Z-shaped incision enhances minimally-invasive surgery

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A novel surgical technique allowing doctors to operate on patients by making a Z-shaped incision inside the stomach could potentially replace certain types of conventional surgery in humans, according to Penn State medical researchers who have successfully demonstrated the procedure in pigs.

If the technique ultimately proves successful in human trials, researchers say it could circumvent the long painful recovery times and medical complications associated with surgery.

The new approach, known as NOTES (natural orifice transluminal endoscopic surgery), involves using a natural opening in the body, in this case the mouth, to advance a flexible video endoscope into the stomach.

Using this tube, and the instruments contained within it, doctors currently make a small straight incision in the stomach to gain access to the abdominal cavity and the organs requiring attention.

"Theoretically, by eliminating body wall wounds with their associated complications and allowing some procedures to be done without general anesthesia, this method could leave a truly minimal surgical footprint, and may even allow certain procedures to be done outside a traditional operating room," said Matthew Moyer, M.D., a gastroenterology fellow at Penn State Milton S. Hershey Medical Center.

But he cautioned that NOTES is still in the developmental phases and

even a simple procedure may be fraught with potential complications at this point.

"One of those barriers is the closure of the access site," said Moyer. "In other words, the opening made in the stomach must be reliably and safely sealed off at the end of the procedure."

Moyer and his Hershey Medical Center colleagues Eric M. Pauli, M.D.,resident surgeon; Randy S. Haluck, M.D., director of minimally invasive surgery and assistant professor, and Abraham Mathew, M.D., director of endoscopy and assistant professor, all at Penn State College of Medicine, believe their technique elegantly solves the problem.

The key to their approach lies in the way the flexible probe exits the stomach. Instead of cutting straight through the stomach wall the researchers guide the endoscope so that it first tunnels under the mucous membrane of the stomach wall for a while before exiting near an organ to be operated on. The endoscope essentially charts a Z-shaped path.

This new technique, known as STAT (self-approximating transluminal access technique), has two main advantages according to Moyer. There is significantly less bleeding involved and the Z-shaped tract effectively seals itself due to pressure created on the abdominal wall by normal breathing.

The team published its findings in a recent issue of *Gastrointestinal Endoscopy*.

The technique has other advantages as well. "Most people operate straight through the gastric wall and then use a bunch of complex maneuvers to get the endoscope where it needs to be," said Pauli. "And it can get difficult to operate because the endoscope is upside down and in a reverse position."

By tunneling through instead, he points out, doctors can maintain a directional sense and guide the endoscope more accurately.

"There are landmarks in the mucous membrane such as specific blood vessels and groupings of blood vessels. We can also see through the wall of the stomach in some areas to guide the endoscope to the organ we want to operate on," Pauli said.

The researchers have so far operated on 17 animals and only one of them has developed a minor complication.

Once they have perfected their tunneling technique, Moyer and colleagues will try to figure out how exactly to remove surgical specimens from an operation.

"The gall bladder, small tumors, even the ovaries are potentially removable through this technique," said Mathew. "We could in theory make the tunnel as big as we want, and take something out into the stomach and cut it into small pieces before extracting it."

If successful, the procedure in humans could translate into significantly shorter recovery times, little or no pain, less anesthesia and without surgical scars. But the researchers acknowledge it may be a while before their surgical technique reaches human trials.

Mathew said he and his colleagues are confident that their technique lets them get the endoscope out of the stomach and back in safely with currently available instruments. "We have to perfect the technique so we can fully understand the risks," he added.

The Penn State researcher envisions minimally invasive surgery being employed to help patients who are critically ill and may not be able to tolerate a traditional surgery or leave the ICU. In such cases, doctors

could access the internal organs and perform procedures such as a biopsy to make a better diagnosis or even perform intestinal bypass surgery.

According to Pauli, these findings could accelerate the pace of research in minimally invasive surgery and ease the way for other breakthroughs.

"We are looking at some fundamental questions: can we get the endoscope in safely, can we get it out safely, and can we get it at the organ we want to operate on. Those are the questions nobody has really answered," he said.

Source: Penn State