Editorial

Anastomotic leak: are we closer to eliminating its occurrence?

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Anastomotic leak is one of the most fretted complications in colon and rectal surgery and its occurrence carries a significant degree of morbidity and mortality for affected patients. Given the degree of harm this complication causes patients, a significant amount of work has been done in the field to identify factors associated with anastomotic leak in an effort to minimize both its occurrence and associated morbidity. In their manuscript, Dr. Eto *et al.* present their experience with standardization of surgical techniques at their institution and its effect on improving anastomotic leak rates (1). Their approach of prioritizing laparoscopic surgery, triangular anastomosis and diverting ileostomy for low anastomoses to attempt to decrease leak occurrence is laudable. Their results show further evidence (2) that anastomotic leak is likely multifactorial; impacted by patient, disease, treatment, and surgeon factors. With this in mind it is important to make every effort to minimize or manage risk in each category in order to avoid a postoperative anastomotic leak.

Historically anastomotic leak rates are estimated at approximately 1–3% for ileocolic reconstructions, 6–12% for left colon reconstructions, and 3–19% for colorectal anastomosis (3,4). For colorectal reconstructions, anastomotic leak can vary by the level of anastomosis. Colorectal anastomosis below 5cm is associated with increased leak rates and many will consider diverting ileostomy at this level even in the absence of other anastomotic leak risk factors (5). Minimizing the occurrence of anastomotic leaks has been common aim in practice throughout modern surgical history. In 1826, Antoine Lembert described suturing techniques aimed to minimize this dreaded complication (6). Ongoing work in hand sewn anastomoses confirmed the efficacy of a single layer closure with one RCT finding its superiority compared with two-layer closure in low colorectal anastomoses (7). Surgical staplers are another common method for creating an anastomosis between two limbs of bowel. Since their initial introduction to the United States by Dr. Mark Ravitch, who was impressed with the technology he had witnessed in USSR, surgical staplers have truly evolved to fit the needs of many types of surgery (8). Today both hand sewn and stapled techniques continue to be used. Stapled anastomoses can be performed with reliable reproducibility and are associated with decreased operative time. With regards to anastomotic leak, stapled anastomoses have been shown to have equivalent outcomes to handsewn in most series while some have shown a benefit with regards to leak rates (4).

Beyond investigating the materials used to create the anastomosis, anastomotic configuration is another surgeon-controlled variable, which may or may not impact leak rates. End-to-end, end-to-side, side-to-end, and side-to-side are all configurations in which to bring two ends of bowel together following a resection. Each technique has its purported advantages and disadvantages. Anatomic constraints within the pelvis typically prohibit side-side anastomoses. Additionally, transanal staplers provide a reliable and reproducible method of anastomosis that favors either and end-to-end or side-to-end configuration. In 1950 Dr. Joel Baker formally described his preference for a side to end anastomosis for reconstruction following proctectomy (9). This side to end configuration has been associated with decreased leak rates compared to straight colorectal anastomosis, though it is worth noting the leak rate in the straight cohort in that study was

significantly higher than most series (10). For low colorectal anastomoses, colonic J pouch has many proponents. This technique has been demonstrated to improved functional outcome when compared with straight anastomosis with regards to bowel movements per day and patient satisfaction (11). Interestingly the creation of a colonic J pouch may confer benefits of decreased anastomotic leak as well (12,13). The hypothesis for this decrease in pelvic septic complications is suggested to be improved blood supply and a reduction in dead space surrounding the anastomosis. Blood supply has recently emerged as a measurable factor potentially influencing leak rates. Several prospective trials are now underway to answer the question.

In the minimally invasive surgical era, questions have arisen if rates of anastomotic leaks have been affected. Laparoscopic sigmoid colectomy has been associated with decreased rates of anastomotic leak when compared with open sigmoid colectomy (14). However, these results have not been seen in most prospective trials comparing open to minimally invasive approaches to colon cancer or rectal cancer (15-18). Comparing laparoscopic to robotic approaches, again leak rates are comparable between the two techniques (19). It should be mentioned that none of these trials were specifically designed to look at anastomotic leak as a primary outcome, though the similarity of the rates in each study suggest the operative approach is likely not a driving factor. Also of interest, most trials comparing laparoscopic and open approaches to colon resection, the anastomotic technique is largely the same between the two groups. In each study arm the bowel is extracorporealized and the anastomosis created outside the body (20). Prospective randomized trials comparing intracorporeal to extracorporeal anastomotic techniques are scarce. Available data predominantly examines outcomes of laparoscopic right colectomy, which historically have a significantly lower leak rate than left sided anastomoses. A meta-analysis comparing the two showed no difference in leak rates between intra- and extracorporeal techniques, though other benefits exist for intracorporeal anastomosis (21,22). Fluoresence imaging is an emerging modality that can be used during surgery to confirm colon perfusion prior to anastomosis; this technique has been shown to be feasible during colon and rectal surgery and ongoing work will determine its role in reducing leak rates (23).

The manuscript presented by Dr. Eto details their experience of standardizing surgical practices in their institution and its effects on anastomotic leak (1). What is well delineated in their work is a dramatic decrease in anastomotic leak rates in the late compared with the early study period. It is unclear though that these results are truly attributable to laparoscopic approach, triangular anastomosis, or diverting ileostomy for colorectal anastomosis. Many factors, such as surgeon experience, bowel preparation changes, and enhanced recovery pathways to name a few, can change over time and influence results. This is particularly relevant when comparing a current cohort against historical controls. It would be surprising for a laparoscopic approach to confer such an advantage in reduction of anastomotic leak in this series as it has not been the case in multiple prospective trials as described above. As the authors state, bias may play a role in this study as the decision to perform either an open or minimally invasive resection rested with the operative surgeon. It is possible that that decision lead to more at risk patients ending up in the open cohort. With regards to defunctioning ileostomy, the authors do not describe the decision analysis that drove the decision to divert. Not all colorectal anastomoses require diversion and even in this study only 35.8% of the colorectal anastomoses in the late group were diverted. A discussion on the factors that influenced that decision to divert would have been informative for the reader. In the current study, the authors have been able to markedly increase the use of triangular anastomosis in their division, though interestingly, they state they did not identify triangular anastomosis as being an independent predictor of reducing anastomotic leak on multivariate analysis. Likely, to truly confirm this anastomotic configuration confers a protective advantage, a prospective trial comparing triangular anastomosis to other techniques would be necessary. Overall the authors present a reduction in their leak rates over time, though it remains unclear that it is related to the adoption of techniques described.

Similar to this paper, the history of the study of anastomotic leaks has led to a number of beliefs, but to date most of them have lacked adequately conducted trials of adequate size as well as lack of reproducible results when studied by other groups. The standardization of operative technique is attractive, and many surgeons adhere to that approach. The problem with that approach is that one size often does not fit all; the ability and option of varying that standardized approach to suit the patient demands or situation is also important. The quest to eliminate anastomotic leaks from surgical practice remains ongoing. Many patient related factors that affect anastomotic healing remain difficult to control, though knowledge of these

factors can aid in appropriate preoperative counseling and intraoperative decision making. Surgeon related factors continue to be debated. Surgeons will likely continue to debate technical aspects aimed at reducing leak rates, though in the absence of prospective randomized trials these debates will likely continue to not provide firm answers.

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