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Dehiscence of anastomosis. What to do and gastrointestinal what not to do

Dehiscencia de anastomosis gastrointestinal. Qué hacer y qué no hacer

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ABSTRACT

Dehiscence of the anastomosis is one of the worst complications that can occur after resection of the digestive tract that increases morbidity, mortality, time of hospital stay, and the costs of care in an important way. Anastomotic dehiscence produces nonspecific symptoms and pain that should not be considered as a cardinal symptom because it is very difficult to make a difference between the usual postoperative pain caused by peritonitis secondary to anastomotic leakage; it is also possible to find alterations in vital signs mainly in the respiratory rate and heart rate. The diagnosis requires a high index of suspicion in a patient with an unusual evolution. The differentiation of the concepts of the dehiscence of anastomosis and fistula must be taken into account. The present systematic review integrates contributions in the incidence and risk factors, classification, prevention, and treatment.

RESUMEN

La dehiscencia de anastomosis es una de las peores complicaciones que se pueden presentar después de una resección del tubo digestivo que aumentan la morbilidad, mortalidad, tiempo de estancia hospitalaria y costos de atención de manera importante. La dehiscencia de anastomosis produce síntomas inespecíficos y el dolor no debe considerarse como síntoma cardinal debido a que es muy difícil hacer diferencia entre el dolor postoperatorio habitual del ocasionado por peritonitis secundaria a fuga anastomótica; también es posible encontrar alteraciones en signos vitales principalmente en la frecuencia respiratoria y la frecuencia cardiaca. El diagnóstico requiere un alto índice de sospecha en un paciente con evolución inusual. Hay que tener en cuenta la diferenciación de los conceptos de dehiscencia de anastomosis y fístula. La presente revisión integra aportes a la incidencia y factores de riesgo, clasificación, prevención y tratamiento.

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INTRODUCTION

Anastomotic dehiscence (AD) in the gastrointestinal tract is one of the most feared complications by significantly increasing morbidity, mortality, length of hospital stay, and costs of care. AD produces non-specific symptoms. Pain should not be considered a cardinal symptom. It is difficult to differentiate usual postoperative pain from pain caused by peritonitis secondary to anastomotic leakage. Most of the time, diagnostic suspicion is based on the experience of the surgeon and the unusual evolution of his patient.

DEFINITION

Currently, there is a definition and criteria established for the diagnosis of biliary leakage, pancreatic fistula, and colorectal leakage[1] when referring to gastrointestinal tract anastomoses, the conceptual difference between anastomosis dehiscence and gastrointestinal fistula must be clearly stated.

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AD is defined as the partial or total loss of continuity in an anastomosis, or very close to the suture line, resulting in a lack of airtightness and communicating the interior of the digestive tract with the extraluminal space,[2] which usually generates clinical manifestations in varying degrees that put the patient's life at risk and requires medical intervention consistent with the severity of the case;[3] in contrast, fistula refers to communication between adjacent organs or the external environment using an epithelialized pathway whose formation process requires a stabilization time following AD, usually from eight to 30 days. The concepts of fistula and dehiscence are different and ordinarily one could consider that a fistula is the chronic form of AD or that a fistula is always preceded by an AD.

INCIDENCE AND RISK FACTORS

The incidence of anastomotic leakage varies according to the anatomical site and is due to differences in bacterial load, vascular supply, stress on the anastomosis, and patient-specific factors such as a history of radiation therapy, type 2 diabetes, chronic steroid use, and others.[4] *Table 1* shows the results of the study published by Turrentine et al.[5] in which 2,237 patients with anastomotic leakage were included; clinical aspects associated with the sample were studied in terms of prevalence and mortality, and an increase was observed in days of hospital stay in patients with AD (13 versus 5 days), frequency of reoperations (45.8% versus 4%), and greater frequency in men than in women (6.2% versus 3.9%).

