

Surgical Staplers: Caitlin Halbert, DO, MS, FACS

Intro

I'm Caitlin Halbert. I'm a bariatric surgeon at training. I am the chief- current Chief of Surgical Services at Wilmington Hospital and Medical Director of our bariatric program. And I'm also the medical director of our surgical physician assists. So I run our busy program up there but also head up the Department of Surgery at Wilmington Hospital.

Why do you use a surgical stapler?

Surgical staplers are something I use on a daily basis. I probably fired a stapler no less than 1000 times in the last year. For bariatric surgery, I do predominantly sleeve gastrectomies and gastric bypasses. Both of those procedures require stapling throughout. I could I guess theoretically cut and suture everything I needed to in those cases, but the surgical stapler is what facilitates those surgeries for me. So I depend on them every day of every week- every case.

How often do you use a surgical stapler during surgery?

I could use a surgical stapler upwards of 8, 9 times in a single case. And I could do- I'm doing maybe four cases a day. My cases can last up to two hours, sometimes longer. Sometimes less.

What defines the success of a surgical stapler?

I think a successful stapler has to have a couple of things. It has to be easily fit in my hands. So I'm female, size six gloves, so it has to fit into my hand comfortably. I have to be able to reach the buttons, which has been an issue with some instruments I've had in the past. It has to be reliable so that I can depend on it to function well with every case to avoid complications. It has to do its job. It has to seal the tissue. It has to take care of any vessels that are going through that tissue and it has to cut down the middle seamlessly without snagging or stopping. And if, it can do those things, then I consider it successful.

What factors can impact the success of a surgical stapler?

One of the biggest factors that I encounter is when I come into difficulty or high potential for complications related to the stapler has to do with the weight of my patients, believe it or not. So just last week I was operating on a patient whose BMI or body mass index was over 60. They were over 400 pounds, not very tall. And all their weight was carried intraabdominally. So their thickness of their tissues are completely different than somebody who has a BMI of 29. So I had to take that into consideration.

The weight of my patients really does correlate to oftentimes a thickness of their tissues. And so it's nice to have potentially a stapler that can tell me, did I pick the right staple height? And to know it before I fired it. So previous, I was using a stapler that would kind of slog through the tissue and slowly and that would give me an idea that, yeah, this is probably a thick tissue for the stapler, but I was already firing it. And so we recently converted to a stapler that actually tells me, yeah, you picked the right one and this is going to be a safe firing for that staple load in it. And I mean, that's great and helps prevent failures because if the tissue's too thick and it tries move through and it fails-- either the staples don't form correctly, it doesn't cut down the middle, it doesn't fire the entire row, it bleeds, it leaks. All these things can happen. So as a bariatric surgeon, I am very keenly aware of that factor influencing my stable line for sure.

How do you know when a failure has occurred?

When there's a misfire or problem with a stapler, I usually know about it immediately. I can see those nice staples form into a B and I can see them lay down nice and flat. Nice railroad right across there. And I can see the knife go right up between there and make a nice clean cut. It's pretty evident if there's a problem. Thankfully- I have not had that happen. But you see videos of it where the staples just don't come down and they just hang wide open. In all my cases, even though I've never seen a failure, I still leak test every one of my cases to make sure that the anastomosis or the staple line is intact and airtight.

What is leak testing?

Leak testing is something fairly unique to folks who operate on the stomach, although you will see some colorectal surgeons doing it as well that work really low down in the rectum. The only reason why it's those two extremes is because we can get to those areas. So we can put an endoscope, an NG tube- we can put a tube down into the stomach and we can pump it up with air. We can put methylene blue in it- we do a couple of different things. And then- it's real technical- we submerge that staple line or anastomosis under fluid laparoscopically and we can see and look for bubbles- or look for blue if we put methylene blue in there. And it's just an extra way to check our work. In bypasses, I always leak test my bypass patients. And in probably 800 cases I've had four positive leak tests in those. Most of that has to do with the suturing part, not the staple line, but I want to find it there. I don't want to know about it a day later.

Can you demonstrate a surgical stapler?

