



Surgical Time is A Risk Factor for Colorectal Surgery Anastomosis Dehiscence

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How to citation this article: Jaqueline Guillen-Martinez, Jose F. Rodriguez-Salinas, Itzel G. Garcia-Felix, Eduardo I. Vega-Chavarria, “Surgical Time is A Risk Factor for Colorectal Surgery Anastomosis Dehiscence”, IJMACR- November - 2024, Volume – 7, Issue - 6, P. No. 132 – 139.

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Objective: To determine if prolonged surgical time is a risk factor for the incidence of anastomotic dehiscence in patients undergoing colorectal anastomosis.

Material and methods: This is an observational, analytical, retrospective, non-experimental cohort study in patients with anastomoses in colorectal surgery between the period from January 2022 to January 2024. They are described in means, standard deviations, medians and interquartile ranges

Results: Anastomotic dehiscence occurred in 20% of surgeries lasting less than 180 minutes and in 21% of those lasting more than 180 minutes ($p = 0.889$).

However, a significant association was found between surgical history and the presence of anastomotic dehiscence ($p = 0.009$). Conclusion: No significance was found between prolonged surgical time and anastomotic dehiscence. However, the study demonstrated a risk in patients with a history of two or more previous surgeries, so prevention measures could be suggested in the future.
Keywords: colorectal surgery, surgical anastomosis, surgical time.

Introduction

Colorectal surgery in our country due to various benign and malignant conditions such as colorectal cancer with an incidence of 15,000 cases during the year 2023, as

well as inflammatory bowel disease, intestinal obstruction, complicated diverticular disease, trauma and ischemia frequently require intestinal resection and anastomosis to ensure gastrointestinal continuity ¹. Colorectal anastomoses have been performed since the 19th century, starting with manual procedures; however, since the 1960s, Steichen and Ravitch have used stapling devices, reducing the difficulty of the procedure, the duration of the surgery and the stress experienced by surgeons. During the last 200 years, the improvement in medical suturing materials and surgical techniques have allowed it to evolve from a potentially fatal surgery to a safe and highly demanded procedure ². A correctly performed anastomosis optimizes results, reduces complications, decreases prolonged hospital stay, reinterventions, diverting stomas, stenosis and even mortality, therefore a meticulous tension-free tailoring, subsequent assessment of tissue integrity and reperfusion are vital. Risk factors for the emergence of complications may be modifiable and non-modifiable, body mass index, American Society of Anesthesiology score, and factors specific to the pathologies such as tumor size and location have been studied, however, these cannot be easily modified ³. Intestinal anastomoses are the union created between two previously sectioned segments with the aim of restoring intestinal transit. The main complication of colorectal surgery is anastomotic leakage, which refers to the communication between the lumen of the hollow viscera and the peritoneal cavity at the anastomotic level ⁴. They are diagnosed within the first two weeks after surgery, however, in some cases a late anastomotic leak could be diagnosed after 30 days of surgery ⁵. The incidence is up to 20% and the associated mortality rates range between 10% and 20%. In addition, a 2% risk of leakage in mid to high colorectal

anastomosis was documented ⁶. And between 2% and 7% when the surgery is performed by experienced teams. This incidence has not decreased in the last 50 years despite advances in surgical techniques and preoperative care ⁷. Multiple risk factors have been identified that affect the incidence of anastomotic dehiscence. These could be classified as preoperative, intraoperative and perioperative ⁸. Preoperative: Male gender represents an important risk factor for developing this complication and this is due to technical difficulties, mainly when creating a colorectal anastomosis in the narrow pelvis. In addition, androgen levels may play a key role in intestinal microcirculation, which eventually poses a challenge for the healing of anastomoses. Likewise, smoking is correlated with an increased risk of dehiscence due to tissue ischemia from vasoconstriction associated with nicotine and microvascular disease, defining as intense smoking more than 40 packs per year, likewise the increased alcohol consumption, more than five drinks per day is closely related to postoperative complications. Underlying chronic diseases such as diabetes mellitus, renal failure, immunosuppression, pulmonary and cardiovascular diseases were also considered important risk factors impacting the anesthetic risk assessment of the American Society of Anesthesiology in grades III and IV for these cases ⁹. Obesity with a body mass index greater than 30 kg/m² is associated with a higher risk of failure, especially in low colorectal anastomoses, as well as visceral adiposity is related to a prolonged operative duration and higher rates of conversion to open surgery. During the preoperative evaluation, albumin and serum protein levels have been used as predictors of anastomotic leakage, however, these studies are not reliable. This may be due to nutritional supplementation

after the surgical event, which corrects nutritional deficiencies and thus the impact of these markers on intestinal healing¹⁰. The intestinal microbiome directly influences the healing process of the new union. During surgery, tissue ischemia and reperfusion allow bacterial translocation and affect the composition of the local microbiome, increasing the amount of pathogens such as *Escherichia coli* and *Enterococcus faecalis*, as well as the decrease in *Lactobacillus* colonies in the ileal and colonic segments at 6 hours postoperatively.