Table 1: Mortality associated with anastomosis dehiscence.[5]

Anatomical site	Leak (%)	Mortality at 30 days with DA (%)	Mortality at 30 days without AD (%)
Esophagus	13.5	16.7	2.6
Stomach	1.6	0.0	1.0
Small bowel	5.5	15.0	5.2
Colon	6.0	2.5	2.4
Rectum	7.0	0.0	0.0
Pancreas	12.0	16.7	5.7

Kiran and collaborators describe a multivariate analysis of the different factors that could lead to an anastomotic leakage *(Table 2)*.[6]

Trencheva et al.[7] studied 616 patients undergoing colorectal surgical procedures and found AD in 5.7% (35/616) of the cases. The risk factors they identified were: anastomosis less than 10 cm from the anal margin (AM), with 13.9% of AD compared with 3% of anastomosis performed more than 10 cm from the AM, which is explained by the need to section more blood vessels to mobilize the colon to the pelvis. High ligation of the inferior mesenteric artery increased the risk of AD by 3.8 times; the male gender presented greater AD because the pelvis is narrower and makes the procedure more difficult. Other factors that influence prevalence are metabolic complications in the transoperative[4] that increase the risk 4.1 times (hemoglobin O_2 saturation < 90%, hypotension < 20% of basal, pH < 7.3, bleeding that has required transfusion, acute myocardial infarction, mean blood pressure < 60 mmHg or systolic pressure < 85 mmHg that required the administration of volume or vasoactive drugs). Prevalence also increases in patients with more than three points on the Charlson comorbidities scale (CCS) *(Table 3)*.[8]

DIAGNOSIS

The medullary aspect of gastrointestinal tract surgery is to avoid denying the possibility of being in the presence of a DA to initiate the diagnostic protocol and treat the patient on time. Karliczek and colleagues have shown that this is an inconvenient situation since when the surgeon was asked to predict AD based on his experience, the sensitivity for predicting leakage in anastomosis performed at < 15 cm from the AM was 62% and the specificity 52%, while for anastomosis performed at > 15 cm from the AM the sensitivity was 38% and the specificity 46%.[9]

A) Clinical manifestations

Semiology in AD cases is imprecise, the usefulness of vital signs in an AD is modest and simplifying the diagnosis of AD to a single element of the clinical picture is inappropriate.

Table 2: Multivariate analysis related to the type of colon preparation in surgery.[6]

Variable	Univariate analysis		Multivariate analysis	
	OR ($IC_{95\%}$)	p	Adjusted OR ($IC_{95\%}$)	p
Mechanical preparation of the colon		< 0.0001		0.026
MBP +/antibiotic+	0.45 (0.32-0.64)	< 0.0001	0.57 (0.35-0.94)	0.026
MBP +/antibiótic-	0.77 (0.59-0.99)	0.049	1.05 (0.72-1.54)	0.79
No preparation/antibiotic- (reference)				
Race/ethnicity (white)	1.16 (0.77-1.73)	0.48	1.33 (0.76-2.35)	0.32
BMC (≥ 30 kg/m^2)	1.20 (0.94-1.54)	0.13	1.11 (0.78-1.58)	0.55
ASA (≥ 3)	1.23 (0.97-1.55)	0.09	1.20 (0.83-1.74)	0.32
Functional status		0.89		0.77
Partially dependent	0.87 (0.32-2.36)	0.78	0.70 (0.16-3.00)	0.63
Totally dependent	1.48 (0.20-11.09)	0.7	1.80 (0.21-15.69)	0.59
Independent (reference)				
High blood pressure	0.91 (0.72-1.15)	0.44	0.84 (0.59-1.19)	0.33
Dyspnea	1.10 (0.71-1.71)	0.68	1.48 (0.86-2.54)	0.15
Previous sepsis	1.18 (0.52-2.69)	0.7	1.05 (0.32-3.39)	0.93
Ascitis	N/A*	N/A	N/A	N/A
Use of steroids	0.99 (0.62-1.59)	0.96	1.13 (0.62-2.06)	0.68
Coagulopathies	1.22 (0.66-2.25)	0.53	0.92 (0.39-2.17)	0.84
Disseminated cancer	1.21 (0.74-1.97)	0.45	1.23 (0.69-2.20)	0.5
Transfusions	0.62 (0.15-2.55)	0.51	N/A	
Infection of previous wounds	1.61 (0.74-3.47)	0.23	1.22 (0.42-3.54)	0.71
Laparoscopy	0.63 (0.50-0.80)	0.002	0.67 (0.47-0.95)	0.024
Hematocrit, %	1.02 (0.99-1.04)	0.15	1.04 (1.01-1.08)	0.018
Lymphocytes, × 10^9/l	1.04 (1.00-1.07)	0.034	1.02 (0.97-1.07)	0.51
Creatinine, mg/dl	1.04 (0.84-1.29)	0.71	1.25 (0.99-1.58)	0.064
Albumin, mg/dl	0.87 (0.68-1.12)	0.27	0.85 (0.61-1.17)	0.31
Colon vs. rectum	0.67 (0.52-0.85)	0.001	0.61 (0.43-0.87)	0.006
Total surgical time (≥ 180 min)	1.61 (1.27-2.04)	< 0.001	1.63 (1.16-2.30)	0.005

