

# The enigmatic esophageal anastomosis

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Esophageal reconstruction after esophagectomy remains one of the major challenges to esophageal surgery. Despite over 100 years of innovation and medical engineering since the first successful human esophagectomy, we as surgeons continue to debate the merits of individual techniques and revisions. Why? Because the long and short-term effects of esophageal resection are intimately associated with the surgical reconstruction of the foregut, much of the time surgeons spend on esophageal resection is devoted to this very topic. While in clinic we discuss with our patients the ramifications of leak and loss of the lower sphincter. A similar time commitment is dedicated to actually fashioning a relatively simple reconstruction in the operating theater. We then worry for the next several weeks over the short-term outcome. For several years later, the surviving patient will be reminded not to over-eat, not to sleep flat, and to limit meals prior to bed to avoid regurgitation that may lead to aspiration.

The literature is burgeoning with examples of failures, successes and improvements to the esophageal anastomosis. A Pubmed search on “esoph\* anastomosis” captured almost 5,400 manuscripts dating back to 1944. My teams have also contributed to that list. But none of the warnings or innovations in those publications has yet enabled us to reach the goal that we seek, a totally reliable anastomosis that will resist reflux/regurgitation.

I recall an exciting paper published by Orringer's group in 2001 describing a modification of Collard's technique of a partially stapled anastomosis (1,2). “Among 114 consecutive patients undergoing this side-to-side stapled cervical esophagogastric anastomosis using the [mechanical] stapler, the incidence of anastomotic leaks requiring drainage has been 2.6%. As a result of this more reliable anastomosis, the authors have been more comfortable with earlier hospital discharge after THE,

and these patients are now being discharged an average of 7 days after their esophagectomy”.

In 2007, our group published a retrospective look on the various intrathoracic anastomotic techniques employed at a center using predominately neoadjuvant therapy for locally advanced patients (3). At that time, our results showed a leak rate of 8.7% with side-to-side stapled, 4.3% with circular-stapled, and 4.3% with hand-sewn anastomosis ( $P=0.78$ ). Post-operative dysphagia was significantly higher in hand-sewn anastomoses at 56.5% vs. 26.1% with side-to-side stapled and 21.7% with circular-stapled ( $P=0.04$ ). Stricture requiring esophageal dilation was highest in the hand-sewn anastomosis at 34.8% vs. 8.7% with side-to-side stapled and 8.7% with circular-stapled ( $P=0.04$ ). We concluded that the circular stapled technique afforded the lower overall complication rate, but that the leak rate still required improvement.

We also recognize that there are some anastomoses at higher risk than others. One type of high-risk anastomosis is performed in the salvage resection after chemoradiation. Our salvage patients were leaking at a rate of 15% until we uniformly employed a transfer of omentum to the chest to wrap the anastomotic and gastric suture/staple lines (4). In the process of evaluating this technique we performed a post-operative swallow study on all patients, not just those that were symptomatic, and we found that we were able to reduce the leak rate to 4.6%. Better, but not perfect.

Another type of high-risk anastomosis is described by Dr. Zheng and his colleagues (5). The cervical reconstruction is at risk for leak for multiple reasons, but much of it is related to blood supply. The video presentation by Zheng *et al.* of the “Li anastomosis” is a technically adept representation of a method for performing a cervical anastomosis after

total esophagectomy with gastric reconstruction (6). The stomach is tubularized and delivered to the neck with abundant length to perform a relaxed, completely double-layered anastomosis, with the benefit of the redundant stomach used to buttress the anastomosis posteriorly and provide an inverted “pop-in” valve. The outcome of a pilot study and subsequent randomized trial showed a significant improvement in the observed leak rate from 5-11% to 1-2.8%. This level of improvement gave Dr. Li and his associates the confidence to begin feeding patients on the first post-operative day and decrease the overall hospital stays from a median of 12-7.6 days.

Of some interest, is the caliber of the conduit in the neck. The size of the conduit has been debated in both directions, smaller and larger. Akiyama, considered a master technical surgeon and esophageal innovator, performed anatomic studies describing the distribution of blood supply to the normal fundus (7). What was emphasized in his injections was the dual responsibility of the right gastric and right gastroepiploic submucosal arcades when the anastomosis was at the top of the complete stomach. Utilizing the whole stomach as a reconstruction that could reach all the way to the neck was often performed in the western patient, where gastric length seemed to be at a premium. On the other hand, in the description by Dr. Zheng the gastric tubularization begins nearly at the pylorus and this seems to deliver a narrow caliber tube with excellent length and blood supply to the neck in their video. And one that is only dependent on the right gastroepiploic arcade.

There are several aspects of the “Li Anastomosis” technique that I really appreciate. First, it is a surgeon’s anastomosis. The meticulous hand-sewn technique provides a tactile sense of confidence in the 360-degree anastomosis. Second, one should notice right away in the video that the gastric tube that has been delivered into the neck is the same pink color that one would expect if the stomach were untouched and in anatomic position. There is no edema. The ability to transport this very long, but narrow and totally pink stomach to the neck is a testament to surgical patience and experience. Really, it is probably the crucial element leading to the great outcomes presented by this group. Alternatively, mishandling of the gastric conduit will only result in delivery of a purplish, swollen gastric tip that will form leaks/strictures. Finally, the potential to decrease reflux in a group of patients with a life-time risk for aspiration is certainly a welcome advance. The inversion of the gastric tip provides protection to the gastric tip, an additional layer of protection to the anastomosis, and is

perhaps a way of creating an inverted nipple-valve at the neo esophagogastric junction

As I have a tendency to be a mid-term adopter of technology and adaptation, what do I need to know before abandoning my (nearly) trustworthy stapler? More patients and external validation would be a great next step. Orringer’s follow-up to the initial 114 patients did not maintain that initial high rate of anastomotic fidelity, nor could we reliably reproduce those initial numbers in our population of chemoradiated patients when we employed the Collard technique. Second, studies that use quality of life as a metric to suggest a decrease in reflux are excellent, and I would add that the endoscopic views and follow-up on the reflux esophagitis would provide additional evidence. Most patients who have undergone esophagectomy have moderate to severe inflammation in the esophageal remnant after a standard cervical anastomosis, and comparative histologic improvement is another way of showing less reflux over the follow-up period. Finally, there is the question of early feeding and early discharge. With a better understanding of enhanced recovery pathways, gently nudging patients to discharge around 7 days is quite standard. What I remain nervous about is early feeding. There are few long-term gains in feeding at day 0-1 compared to waiting until day 4, 7 or 10 for that matter, except that one may be able to avoid a feeding tube in a majority of patients. The opposing argument to early oral feeding is that it will lead to the occasional, very significant aspiration event. This may not turn into a statistically significant difference in outcomes when viewed over large series of patients, but it could mean the world to the individual(s) that gets into trouble.

I congratulate Dr. Zheng and his colleagues on a very nice presentation, and for the excellent results that have been presented. I am looking forward to seeing future projects from this group of innovators.

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## Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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