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EAST MULTICENTER STUDY

Colorectal resection in Emergency General Surgery – To anastomose, or not to anastomose

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Background:

Emergency general surgery (EGS) patients undergoing urgent/emergent operations with gastrointestinal resection have high complications rates. Anastomotic failure (AF) has a mortality rate approaching 40% in some series, making it one of the most dreaded complications following colon resection[1–4]. AF also has adverse effects on length of stay and cost of hospitalization, can lead to a permanent stoma, may require unplanned re-operation or percutaneous drain placement, and is associated with increased rates of wound complications and diminished quality of life. Even when the anastomosis is salvaged, inflammatory changes may result in poor functional outcome, anastomotic stricture, and decreased long-term survival. The incidence of AF varies widely depending on the type of anastomosis, its distance from the anal verge, and the indication for bowel resection[1]. Fecal diversion by end or loop ileostomy or colostomy is a means of protecting an anastomosis or avoiding anastomosis entirely. Unfortunately, fecal diversion comes at the expense of complications including dehydration, peristomal dermatitis, prolapse, and parastomal hernia formation. These complications occur in up to 75% of patients depending on stoma type[5–8], with nearly 20% of patients requiring hospital admission[9], making this an increasingly important issue as financial penalties for hospital readmissions are increasingly common. Further complications may be amassed at stoma reversal, with morbidity reported in the range of 10-50%, with the highest rates in patients with end colostomy[5,7,8,10]. In the trauma population, most advocate that in the absence of the most severe and devastating wounds, primary anastomosis should be performed[11,12], with the caveat

that in a severely injured patient, AF can easily become a lethal event. Primary anastomosis in the EGS patient requiring colon resection has anecdotally fallen out of favor; however, significant morbidity exists with diverting ostomies and their reversal, which may be worse in this population given the potential for generalized peritonitis at time of operation, bowel wall edema, and, often numerous, medical comorbidities such as tobacco use, obesity, and steroid intake.

A recently published prospective multicenter trial sponsored by the American Association for the Surgery of Trauma (AAST) illustrated that overall, urgent/emergent bowel resection and anastomosis in EGS patients had a failure rate of 12.5%, with nearly twice the rate for colo-colonic anastomoses (23%), and a 22% failure rate in patients managed with an open abdomen[3]. This study primarily involved small bowel resections and anastomoses (72%) and excluded patients with fecal diversion, thereby failing to evaluate the ideal management of the EGS patient requiring colon resection. Other groups have found similar, or lower, AF rates in predominately elective, oncologic colorectal surgery, with scarce prospective data in the EGS population[1,5,13–17]. The goal of this study is to evaluate outcomes in the EGS patient requiring urgent/emergent colon resection, with a specific focus on the comparison of patients undergoing anastomosis versus fecal diversion. Through a prospective multicenter assessment, we hope to gain a better understanding as to how best optimize outcomes in this complicated patient population. We hypothesize that primary anastomosis is associated with higher rates of perioperative morbidity/mortality and that fecal diversion improves overall mortality, decreases length of stay, and lowers rates of surgical complications requiring unplanned operative intervention.

Specific aims:

Primary Aim:

Define the early postoperative morbidity and mortality of EGS patients undergoing colon resection in the urgent/emergent setting, with a specific focus on the comparison of patients undergoing colonic anastomosis versus diversion.

Secondary Aims:

1. Compare discharge needs for EGS patients undergoing colon resection with anastomosis versus those undergoing resection with stoma creation.

2. Evaluate anastomotic and stoma complications in EGS patients managed with an open abdomen and staged gastrointestinal reconstruction.

3. Evaluate and validate the new AAST EGS organ-specific disease grading scale[18] in patients undergoing colon resection for EGS specific pathologies.

4. Evaluate the rate of anastomotic failure in patients undergoing handsewn versus stapled colonic anastomoses.

This study is: prospective

Study population:
Inclusion criteria: All patients undergoing urgent/emergent colon resection (less than 24 hours after decision to operate) by an acute care surgeon will be enrolled.

Exclusion criteria: Exclusion criteria include elective operations performed by acute care surgeons within 24-hours of the decision to operate (*e.g.,* scheduled resection of non-obstructed, non-perforated malignancy), prisoners, pregnancy, wards of the state, patients less than 18-years of age, traumatic mechanisms of injury, and death within 24-hours of index operation.