Most patients undergoing surgery of the gastrointestinal tract will present some degree of alteration in vital signs (polypnea, fever, tachycardia, hypotension) especially in the early postoperative days; However, in patients with AD these alterations are more accentuated and do not show a tendency towards normalization as in uncomplicated cases; the persistence of tachycardia (> 90 beats per minute) and polypnea (> 20 breaths/minute) can be found in approximately 90-95% of AD cases,[10] thus demonstrating its clinical utility.

In the field of bariatric surgery, Arteaga-González and colleagues[11] studied 200 patients undergoing bariatric surgery and reported variations in heart rate, white blood cell count and blood pressure, among others *(Table 4)*; they also observed that up to 7.7% of abdominal computed tomography (CT) scans, 28.6% of methylene blue tests and 22.2% of water-soluble contrast tests were falsely negative in patients with confirmed AD at the time of surgery.

Abdominal pain is a symptom that should be taken into account. Its location can be modified according to the site of the anastomosis inside

the abdomen. Persistent abdominal pain associated with systemic inflammatory response syndrome (SIRS) may be an enough indication to re-intervene a patient, even if AD has not been confirmed on radiological studies.

It should be mentioned that the patient's functional status and cooperation are elementary to evaluate the evolution, so it is advisable to be extremely cautious in those patients with disabling disorders that hinder communication.

B) Laboratory

Laboratory studies should be analyzed with caution since biochemical alterations are to be expected because of the physiological inflammatory response triggered by the surgical procedure.

Serum parameters that are clinically useful when studying AD patients are the evolution in the leukocyte count, serum levels of procalcitonin, and C-reactive protein. A study by Singh et al.[12] reported that the use of serum C-reactive protein suggesting values above 172 mg/dl on day three of the postoperative period (PO), 124 mg/dl on day four of PO and 144 mg/dl on day five of PO should lead to suspicion of AD with a negative predictive value of 97%; other reports suggest that a maximum C-reactive protein value of 135 mg/dl on day three of PO may be sufficient to discharge the patient with peace of mind (sensitivity 73%, specificity 73%, positive predictive value 95.4%)[13] when recommendations for early discharge are followed.

Procalcitonin (PCT) is a soluble calcitonin precursor normally released from the C cells of the thyroid gland in response to severe systemic inflammation. It can be released into other tissues including activated leukocytes. Under normal conditions, it is found at concentrations of approximately 0.05 ng/ml. However, in septic processes it can reach up to 700 ng/ml within two to three hours after the onset of the systemic response, such elevation being measurable even before the elevation of the white blood cell count and the clinical manifestations of SIRS.[14] In the clinical context, values below 0.5 ng/ml represent a low risk of severe sepsis, while values above 2 ng/ml represent a very high risk. Its concentration should be assessed with caution in patients with impaired kidney function given it is eliminated by the kidney.[15] Unlike C-reactive protein, serum PCT is elevated almost exclusively during bacterial infections, so its usefulness for the diagnosis of AD is the same as for assessing response to antimicrobial therapy.[16] An elevation is expected on the first day of the PO due to naturally occurring contamination during intestinal surgery.[17] However, its tendency should be of a gradual decrease (> 30% per day) over the course of the following days.