Intraoperative: Some ways to assess the integrity of intestinal anastomoses and detect dehiscences during surgery are air leak tests, dye solutions, intraoperative endoscopy and assessment of perfusion at the anastomotic site, feeling that dye solutions are more sensitive to detect intraoperative leaks than the air test, in case of a positive dye leak and a negative pneumatic test can be treated only with suture reinforcement¹¹. The most important intraoperative predictive factor is the distance from the anal verge to the new union, which means that, the shorter the distance between them, the higher the risk of leakage, reporting a leak rate 3.4 times higher for anastomoses located less than 5 cm from the anal verge. In patients with two or three proven risk factors, the creation of a protective stoma should be considered in cases of low rectal anastomosis⁷. Statistical differences in the strength of the anastomosis with circular, linear or manual suture stapling devices are controversial. A retrospective study conducted in Denmark demonstrated a 50% increase in leakage after stapled anastomosis vs. manual suture¹². Regarding the choice of staplers, the double stapling technique has a lower burst pressure than triangular anastomoses, which reduce the risk of leakage in cases of colon cancer. In addition, reinforcing suture and three-row stapling have

no effect on the strength of the anastomosis. Therefore, the clinical impact in patients with anastomosis with manual suture is less than in patients where a stapling system was used¹³. The vascular perfusion of the anastomosed segments is directly related to the healing of said site, traditionally visual inspection of the tissue, arterial bleeding at the sectioned edge of the enterotomy or pulsation of the blood vessels are used, however, today there are techniques such as Doppler flow measurement. transmural that inversely correlates the risk of leakage. During the healing process the tension of the union site decreases the submucosal flow to the anastomosis, so the segments must be able to overlap without pulling during surgery, however during coloanal, ileal anastomoses and in extended left colectomy the lack of stretching of the mesentery limits the extension, increasing the tension and thus raising the risk of dehiscence, so it is suggested to perform the Deloyer maneuver mobilizing the right and transverse colon preserving the vascular pedicles¹⁴. Many factors influence the duration of colorectal surgery, the type of open or laparoscopic surgical approach, the experience of the medical team and the quality of the adhesions. Increasing the transoperative time in addition to the risk of bacterial exposure and tissue damage causing ischemia and subsequently sepsis. Likewise, prolonged operating time defined as that greater than 180 -200 minutes, operations had an impact on the length of hospital stay and the greater number of complications¹⁵.

Perioperative: Starting enteral nutrition early during postoperative recovery increases regular bowel movements, improves microcirculation and tissue reperfusion, and decreases the growth of pathogenic bacteria, restoring intestinal function and reducing hospital stay¹⁶. The clinical presentation may begin with

nonspecific symptoms; fever, pain, purulent drainage or signs of peritonitis, relating moderate or intense pain as a predictor of dehiscence, especially during the first postoperative day. The diagnosis of anastomotic leak usually occurs during the first two weeks after surgery between days 7 and 12 or even after day 30¹⁷. A high level of suspicion early on by the medical service increases the effectiveness of treatment. There are serum markers associated with the risk of leak such as C-reactive protein, white blood cell count and procalcitonin that, if elevated, suggest the need for further diagnostic imaging tests¹⁸. Abdominal CT is the most commonly used technique for diagnosis. Compared with oral contrast, rectal contrast enema has a higher sensitivity, therefore it should be considered the anastomoses of choice in post-surgical colorectal surgery patients. Classification: 50% of intestinal anastomoses are performed in the large intestine, with the colorectal anastomoses having the highest leak rate (4-26%), the ileocolic anastomoses (1-4%), the colo-colonic anastomoses (2-3%), the ileorectal anastomoses (3-7%) and the ileal pouch anastomoses (4-7%)¹⁹. Various world organizations have classified anastomotic leaks by the size of the defect when the gap is less than or greater than 1 cm, however the International Study Group on Rectal Cancer proposed a scale based on radiological studies in 2010; Grade A leaks detected in radiological studies, discrete clinical alterations and not requiring therapeutic intervention, Grade B leaks requiring medical management, antibiotics or percutaneous drainage and Grade C leaks associated with peritonitis and systemic inflammatory response syndrome and also requiring surgical intervention including derivative procedures.²⁰ Treatment should be carefully selected due to the rapid progression of septic shock, however in

patients with severe generalized peritonitis medical treatment will be insufficient, while surgical treatment should be individualized for each patient and in case of a high degree of tissue inflammation it is prudent not to injure them, limiting oneself to surgical drainage. In cases of dehiscence greater than 2/3 of the circumference, a proximal diverting stoma with distal closure can be made. However, if the patient is hemodynamically stable and the resources are available, resection of the affected segment and redoing the anastomosis may be chosen. The use of local drainage after anastomotic leak has been studied, preserving the primary anastomosis in 50% of cases²¹. Colorectal surgery is associated with a hospital stay of 8 days for open surgery and 5 days for laparoscopic surgery, however complications increase supplies, costs and hospital stay, a readmission rate of 35.4% has been documented even with improvement in the surgical procedure, anastomotic dehiscence remains the most frequent complication accompanied by intra-abdominal abscesses, peritonitis, sepsis and thus increasing hospital morbidity and mortality. The most frequent long-term complications are deterioration of pelvic organ function, in oncological cases the increase in local recurrence and permanent stoma thus achieving a worse prognosis and quality of life in patients with colorectal pathologies.

