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Innovations in Open Stapling: The GIA™ Stapler With Tri-Staple™ Technology

Ryan K. Jones, MD

*Colorectal Surgeon
Norton Women's and Children's Hospital
Louisville, Kentucky*

Advances in Open Surgical Stapling

Three-row staplers with graduated compression have been widely adopted for a range of laparoscopic procedures.¹ These staplers provide secure closures at the staple line that stop bleeding while permitting the perfusion that is necessary for healing.¹ A linear stapler with 3 (vs 2) rows of staples is driving a comparable evolution in open procedures that can provide an added level of confidence, even for experienced surgeons.² Ryan K. Jones, MD, a colorectal surgeon at Norton Women's and Children's Hospital, in Louisville, Kentucky, estimates that 80% of his procedures are performed laparoscopically or robotically. When an open approach is necessary, however, he has found the introduction of graduated-height 3-row stapling to be a meaningful advance.²

Making the Switch

Dr Jones uses the GIA™ stapler with Tri-Staple™ technology (Figure 1) for side-to-side anastomoses in open resections of

the small and large bowel. Already convinced of the benefits of 3 rows of staples for achieving a reliable staple line in laparoscopic surgery, he switched from 2-row linear staplers in open procedures to the first Tri-Staple™ open linear device soon after it became available.¹ "I was eager to move to the GIA™ open device," Dr Jones said.

In fact, his interest with the GIA™ stapler with Tri-Staple™ technology may have influenced other surgeons at his hospital and health system, some of whom were experiencing leaks in open colorectal procedures with a 2-row linear stapler that predominated when Dr Jones arrived.^{2,a} In the context of these complications, Dr Jones' experience with the advantages of Tri-Staple™ technology "led the hospital system to open it up to other surgeons. Those who had experienced complications with the 2-row linear staplers were the most interested, and after they switched, the feedback was very positive," he said. "They reported improved confidence in the firings."

Dry Staple Lines

Although Dr Jones was not experiencing leaks with 2-row staplers in open surgery, he would sometimes observe ooze along the staple line. He considers even modest evidence of an imperfect closure to represent an unacceptable risk for hematoma and an unwanted event that can



Figure 1. The GIA™ stapler with Tri-Staple™ technology.

delay completion of a case. Since switching to the GIA™ stapler with Tri-Staple™ technology, he has not observed bleeding at the staple line in the lumen of the anastomosis (Figure 2).³ “This has meant no oversewing of the closure line,” Dr Jones said. “There is always a risk of introducing a new injury with additional suturing, a problem that is avoided with dry staple lines.” The “peace of mind” that Dr Jones gets from the absence of bleeding at the staple line, however, is not the only characteristic of the GIA™ stapler with Tri-Staple™ technology from which he derives reassurance.

The Technology

3 Rows of Varied-Height Staples

Dr Jones prefers a third row of staples for that peace of mind he describes. “I appreciated this concept in laparoscopic staplers, and it’s also relevant to open cases,” he said. “The extra row is reassuring.” The advantages of the GIA™ stapler with Tri-Staple™ technology also derive from the graduated staple heights inherent to the technology.² The first row contains the shortest staples and creates a secure seal, while “the greater height of the second and third rows avoids the barrier to perfusion, which is essential to



Figure 2. Dr Jones has experienced less bleeding at the staple line compared with his former 2-row stapler.

Based on reference 3.

healing,” Dr Jones said.^{1,4,b}

Tri-Staple™ technology provides 50% more staples than the GIA™ stapler with DST Series™ technology and other 2-row linear cutters.^{5,c} In addition, manufacturer studies and an in vivo experiment using micro-CT imaging validate improved perfusion from graduated-height staples.^{1,4,b} The latter study demonstrated higher perfusion volumes with graduated-height staples than a single staple line in an animal model.^{1,b}

Three rows of varied-height staples in the stepped cartridge face also generate less stress on tissue during compression and clamping.^{6,d} “The graduated height lends itself to a more favorable compression of the tissue,” Dr Jones said. “By pushing fluid away from the staple line, it reduces pressure on the tissue when the stapler is fired.”