PCT is not elevated in inflammation of non-infectious origin,[18] except in liver transplant

Table 3: Charlson comorbidity scale (CCS) reproduced and translated.[10]

1	
	Myocardial infarction
	Congestive heart failure
	Peripheral vascular disease
	Cerebrovascular disease
	Dementia
	Chronic obstructive pulmonary disease or chronic lung disease
	Connective tissue diseases
	Ulcerative disease
	Diabetes mellitus
2	
	Hemiplegia (can't move one or more limbs)
	Moderate or severe kidney disease
	Diabetes with terminal organic complications
	Any tumor
	Leukemia
	Lymphoma
3	
	Moderate or severe liver disease
6	
	Metastatic Tumor
	AIDS
Total score	

Table 4: Utility of clinical signs in the diagnosis of anastomotic dehiscence (AD).[13]

Risk factors for AD	Groups	Leak (%)	p (0.01)
Sex	male vs. female	5.5 vs 4.8	0.856
Age (years)	< 48 years ≥ 48	2.3 vs 10.1	0.026
BMI (kg/m^2)	< 38 ≥ 38	2.3 vs 10.8	0.021
Temperature (ºC)	< 30 ≥ 38	4.3 vs 13.3	0.145
HR (bpm)	< 100 ≥ 100	3.2 vs 28.6	0.001
BP (mmHg)	< 100 ≥ 100	21.2 vs 1.8	< 0.001
Leukocytes (u/mm^3)	< 15,000 ≥ 15,000	1.5 vs 11.3	0.012
Technique	RYGB vs sleeve	5.2 vs 0	0.211
Pneumatic test	Negative vs positive	5.1 vs 0	0.689
Revision surgery	Yes vs no	11.1 vs 4.7	0.376
Learning curve	< 20 ≥ 20	10.4 vs 3.3	0.061

recipients, severe and prolonged cardiogenic shock, patients with thermal shock, severe pancreatitis, and rhabdomyolysis.

Serum lactate, previously considered a marker for sepsis, severe sepsis, and septic shock, only indicates an alteration in oxidative metabolism and is closely related to criteria for hypoperfusion and multiple organ failure.[19]

Fouda et al.[20] studied the levels of IL6, IL10, tumor necrosis factor in abdominal drainage fluid of patients undergoing colorectal surgery and showed that on day 5 of PO the levels of these cytokines in patients with AD were five times higher than in patients without AD, who showed a gradual decrease in cytokine levels since surgery. The measurement of cytokines is not very specific because the levels can vary greatly without presenting a directly proportional clinical correlation.

C) Radiology

Complementing the diagnosis with radiological studies is necessary in cases of suspected AD. CT of the abdomen has displaced plain radiography of the abdomen due to the greater detail provided by the first study. Although the findings seen on a plain radiograph of the abdomen are not very accurate, subdiaphragmatic free air detection after day five of PO should be suspected of AD,[21] or even some reports have indicated that disruption of the surgical staple line can be identified.[22]

A contrasted abdominal CT scan is considered the best diagnostic test for AD. It has been reported to be 94-100% accurate.[23] The diagnosis of AD can be confirmed when fluid collections are found around surgical anastomoses,[24] and air leakage or leakage of contrast material from inside the intestinal lumen. However, the latter can be observed in only 10% of cases.[25]

Diagnosis by an enema with contrast media is of little use in evaluating AD within the first five days of PO because of the risk of procedure-related complications, so these types of studies are reserved until after seven or eight days of PO when AD has frequently occurred clinically. Markham and colleagues described the use of barium enemas to assess the integrity of rectal anastomoses before the closure of a protective stoma and reported that up to 41% of patients presented with non-clinical radiological leakage,[26] so it has been suggested that closure of the protective stoma be delayed in these patients.[27] The introduction of contrast material through the fistulous path is valid for chronic processes.