Therapeutic interventions: This is a prospective observational study. The decision to perform proximal diversion or anastomosis is solely the responsibility of the managing acute care surgeon. No guidelines or protocols will be suggested so as to avoid any influence on practitioner decision-making.

Consent procedures: As patients will be managed according to institutional patient management protocols, waiver of informed consent is requested. Data will be recorded on a data collection sheet and transferred to a secured database that is devoid of patient identifiers.

Primary outcomes: The primary outcome will be perioperative mortality and need for unplanned procedural intervention (intervention by a surgeon, radiologist, or interventional radiologist).

Secondary outcomes: Secondary outcomes will examine indication for index operation, surgical site infections (superficial, deep-incisional, organ space), operative time, bowel obstruction, stoma complications (necrosis, prolapse, retraction), intensive care unit and hospital length of stay, need for nutritional support or antimotility agents upon discharge, and discharge disposition.

Data collection: Each institution will prospectively collect data points (demographics, management variables, outcomes) on a standardized form. Patient follow-up will be through discharge from the hospital. Investigators at each institution will enter the collected data into the Research Electronic Data Capture (REDCap) portal. REDCap is a data collection tool that relies on a thorough study-specific data dictionary designed by the PI of the study. REDCap was developed specifically around HIPAA-Security guidelines and is implemented and maintained according to University of Maryland guidelines. Accordingly, REDCap servers are securely housed in an on-site limited access data center. All web-based information transmission is

encrypted. The data is all stored on a private, firewall-protected network. All users are given an individual user ID and password and their access is restricted on a role-specific basis.

Data analysis: Risk factors for anastomotic and stoma complications will be assessed using univariate and multivariable analysis. Continuous variables will be compared using Student's t-test for normally distributed variables and Mann Whitney U-test for non-parametrically distributed variables. All tests will be two tailed. Time to events will be reported as median and interquartile ranges and analyzed using Kaplan-Meier survival curves. Chi-squared and Fisher's exact tests will be used to compare categorical variables. All variables with a *P*-value < 0.2 on univariate analysis will be entered into a multivariable logistic regression analysis to identify independent risk factors for anastomotic failure and development of complications. Data will be reported as adjusted odds ratios with 95% confidence intervals. A *P*-value < 0.05 will be considered statistically significant. Overall morbidity will include both surgical and medical complications. The overall morbidity will be reflective of the number of patients who had at least 1 complication; that is, patients with more than 1 complication will only be counted once. The Principal Investigator at the University of Maryland Medical Center will procure and analyze the data, which will then be distributed for review by all co-authors. Statistical analyses will be performed in conjunction with a statistician at the R Adams Cowley Shock Trauma Center.

Sample size & power estimates: Given the lack of data regarding the management of patients after colon resection, our sample size and power estimates are largely based on our clinical experience, the previously cited AAST trial[3], and literature from trauma and elective practice. We have performed power analyses with the assumption that 2-3 times as many patients will undergo fecal diversion as primary anastomosis with a difference in mortality and need for unplanned procedural intervention of 8-20%, we anticipate needing up to 100 patients with anastomosis and 275 with diversion to achieve a power of 90% and an alpha value of 0.05 with a standard deviation in each group of 20%.

2:1 ratio diversion : anastomosis

Diversion (n)	Anastomosis (n)	Expected difference
198	99	8%
88	44	12%
32	16	20%

3:1 ratio diversion : anastomosis

Diversion (n)	Anastomosis (n)	Expected difference
264	88	8%
117	39	12%
42	14	20%

Potential limitations: The conclusions that can be drawn from this study will be limited by its design as a prospective study. This introduces inherent bias in choosing operative management. Additionally, some instances of AF may be influenced by technical failure, which will impact our results and is difficult to measure or control for.

Risk/benefit analysis: This study involves no more than minimal risk to patients. There is no benefit for the subjects who have already undergone treatment. There is a potential future benefit if we can accurately define patients at "high risk" of complications from primary

anastomosis or fecal diversion. If patients at risk for complications can be identified in advance, variations in surgical practice and close postoperative monitoring may reduce future morbidity/mortality.

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