User-Friendly Features

Numerous features improve the experience of surgeons beyond the advantages of Tri-Staple™ technology. For example, the retraction force is approximately 70% less with the GIA™ stapler with Tri-Staple™ technology than the GIA™ stapler with DST Series™ technology.^{7,e} Although Dr Jones might need to apply extra pressure for firing in thicker tissue or when 1 staple line crosses another, he does not believe this is unexpected of a stapler laying down 3 staple rows, and it has never impaired his firing ability. “I like the feel of the device. It’s easy to hold and maneuver,” Dr Jones said. He added that features, such as a large firing knob^{8,a} and a new knife blade with each firing, enhance usability and that the palm is used to fire the device, which provides a controlled application of pressure. “I don’t want to have any risk of the tissue tearing. I have had staplers that did not cut appropriately, which causes problems or the need for a redo,” Dr Jones said. “The new blade with every firing provides an extra level of confidence, even when stapling thick tissue.”⁵

Interchangeable Cartridges

Medtronic is developing Tri-Staple™ cartridges with a variety of staple heights and cartridge lengths. Today, cartridges come in 2 sizes and are color-coded for staple heights. Of the 2 lengths currently available, (60 and 80 mm), the 80-mm cartridge is the longest available with Tri-Staple™ technology. “With the longer stapler cartridges, you can get an extra couple of centimeters without a second firing, which can



Figure 3. The GIA™ purple stapler with Tri-Staple™ technology is for medium/thick tissue (staple heights: 3.0, 3.5, and 4.0 mm). The black cartridge is for thicker tissue and provides the largest open staple height available (staple heights: 4.0, 4.5, and 5.0 mm).^c

Based on reference 5.

make the procedure more efficient,” Dr Jones said.^{9,c} Internal manufacturer testing associates the GIA™ stapler with Tri-Staple™ technology with an 8% to 11% greater likelihood of completing a transection in a single firing.^{9,c} Both the 80- and 60-mm lengths can be used in up to 8 firings per procedure,² and with interchangeable cartridges across a broad range of tissue thickness.⁵ “It is extremely easy to change cartridges. The scrub tech can do it with very little downtime, which is good for workflow,” Dr Jones said.

“It’s helpful to have a choice of staple heights, which I think reduces the chance of misfiring on thicker tissue,” Dr Jones said. The purple cartridge is for medium/thick tissue, with staple heights of 3.0, 3.5, and 4.0 mm. For thicker tissue, the black cartridge provides staple heights of 4.0, 4.5, and 5.0 mm, which is the largest among available open staplers (Figure 3).^{5,c} “The cartridges provide a great deal of flexibility. I typically use the purple load for small-bowel and colon resections, but the black cartridge lets you tackle thicker tissue.^{5,c} Although you generally make the cartridge choice during preoperative planning, there is no problem if you change your mind at the start of the case,” Dr Jones said.

Conclusion

A decade after triple-row stapling was introduced for minimally invasive surgery, the GIA™ stapler with

Tri-Staple™ technology has brought the same sophistication to open procedures.² The graduated staple heights provide a secure closure while leaving room for the perfusion needed for healing.¹ Three rows provide 50% more staples,^{10,c} and cartridges can be selected for optimal tissue thickness.⁵ The design reduces tissue stress during compression and clamping,^{6,d} and a fresh blade with every firing ensures accurate and reliable cutting.⁵ According to Dr Jones, the new device brings the advantages of laparoscopic Tri-Staple™ technology to procedures performed with an open approach. “I have substantial experience with 3-row laparoscopic staplers. I saw the advantages of this approach, so I was happy to see this become available in the open setting,” he said.

^a Compared with the GIA™ stapler with DST Series™ technology.

^b Preclinical results may not correlate with clinical performance in humans.

^c Compared with the GIA™ staplers with DST Series™ technology, Ethicon Linear Cutter, and Ethicon Proximate™ Linear Cutter.

^d Compared with the GIA™ stapler with DST Series™ technology and Ethicon Proximate™ Linear Cutter.

^e Compared with the GIA™ stapler with DST Series™ technology, Ethicon Linear Cutter, Ethicon Proximate™ Linear Cutter, Frankenman Chex™ Linear Cutter Stapler, and Panther Linear Cutter Stapler.

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