The use of contrast agents is necessary to improve the diagnostic accuracy of radiological studies; however, these substances can cause adverse events. The most commonly used preparations are barium sulfate suspensions and water-soluble iodine salts; barium should

be reserved for cases where the anastomosis is intact because of the risk of developing chemical peritonitis secondary to extravasation of this substance; Iodine-based water-soluble contrast can be safely used orally despite the suspicion of AD because it does not cause chemical injury when leaked from the intestinal lumen; however, its intravenous administration should be avoided in patients with renal failure because it causes contrast-induced nephropathy.

CLASSIFICATION OF THE LEAK

AD was arbitrarily classified as minor defect when the solution of continuity was < 1 cm or less than one third of the anastomosis or major defect with loss of solution of continuity > 1 cm or greater than one third of the anastomosis.

In 2010 the International Rectal Cancer Study Group proposed a system to classify post-anastomosis leakage from the anterior rectal resection into grade A in leakage detected with radiological studies with discrete or absent clinical disturbances that do not require active therapeutic intervention; however, when detected they may delay the closure of the protective stoma, grade B in leakage that requires therapeutic intervention (e.g. medical management, antibiotic treatment or percutaneous drainage), but are manageable without surgical intervention and grade C in anastomotic leaks associated with peritonitis and systemic inflammatory response syndrome (SIRS) that require surgical intervention and commonly involve fecal transit procedures.[3] Although this system was described for rectal surgery, it may apply to other viscera.

PREVENTION

The best strategy to decrease complications in our patients is to focus on knowledge and develop prevention strategies in each field. For their application, we can group these strategies into:

A. Bacteriological

The intestinal flora suggests the term intestinal microbiota which is composed of an extensive variety of aerobic and anaerobic germs composed of 90% of *Firmicutes* (to which the lactobacilli belong) and *Bacteroides* (to which the bacteroid species belong, these represent 30% of all bacteria); the remaining 10% is represented by actinobacteria and proteobacteria, among which are the known enterobacteria, *Escherichia, Klebsiella, Pseudomonas* and *Salmonella* which represent less than 1% of the intestinal flora *(Figure 1)*.

Normal healing processes can be affected in their different phases by variations in the bacterial load and by the bacterial phenotype that can transform from symbiotic to a "tissue destroyer" when there are states of stress in the host. It is characterized by greater virulence and pathogenicity when synthesizing collagenases and matrix remodeling metalloproteases (MMP-remodeling); this means that the same bacteria can behave differently in a healthy host than in one under surgical stress.[28] The most studied germs with these behavioral modifications are Pseudomonas *aeruginosa*[29] and *Enterococcus faecalis*,[30] and some research also points to *Yersinia enterocolitica*, *Escherichia coli (E. coli sp.)*, *Salmonella typhi* and *Campylobacter jejuni*.[31] These alterations can be detected to some degree in all normal intestinal flora; however, it is common to find a more notorious pathogenic phenotype in the germs that inhabit the site of the anastomosis.

Some studies suggest the possibility of administering probiotics pre and postoperatively to balance the intestinal flora and promote a

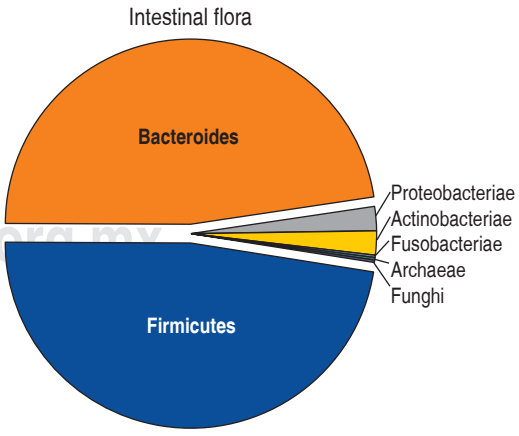

Figure 1: *Conformation of the intestinal flora.*

symbiotic flora, with acceptable effects in reducing days spent in the intensive care unit, mechanical ventilation time, and postoperative infections in critical patients. 32 However, with weak results in terms of reducing the risk of AD. Opponents of such management point out that it is unrealistic that some strains of lactobacilli are enough to normalize the microenvironment of the patient's intestine.