Material and methods

This is an observational, analytical, retrospective, non-experimental cohort study in patients undergoing anastomosis in colon and rectal surgery in the period from January 2022 to January 2024. The sampling is non-probabilistic, for consecutive cases. The IBM SPSS statistical package, version 20.0, was used.

Inclusion criteria: Patients over 18 years of age with colorectal anastomosis performed from January 2022 to January 2024.

Exclusion criteria: Patients who underwent colorectal anastomosis with a protective stoma and Death of the subject during the surgical procedure.

Elimination criteria: Patients whose record is incomplete.

This research study was conducted in accordance with internal institutional regulations, the ethical standards of the Regulations of the General Health Law on Research and the Declaration of Helsinki as last amended by the General Assembly in October 2013, as well as current international codes and standards of good clinical research practices. Patient confidentiality was preserved for the sake of care, safety, and well-being. The principles contained in the Tokyo Amendment, the Nuremberg Code, the Belmont report, the procedure for the evaluation, registration, monitoring, amendment, and cancellation of research protocols submitted to the local health research committee and the research ethics committee 2810-003-002 of 2018, and the United States Code of Federal Regulations were respected and is authorized by the ethics committee.

Results and Discussion

Of the 63 patients who met the inclusion criteria, 36% presented anastomotic leakage as a postoperative complication, slightly higher than the international average, which reports 26% in the large intestine. The other complications observed were residual abscess (4 cases), surgical site infection (1 case), and inadvertent injury (1 case). Likewise, 56% of the patients had some comorbid disease, with type 2 diabetes mellitus standing out with a frequency of 66%; however, descriptive observational studies report that pulmonary disease is

the most frequent worldwide, with 29% of patients (19). In the described literature, the operating time of more than three hours is closely related to anastomotic leakage ($p=0.04$) (9), but in the present study, anastomotic dehiscence occurred in 20% of surgeries lasting less than 180 minutes and 21% in surgeries lasting more than 180 minutes, therefore there are no significant differences between both groups ($p=0.889$).

In this highly specialized medical unit, 92% of the surgeries were previously scheduled and evaluated, assigning 79% of patients as mild or controlled systemic diseases, i.e. ASA II. As in the global statistics, there is a higher prevalence of leakage in patients with a history of colon cancer, representing 19.4%, while in this study the prevalence was 33.3% followed by diverticular disease (25.4%), IBD (7.9%) and FAP (6.3%). In Denmark, a 50% increase in anastomotic leakage was demonstrated after the use of mechanical staplers (12). Of the patients studied with mechanical anastomosis, only 17% presented dehiscence, while, in patients with manual anastomosis, dehiscence occurred in 40%. However, a significant association was demonstrated between surgical history and the presence of anastomotic dehiscence ($p = 0.009$) in patients with two or more previous procedures, so this variable could be studied to decrease the incidence rate in this highly specialized hospital. Finally, limitations were identified in this study, since in the medical unit, transoperative colonoscopy is not performed to verify anastomotic quality, which could benefit an early diagnosis of leakage.

Conclusion

Within elective surgeries, the rate of anastomotic leak in colorectal surgery is higher in our highly specialized center than the international average. Of the risk factors

studied, no significance was found between prolonged surgical time and anastomotic dehiscence, so a modification of this factor could not be suggested. However, the study showed a higher risk in patients with a history of two or more previous surgeries, so in the future preventive measures could be suggested for this study variable.

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Legend Tables:

Table 1: Comorbidities in patients undergoing colorectal surgery

Comorbidities	n	%
Type 2 diabetes mellitus	23	66
Systemic arterial hypertension	11	31
Lung disease	1	3

Regarding personal pathological history, these were the most frequent comorbidities.

Table 2: Diagnoses in patients undergoing colorectal surgery.

Diagnosis	n	%
Colon cancer	21	33.3
Diverticular disease	16	25.4
Inflammatory bowel disease	5	7.9
Polyposis familial adenomatous	4	6.3
Colovesical fistula	4	6.3
Gunshot wound	3	4.8
Bowel disruption due to hysterectomy	2	3.2
Complicated appendicitis	2	3.2
Acute Abdomen	1	1.6
Sigmoid volvulus	1	1.6
Bleeding from the digestive tract	1	1.6
Megacolon	1	1.6
Fournier's gangrene	1	1.6
enterocutaneous fistula	1	1.6

In an analysis of recent medical diagnoses, colon cancer was identified as the most prevalent condition, representing 33.3% of cases, followed by diverticular disease with 25.4%.