# Could FastStitch device be the future of suture?

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Johns Hopkins undergraduates invented this abdominal suturing tool, called FastStitch, to guide the placement of stitches and guard against the accidental puncture of internal organs. Credit: JHU

After a surgeon stitches up a patient's abdomen, costly complications -- some life-threatening -- can occur. To cut down on these postoperative problems, Johns Hopkins undergraduates have invented a disposable suturing tool to guide the placement of stitches and guard against the accidental puncture of internal organs.

The student inventors have described their device, called FastStitch, as a cross between a pliers and a hole-puncher. Although the device is still in the prototype stage, the FastStitch team has already received recognition and raised more than $80,000 this year in grant and prize money to move their project forward. Among their wins were first-place finishes in

University of California, Irvine, and University of Maryland business plan competitions and in the ASME International Innovation Showcase.

The FastStitch device is needed, the students say, to improve the way up to 5 million open abdominal surgeries are conducted annually in the United States alone for treatment of cancer, liver problems and other common ailments. If incisions from those procedures are not closed properly, a patient can develop complications such as infection, herniation and evisceration, all of which require additional treatment and in some cases, more surgery. Just one of these complications --herniation, in which intestinal tissue can protrude through the abdominal wall after the muscle layer splits apart -- leads to $2.5 billion in additional costs annually in follow-up treatment and medical malpractice expenses, the students said.

Addressing this problem became a biomedical engineering course assignment for eight Johns Hopkins students over the past school year. They were asked to design and test a tool that that would improve the way surgeons stitch together the strongest part of the abdomen, the muscle layer called the fascia, which is located just below the patient's skin. "Doctors who have to suture the fascial layer say it can be like pushing a needle through the leather of your shoe," said team member Luis Hererra, a sophomore biomedical engineering major from Downey, Calif. "If the needle accidentally cuts into the bowel, it can lead to a sepsis infection that can be very dangerous."

To help prevent this, the students designed the FastStitch needle to remain housed within the jaws of the stitching tool. "You place the fascial layer between the top and bottom arms of the device," said Sohail Zahid, of Morris Plains, N.J., leader of the student team. "Then, as you close the arms, the spring-loaded clamp is strong enough to punch the needle through the fascial layer. When this happens, the needle moves from one arm of the tool to the other."

The device also features a visual guide to help ensure that the stitches are placed evenly, located the proper distance away from the incision and apart from one another. This should also reduce postoperative complications, the students said. The hand-size pliers-like shape was chosen because it would feel familiar to surgeons and require less training. The prototype was constructed mostly of ABS plastic, so that the instrument can be inexpensive and discarded after one use.

"We're developing the future of suture," said Zahid, who earned his undergraduate degree in May and has applied to Johns Hopkins' M.D./Ph.D. program in biomedical engineering. "We believe that if the FastStitch tool is used to close abdominal incisions, it will help in three important ways: It will help surgeons by making the closure process simpler and safer. It will help hospitals by reducing costs. And, most importantly, it will help patients by reducing post-operative complications."

Physician Hien Nguyen, an assistant professor of surgery in the Johns Hopkins School of Medicine, served as the students' clinical advisor during the development of FastStitch. "Just about every major operation in the chest and abdomen requires a large cut to be made through the muscle layers," he said. "If these layers are not brought back together evenly, complications can occur. This device allows the surgeon to bring the muscle layers back together evenly, safely and quickly, and this can lead to better outcomes and fewer complications."

Nguyen had discussed the need for a better suture tool with the undergraduate design team in a program offered by the Department of Biomedical Engineering, which is shared by the university's School of Medicine and its Whiting School of Engineering. The course is conducted within the Center for Bioengineering Innovation and Design.

In addition to Zahid and Herrera, the other students who have

participated in the FastStitch project are Andy Tu, Daniel Peng, Stephen Van Kootyen, Leslie Myint, Anvesh Annadanam and Haley Huang. Through the Johns Hopkins Technology Transfer office, the team members have obtained preliminary patent protection for their invention. All eight students are listed as co-inventors, along with Nguyen and Johns Hopkins graduate student Adam Clark.

The students have formed a Baltimore-based company, Archon Medical Technologies, to conduct further research and development of FastStitch. The company is being supported by grant funding and by most of the prize money won in the student invention and business plan contests earlier this year. Animal testing of the device is under way, and further testing with human cadavers is expected to begin later this year.

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