In intestinal surgery, parenteral antimicrobial prophylaxis is recommended including coverage against Gram-positive and anaerobic germs, following international clinical practice guidelines. It has been proven to reduce infections by half. Although the concept of administering enteral antimicrobials before and after surgery was abandoned for some years, more recent microbiological studies revive the need to administer antibiotics with little or no enteral absorption such as neomycin or erythromycin as a complement to parenteral antibiotics. 33 The doses that can be administered enterally are 1 g neomycin + 1 g metronidazole[19,18,] and nine hours before surgery, or 2 g neomycin + 2 g metronidazole[13] and nine hours before surgery.

B. Technical considerations

In general terms, when an anastomotic failure occurs within the first few days, from the first to the fourth, it is considered due to technical errors, while failures that occur five to seven days after the procedure are suggested to be caused by ischemia at the anastomotic site.[34]

1. **Anastomosis preparation:** when performing the anastomosis, care should be taken to ensure it is tension-free, since axial traction may increase the space between sutures and increase the possibility of leakage, and in other cases ischemia in the suture area.[35]
2. **Perfusion and microcirculation:** preserving the vascularization of the intestinal segment is cardinal to success. Special attention and meticulousness must be given when manipulating the vascular arches and avoiding distension, torsion, or unnecessary section of the vessels during surgery. The intraoperative use of dyes such as indocyanine green,[36] conventional Doppler ultrasound,[37] or laser Doppler ultrasound[38] have been described as aids to identify the best irrigation site and guide during the preparation of the anastomosis; however, the availability of these tools persists as a problem for their daily application.
3. **Manual suture vs. mechanical suture:** Scientific evidence between performing the anastomosis with staplers or manually has delineated that in inexperienced surgeons mechanical suturing offers reduced surgical time with more homogeneous results as long as the proper staple height is selected and no more than two mechanical suture lines are spliced; when experienced surgeons perform manual anastomosis the result is practically the same when compared to mechanical suture in terms of incidence of anastomotic leakage regardless of the gastrointestinal tract segment, reporting only an increase in surgical time.[39,40]

The shape and closing height of the surgical staples must be considered as one of the important technical factors. Each manufacturer has designed its color codes on its staple cartridges, so they must be properly selected according to the type of procedure. It is common for more than one staple shot to be required; however, splicing more than three mechanical suture lines in the same place increases the risk of leakage by more than twice.

Sutureless anastomosis by compression rings of nitinol[41] has been described as allowing scar tissue to heal between the edges of the ring at the anastomosis and then be expelled as the surgical edges slough off eight to 10 days after the procedure;[42] supporters of this method argue that not piercing the tissue to place the suture or staples decreases bleeding, generates less tissue damage, less inflammatory reaction, and less risk of anastomotic failure.[43] Nitinol is a nickel-titanium alloy whose memory characteristics keep it in a shape that allows constant pressure to be exerted on the anastomosis site and, compared to stainless steel, is less toxic, carcinogenic

and immunogenic due to its lower nickel content and the stability that the alloy confers on titanium.[44]

4. **Drainages:** the use of surgical drains was based on considering them as a sentinel for the integrity of the anastomosis; unlike esophageal surgery where there is a general acceptance of using surgical drains (grade 5 evidence),[45] in abdominal surgery the discussion remains because closed drains are considered to be obstructed and lose that watchdog function, while open drains contaminate the wounds.
   In colorectal surgery, the evidence recommends the use of drains in procedures performed below the sacral promontory, while in intra-abdominal surgery the utility is little or non-existent.[46] In the field of bariatric surgery, similarly, the evidence is not strong enough to recommend their routine use,[47] since the patient's general conditions and the presence of SIDS or tachycardia may be sufficient indications for reoperation despite the lack of clinical confirmation of anastomotic leakage.
5. **Leakage test:** the underwater tightness test ("rim test") should not be a rule for all procedures, since manipulation of the newly created anastomosis can unravel the tissues and increase the risk of AD. In selected cases, this test is useful to demonstrate the site where the technical error occurred during the surgical procedure; however, it is preferable to perform the test endoscopically to evaluate the integrity of the anastomosis and the hemostasis of the surgical site.[11,21]

