Laboratory, University of Washington. First task: find the stone.

Bryan Cunitz:
Here is the bright spot with a long tail that is caused by the ultrasound echo, the vibrations of the stone. We find the right orientation; you see that we're pushing it out to an open space. Once we have that, press the clear… and it shot right out of there.

This is our training and development ultrasound phantom. It's made by a local company called Blue Phantom. Inside is an actual kidney phantom where the collection space is fluid-filled. There's a glass bead that's about 5 mm in diameter that represents the kidney stone and shows up very well in ultrasounds.

The system has several components to it. The first is the ultrasound probe. This commercially available one is an abdominal probe – a C52 from the HDI Phillips system. We have written software for it. It's all Matlab-based software. We've made big jumps in our development along the way while at the same time being able to collect valuable data for processing afterward and helping develop very useful algorithms for stone detection as well as improving our capabilities for moving stones in the system. We also have a suite of Doppler controls. Then we have our push controls. You can change push frequency, the duration of the push, and the actual output level.

Narrator:
Urologist Mathew Sorensen tries his hand at the system. Searching for... and then moving a simulated kidney stone.

Mathew Sorensen:
It's common for there to be left over pieces, fragments, dust, or gravel after we do a treatment for a stone. Sometimes those clear on their own, often they don't. They can grow to bigger stones that require additional treatments. One of the arguments in favor of this therapy is that it's noninvasive and we suspect it won't have much discomfort and it will allow us to clear out some of those fragments that tend to be left over.

We haven't been able to detect any damage or injury and so it's essentially what we believe will be a safe and noninvasive way to treat these stones and stone fragments.

Cunitz:
The amount of energy that it takes to move the stone doesn't turn out to be much more than diagnostic levels. What we do is focus it down to a small point so it's concentrated and we compress the amount of energy to a very short amount of time with a very high burst and with a lot of off time afterward.

Michael Bailey:
We have a prototype at this point. We've submitted our letter to FDA and are in the process with them to get approval for a human feasibility study. So we want to demonstrate this works in people – may be able to do that even this summer. And at that point, we would look for a partner to commercialize this. Or we would actually start our own company to build pretty much the exact prototype we have.

This is APL — The Applied Physics Laboratory at the University of Washington in Seattle.