

Students take clot-buster for a spin

April 21 2014, by Mike Williams



The wire tip of a new device to break up blood clots in the bladder creates a vortex when it spins; this pulls clots in and dissolves them. Rice University students created the device as their senior engineering design project. Credit: Jeff Fitlow

(Phys.org) —In the hands of some Rice University senior engineering students, a fishing rod is more than what it seems. For them, it's a way to help destroy blood clots that threaten lives.

Branding themselves as "Team Evacuator," five students have been testing a device to break up [blood clots](#) that form in the bladders of adult patients and currently have to be removed by suction through a catheter in the urethra.

The urethra remains the least-invasive access to the bladder, where clots can block urine from passing and ultimately lead to kidney failure. The students' device, which looks something like a tiny, flexible eggbeater on a stick attached to a cut-down rod and reel, is designed to fit through the catheter and break up the clots without harming the bladder wall.

The bioengineering students – Aaron Hu, Adrian Gallegos, Tiffany Huang, Patrick Yun and Lung-Ying Yu – use the modified rod to power the device for tests on simulated blood clots made with pig blood and gelatin.

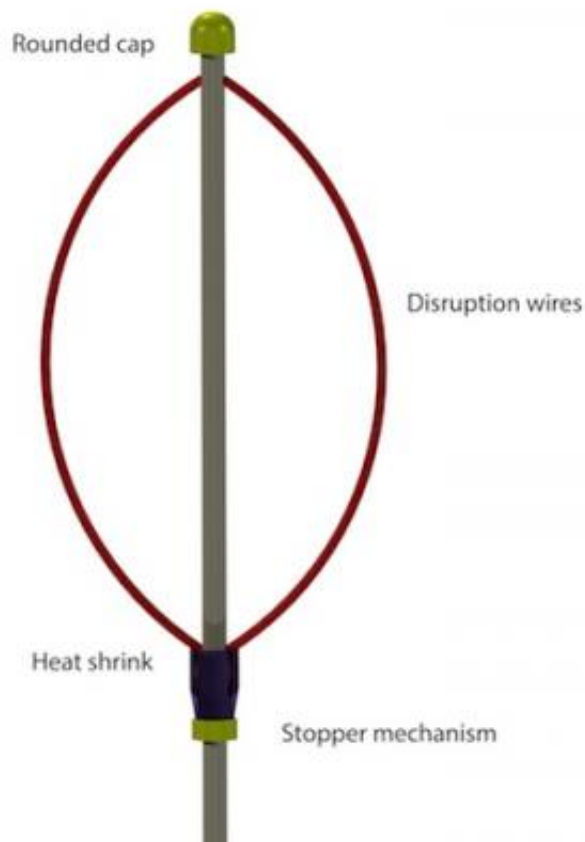
The finished version will be battery-powered so it can be operated with one hand; it will turn wires at upward of 800 revolutions per minute, enough to create a vortex that pulls clots toward the spinning wires that dissolve them.

The wires are made of nitinol, a nickel-titanium alloy considered a memory metal. "It's the same kind of metal used in braces," Hu said. "You can deform it any way you want, but at a given temperature, it goes back to its original shape." The wires collapse within the catheter walls and expand to their functional shape when pushed through into the bladder. "Nitinol collapses very well," he said.

The device designed at Rice's Oshman Engineering Design Kitchen costs about \$20 in parts for the battery-powered version, Huang said. "Even though it could probably be reused, it's meant to be disposable," she said, demonstrating the tight fit between the steel tube that supports the wires and the motor.

Nadeem Dhanani, an assistant professor of surgery in the Division of Urology at the University of Texas Health Science Center at Houston, had previously worked on projects with students at Massachusetts Institute of Technology and approached Rice with a request for a better

device. "I had what I thought was a good solution to this clinical challenge, but I also acknowledge the fact that I was looking at it from one direction," he said. "Getting to incorporate the thoughts and experience and expertise of people with different backgrounds is a great opportunity."

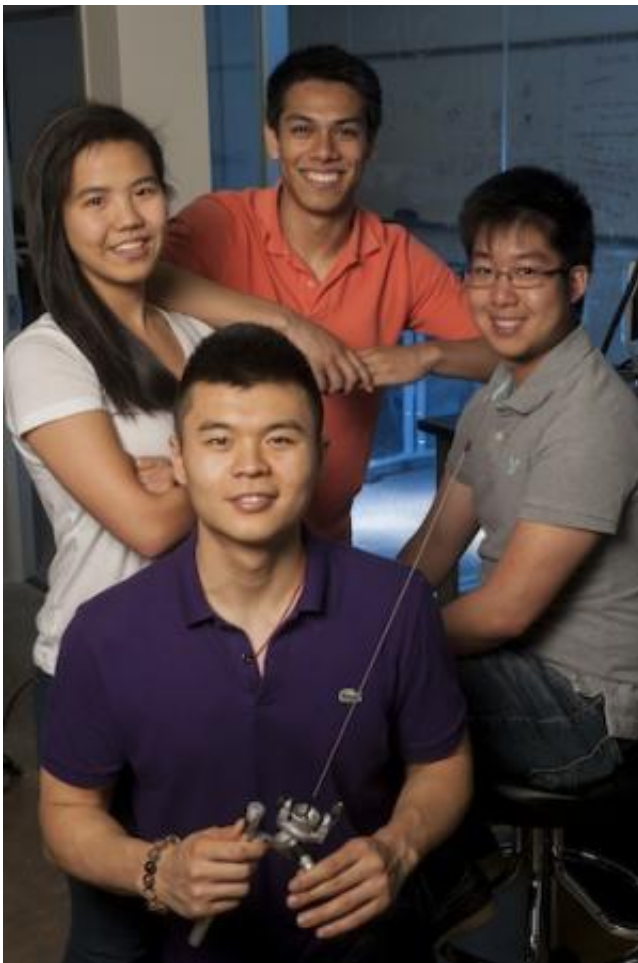


Flexible nitinol wires at the tip of a device that breaks up blood clots collapse so they can pass through a catheter and regain their shape when they reach the bladder. Rice University students created the device as their senior engineering design project. Credit: Team Evacuator

Dhanani, who is mentoring the students with Rice engineering lecturer Eric Richardson, described current techniques to remove clots at a

patient's bedside as antiquated. "We're often forced to take patients to the operating room despite their poor health because we have no other alternative. If we're able to save them the additional hazards of surgery and an anesthetic, we would be doing them a great service," he said.

Team Evacuator focused first on safety. One advantage of their device is that the clot-busting wires are unlikely to contact the bladder's inside wall. "We also found that switching the direction of the spin at intervals breaks up the clot a lot better than one continuous direction, so we're building that function into the motorized version," Hu said of the team's tests on pig blood and gelatin.



Members of the Rice University senior engineering team that designed a new

device to break up blood clots in the bladder show a test version of their invention. Clockwise, from front, are Lung-Ying Yu, Tiffany Huang, Adrian Gallegos and Aaron Hu. Not pictured: Patrick Yun. Credit: Jeff Fitlow

The students are pleased with the simple, functional product of their capstone project, a requirement for most [students](#) at Rice's George R. Brown School of Engineering. "When we're done with this at the end of the semester, it will be a finished product," Gallegos said.

"For us, the best outcome will be seeing this device go even further. Realistically, we can get right to the stage before animal testing, and that's a major point," Hu added.

"(The [device](#) is) cost-effective, easily accessible and relevant at the point of care and has a chance of actually being welcomed and adopted by the intended audience—the operators—because it's intuitive for them and utilizes their skill sets," Dhanani said. "We came up with a good solution."

Provided by Rice University

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