C. Control of factors related to the patient

When addressing this field, we must consider that we can influence some risk factors, which will be described later; however, there are non-modifiable factors that increase the risk of AD. Some of the factors that directly increase the risk of AD are a medical history of chemotherapy or radiotherapy, hypotension in the transplant, poorly controlled type 2 diabetes, chronic steroid use, smoking, and atherosclerosis, use of large diameter staplers (31-34 mm) to make the ileal reservoir in the ileoanal anastomosis, the male gender in the case of colorectal surgery due to the technical difficulty because of the narrower male pelvis4 and to perform anastomosis below the peritoneal fold.[48]

1. **Intestinal preparation of the colon:** Since 1971 Nichols and Condon[49] have described the usefulness of mechanical bowel preparation (MBP) and its effects on intestinal bacterial load. In their report, they analyzed the modifications in intestinal flora by taking cultures in the ileum, cecum, and transverse colon of patients undergoing cholecystectomy. For their study, they divided patients into six groups: no MBP and no antibiotic, MBP without antibiotic, MBP + kanamycin, MBP + neomycin, MBP + sulfonamides (phthalylsulfathiazole) + neomycin, MBP + erythromycin + neomycin. In this study, they demonstrated that MBP alone helped remove only visible matter without causing changes in the intestinal flora; the MBP + kanamycin, MBP + neomycin, and MBP + neomycin + sulfonamides groups had no noticeable changes in the number of aerobes and anaerobes; while the MBP + erythromycin + neomycin treated group greatly reduced the number of aerobes and anaerobes.[49]
   Kiran and colleagues[6] studied 8,442 patients retrospectively, dividing them into groups: no MIC without antibiotic (27.2%; 2,296); MIC without antibiotic (45.3%; 3,822) and MIC with antibiotic (27.5%; 2,324) and reported differences in surgical site infection (14.7% versus 12.1% versus 6.2%), postoperative ileus (15.1% versus 12.3% versus 9.2%), bowel leakage (4.6% versus 3.5% versus 2.1%), sepsis (4.4% versus 2.8% versus 2.3%) and 30-day mortality (1.6% versus 0.6% versus 0.3%). Although this study does not specify which drug or which dose was used, it is clear that MBP is useful only if performed in conjunction with oral antibiotics *(Table 5)*.
   New literature is included in the latest guidelines of the American Society of

Table 5: Complications related to the type of colon preparation.[6]

	Percentage		
	MBP (-)/ antibiotic (-)	MBP (+)/ antibiotic (-)	MBP (+)/ antibiotic (+)
Surgical site infection	14.7	12.1	6.2
Post-operative ileus	15.1	12.3	9.2
Intestinal leakage	4.6	3.5	2.1
Sepsis	4.4	2.8	2.3
Mortality at 30 days	1.6	0.6	0.3

MBP = mechanical bowel preparation.

Colon and Rectal Surgeons published in 2019, which recommends the use of MBP with oral antibiotics for colorectal resection as a grade 1B evidence. On the other hand, the use of IPM without antibiotics in elective colorectal surgery with a grade of evidence 1A, as well as the use of only oral antibiotics without IPM (grade of evidence 2C) or the use of enemas without IPM or the use of oral antibiotic therapy (grade of evidence 2B) are not recommended.[50]

2. **Protective stomas:** controlled clinical trials confirm the safety of performing protective stomas in patients at high risk of AD to prevent anastomotic leakage in high-risk anastomoses, such as those performed very close to the anal margin. This behavior results in fewer septic complications and fewer re-operations, with the disadvantage of negatively impacting the quality of life and increasing associated morbidity while the stoma is being held, without eliminating the possibility of remaining with the stoma permanently.[51-53]

TREATMENT

The clinical presentation of an AD can manifest in different ways. Treatment should be according to the needs of the patient. Group B AD cases can be managed medically, while group C cases, although the anastomotic disruption is not confirmed radiologically, should be managed with urgent surgery, because the progression from peritonitis to septic shock is rapid and catastrophic, and it requires management in the intensive care unit with hemodynamic support. In all patients with severe generalized peritonitis, attempts at medical treatment are insufficient until the septic focus has been controlled.[54]