This is the Covidien Signia stapler. It's an automatic stapler. It doesn't require like a hand crank to close the stapler. It is obviously cordless. It's a reusable battery pack inside here that goes into a wall charger and can be used infinitely until it breaks essentially. You have a handle piece that plugs in here. This can be used up to about a 100 times, I believe, before it has to be replaced. This outer candy shell here is a dispensable, so this gets thrown away, but this is the sterile shell that we put around it. And so we open it up sterily. And then our non-sterile nurse drops this black component right inside of it. And then this comes up on a sterile tray. And so we plug that in. And then we have reusable staple fires. They get plugged in here. And it's really very self-explanatory. Put the arrows together and then spin it around. And of course I'm looking at it from upside down here. And this plugs in here, then here we go. And then it's ready to fire. So when the nurses hand it to us they go through a safety check, they close it, open it and close it. For the staple fires that have a chip, it will actually read back here for tissue thickness feedback. Now I have one that does not have that today because it's a little bit more expensive. But it has a display on the back-end here that would have a 1, 2, and 3 and that's telling me the tissue thickness relative to the staple height. It can go up and down, left to right, rotates and certainly open and close from this from the handle here. It's really easy to use. Very lightweight. We had switched this probably a year and a half ago and I fired it around 1500 times since we've gotten it so I've been very happy. It's like my right-hand tool. This one that we have here has a tip at the end so that you kind of scoop underneath tissue and get around it. It throws three staple loads on each side that are staggered and then has a new blade on each load, which is really good. Our old stapler had a reusable blade, which as you can imagine, dulls over time. So there's a fresh blade on every firing which makes the tissue nice and clean, and helps prevent the tissue from dragging. So some of them come preloaded. They will have what we call a peri-strip or a tissue thickness reinforcement. There's many different names for it. It's like a TRX, PRX- I don't know the name of it- but it's staple line reinforcement that gets placed on here that's already glued onto it. And some of the pre-, they're kind of pre-done up ahead of time so the nurses don't have to kind of finagle with glue or strings or any that-- it's already preloaded on there and ready to fire. So we use that sometimes to help reduce bleeding along the staple line. There's not a lot of really good data to say that it does that, but a lot of us do that to help us sleep at night.

Can you provide a weight analogy?

So this would be like a baseball mitt with a baseball in it- it may be close enough. It's not too heavy that it's like your hand doesn't get heavy playing baseball or carrying your mitt around. And even with a baseball, it doesn't feel bad. But you wouldn't want to carry this around all the time. And it's a bit-- it's not clumsy, it doesn't feel clumsy to us. Would I love for it to be lighter? Absolutely, absolutely. Lighter is always better. You've got extra down here that my hand doesn't need. But, you know, obviously the technology is not quite there yet.

Are any components of the Covidien stapler reusable?

This part of the stapler is actually reusable, and this is really the densest technical part of the device. And so by having this be reusable and not disposing of it after every patient helps reduce their costs overall. And so every case that we are using this device, we can eliminate a lot of wasted cost. The other thing is it doesn't have a limit. So there are a lot of limits on staplers. There are some that, like I mentioned before, that have the same blade that they use. So a lot of those disposable ones use the same blade through every firing. And so after, I can't remember if it was like 15 firings, 12 firings you have to throw that disposable away and open up a new one even if you only had one more firing to go. So this, you're allowed to keep firing because there's a new blade with every staple fire.

What are the pros and cons of a stapler?

There's a lot of pros and cons to the staplers that we use, and I think one of the pros is that they're always evolving- they're changing, they're trying to stay current with the technology. And industry is always trying to meet the needs of its clients, surgeons. And they take that feedback and work with engineers to make that happen. That's a big pro- it means that there's always going to be something better on the horizon and we have to keep our eyes out for it. You know, the biggest con right now is the size of these staplers. We're working with these like tiny, thin little phones that can do so much and our Apple Watches and everything else- they're all compact in there. And yet we have staplers that are pretty big that we have to handle. Thankfully, they are cordless, which is an added feature. But that's one of the biggest complaints is that they're big, they're so very big. I think that technology, when it comes to that tissue thickness feedback that I mentioned earlier, we're starting to get there. The da Vinci stapler is an amazing tool for that reason- it gives so much feedback during its firing. It literally pauses when it says, Hey, wait a minute, I just encountered tissue that's too thick, let me pause here, compress a little bit longer before I fire again. It's independently thinking of the surgeon, which is great because I have no idea how thick that tissue is. The Medtronic stapler is getting there. It's telling me a relative tissue thickness to the staple height. And it's continually telling me that feedback as I'm firing it, and on its own will slow down, but then continue with that slower rate for the rest of the firing if it encounters thicker tissue. There are other staplers who don't have any of that type of feedback. And I think that's going to leave them in the dust to be quite honest because I think it's going to be an expectation of the surgeons moving forward to have that type of technology embedded in them.

What should engineers consider when designing a stapler?

I just really hope that when industry and engineers are working together to create new devices that they're really considering every surgeon that enters the operating room and handles a piece of machinery-- because my size six hands are very different than a size 8.5 man's hands. I don't think there's any magic size that it should be, but it has to be accommodating. One thing in particular about this is that for the button to fire, it's on two sides. It's on this side, and it's over here so that I can reach it by one of them. I usually bring my thumb up for that. So having some of those options on the device make it easier for us to accommodate, no matter what size we are. Really you have to put this in a lot of different people's hands to see how it's going to feel for them. Because at the end of the day, if it doesn't feel right, the surgeon's not going to use it. Everyone's going to be reliable and have a reliable stapler. Ideally, right? But it's how

does it feel, how does it work? And what is the ease of use for the surgeon that's really going to market that tool.