# Trial to test using ultrasound to move kidney stones

January 10 2014

Almost one in 10 people will someday experience a kidney stone, which creates what is described as the most intense pain imaginable. This increasingly common condition leads to hundreds of thousands of surgeries in the United States each year.

A new device developed at the University of Washington would let doctors use ultrasound to move kidney stones inside the body and help them pass by natural means.

"Ultrasound is used today to break up large stones. That's not what we're doing," said Michael Bailey, an engineer at the UW Applied Physics Laboratory. "We've developed low-power ultrasound that could move small stones to reduce pain, expense and treatment times."

A 15-patient trial using this technology is now under way at UW Medicine. The research is supported by the National Institutes of Health and the National Space Biomedical Research Institute, which is interested in the project because astronauts have an increased risk of developing kidney stones during space travel.

The UW team showed a prototype last spring at the American Urological Association's annual meeting, and Bailey was invited to give a keynote presentation. He was the only presenter in that session who was not a medical doctor.

"This is something urologists are excited about, so that's why we're pursuing it," Bailey said.

Kidney stones are crystals that develop in the urine. Shock-wave ultrasound has been used to treat big kidney stones for 30 years. That technique, known as lithotripsy, sends short pulses of high-energy ultrasound to shatter large stones. While the technique is noninvasive it usually requires general anesthesia and a hospital visit. It also leaves behind fragments that can grow and require another trip to the hospital or emergency room.

A patient with a small stone traditionally has to wait, drink plenty of water, and hope that the stone passes uneventfully. Medical studies have looked at standing on your head or hitting the patient in the lower back (technically called inversion and percussion). Those methods try to jiggle small stones from the lower part of the kidney, where they have only a 35 percent chance of passing naturally, to the middle of the kidney, where they have an 80 percent chance of passing without treatment.

The UW team proposes a gentler, more targeted way to guide the stones toward the exit route.

The prototype is a commercial ultrasound system modified to emit pulses only slightly stronger than those used for pregnancy imaging. These sustained, low-intensity waves are just enough to push the crystal through the surrounding fluid.

In the lab, Barbrina Dunmire, an engineer at the Applied Physics Laboratory who helped build the device, points an ultrasound probe at a stone inside a latex kidney. She activates the ultrasonic pulse and the stone immediately swings away through the clear liquid. A doctor would put the probe on a patient's lower back, then use an onscreen ultrasound image to locate the stone and direct the ultrasonic pulse.

Urologists and urology residents at UW Medicine tested three successive prototypes on artificial kidneys and pigs, and helped to design the touchscreen user interface.

"We've had extensive testing in an animal model," said Dr. Jonathan Harper, an assistant professor of urology at UW Medicine. "If it acts in the same way in a human kidney, I think it's extremely promising."

The current Seattle trial is the first time the system is being tested on humans.

Besides guiding kidney stones to help them pass naturally, other applications could be to reposition a stone before or during surgery; to displace a large stone obstructing the ureter to relieve the patient's pain and avoid emergency surgery; and perhaps someday to escort small stones right down the ureter.

If clinical trials go well, researchers believe the device could be used in an urologist's office or by trained emergency room staff, potentially saving hundreds of millions of dollars in U.S. medical expenses.

The team is working with the UW Center for Commercialization. Once the UW team has proven the technique works in humans, Bailey said, the project will be ready to seek FDA clearance and be brought to market.

"Just get it out there and let us try it," said Bailey, who also is a UW assistant professor of mechanical engineering. "That was the feedback we got from the urologists."

**More information:** Project page: www.apl.uw.edu/pushingstones