Once the condition of the abdomen has been evaluated, surgical treatment should be individualized for each patient, and the decision made in the operating room. In cases of severe inflammation and induration, it is prudent not to further injure the tissues and to limit washing, draining, and if possible, performing a proximal stoma. In cases where dehiscence affects two thirds of the circumference or more, the anastomosis can be dismantled, a stoma made and closed distally (or the two orifices externalized), although if the patient is hemodynamically stable and resources are available, a resection of the affected segment can be decided and the anastomosis redone, albeit with a greater risk of DA once the inflammation in the intestine subsides and the tension in the sutures loosens.[17,55] In patients without systemic manifestations of infection, conservative management with antibiotics, analgesia, fasting, intestinal decompression, and parenteral nutrition may ensue. Treatment for collections around anastomoses detected by tomographic studies can be divided according to their size; those under 3 cm can be managed with medical treatment, and those over 3 cm can be drained percutaneously,[56] with a success rate of 81% and mortality of 3%.[57]

Endoscopic therapies can be used as a resource to avoid re-intervention of the AD patient. Disruptions may be treated by placing stents in the esophagus[58] or colon[59] as a bridge to the defect to contain the leakage and allow healing. Some fistulas can be closed from within the intestinal lumen by placing conventional endoscopic clips or special bear-trap clips that are placed over the tip of the endoscope also called OVESCO

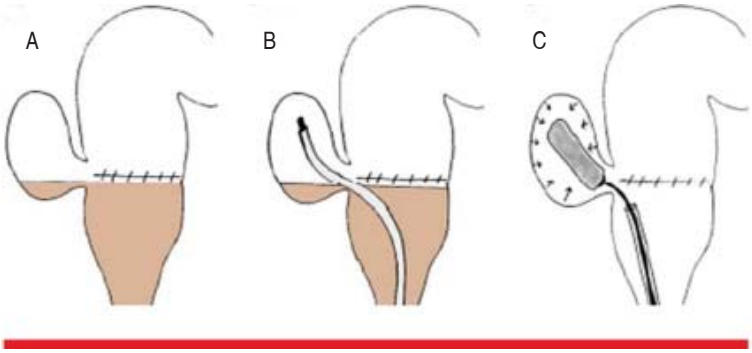

Figure 2: *Treatment with suction and transendoscopic negative pressure.[66] Endoscopic vacuum treatment.* ***(A)*** *Anastomotic leakage after total mesorectal excision.* ***(B)*** *Endoscope over tube in the cavity.* ***(C)*** *Placement of endo-sponge into the cavity through the overtube.*

(over-the-scope)[60] and allow the closure of larger defects. To assist in the drainage and obliteration of the para-anastomotic spaces, suction-assisted endoscopic drainage therapies have been described, in which the same principles of suction-assisted closure (VAC) therapy are followed; for application, a sponge is introduced into the para-anastomotic sinus and the system is connected to a suction hose, either transorally or transanally, as needed[61] *(Figure 2)*. Although some studies showed encouraging results with up to 97% success rates,[62] a multicenter study of transanal drainage for chronic presacral sinuses conducted in the Netherlands [63] demonstrated a success rate of up to 75%; this study included 16 patients with low anterior colon resection and AD, requiring an average of 13 suction system replacements (eight to 17), and found that those patients who started treatment within six weeks of the AD diagnosis were 75% successful, while those who started after six weeks of the diagnosis were 38% successful.

CONCLUSIONS

It is clear that despite a better knowledge of the etiology, prevention, diagnosis, and management of intestinal anastomosis, leaks occur. We must take great care in the prevention and timely diagnosis and take action on the factors that influence the presentation of the problem as they are:

- Microbioma of the patient.
- Preoperative preventive measures and their indications.
- Preparation of the colon.
- Purified surgical technique.
- Use of perioperative antibiotics, both oral and intravenous.
- Perfect anastomosis.
- Consider proximal stoma in high-risk anastomosis.

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