DOI: 10.46768/racp.v33i01.125

Risk Factors Associated with Anastomotic Leakage in Colorectal Surgery

Andrés Chandía Núñez[1], Haroldo Steger[2]
Coloproctology Service, Sanatorio Adventista del Plata, Entre Ríos, Argentina.
[1]General Surgery Resident.
[2]Head of Coloproctology Service.

ABSTRACT
Introduction: *Anastomotic leakage (AL) is a complication of colorectal surgery with an incidence that varies from 2 to 19%. There are numerous studies in the literature on the identification of risk factors (RF).*
Objective: To carry out a descriptive characterization of the institutional results and to establish the rate of AL and its associated RF.
Design: *Retrospective, longitudinal study, based on a prospective database. Material and methods: Series of consecutive patients operated on for colorectal pathology with primary anastomosis, with or without diverting stoma, between 2017 and 2020. Forty-eight patients were excluded because they did not meet the basic data of the database (albumin, weight, size).*
Results: *One hundred-eleven patients (55.8% men, mean age: 66.7 years) were included. The most frequent surgical indications were colorectal cancer in 83 patients (74.7%) and diverticular disease in 18 (16.2%). The AL rate was 12.6% and the overall mortality was 4.5%, higher in patients with AL (14.8% vs. 3%). AL was 7.2% in colocolic anastomosis, 3.6% in low colorectal anastomosis and 1.8% in ileocolic anastomosis. The relevant RFs were: hypoalbuminemia (3.6 ± 0.7), BMI (>30.1), male gender (8/14 patients; 57.1%).*
Conclusions: *Similar results to other international studies were evidenced. Hypoalbuminemia, BMI >30, male gender, and surgical time >3 hours were found to be associated with a high rate of AL.*

Keywords: *Anastomotic Leakage; Colorectal Surgery; Risk Factors*

INTRODUCTION

Anastomotic leakage (AL) after gastrointestinal surgery is a serious postoperative event that leads to significant morbidity and mortality.

Postoperative leak rates are frequently used as an indicator of the quality of the surgical care provided. The comparison of rates between institutions depends on the use of standard definitions and measurement methods of AL.[1] Its incidence varies widely in different publications, ranging between 1.8 and 19%.[2] This wide range is due in part to variability of concepts and definition of AL, the inclusion criteria considered in the publications and the differences in the type of resection and anastomosis. The classic risk factors (RF) associated with AL include rectal surgery (height of the anastomosis), neoadjuvant treatment, male gender, transfusions, comorbidities such as obesity (BMI > 30) or malnutrition, smoking and alcohol consumption, as well as ASA (American Score of Anesthesiologists) > 2.[3] AL can cause sepsis, reoperations and, in some cases, associated mortality. Some studies, such as the one by Parthasarathy et al. in 2017,[4] show that AL is more frequent in young patients.

The objective of this study is to evaluate the RFs, such as hypoalbuminemia, type of surgery, type of anastomosis, BMI, hospital stay, surgical time, among others, associated with AL presented by patients undergoing colorectal surgery (right colectomy, left colectomy, segmental resection, Dixon operation) during the period January 2017-December 2020, and to compare with international studies.

MATERIAL AND METHODS

This is a retrospective longitudinal study, of a prospective database of patients operated on by the Colorectal Surgery team of the Sanatorio Adventista del Plata, between January, 2017 and December, 2020. A review of electronic and physical clinical records was carried out to build a database in Excel®. Patients with incomplete data in the medical records were excluded.

In this work, as in that of López-Köstner, et al.[5] AL is defined as that presented by patients who, in the context of an abnormal postoperative period, present: 1) leakage of intestinal content through the drains or the surgical wound, or a fistula to a neighboring organ; 2) reintervention and intraoperative confirmation of AL due to presence of leakage, localized collection or generalized peritonitis or 3) computed tomography showing contrast leakage, collection or peranastomotic air bubbles.

RESULTS

Of 159 patients obtained from the database, 48 were ex-

The authors declare no conflicts of interest.
Andrés Chandía Núñez
andres.felipechn@sanatorioadventista.org.ar
Received: *March 2021.* ***Accepted:*** *September 2021.*

cluded for not meeting the inclusion criteria, thus leaving 111 for the study. Their demographic and surgical data are shown in Table 1. The mean age was 66.7 years and 55.8% were men. The surgical indication was colorectal cancer in 74.7% of the patients, diverticular disease in 16.2% and other types of tumors in the rest. The vast majority of operations were elective (79.2%). The type of resections is shown in Table 1.

Of 111 patients operated on and included in this study, 14 (12.6%) had an AL. Colocolic anastomosis was the one with the highest incidence, reaching 7.2% (Table 1). The median time to certify the diagnosis of AL from the day of surgery was 4.1 (2-7) days.

Regarding the RFs, the male gender had a higher incidence (57.1%). Furthermore, patients with AL had a lower mean age (61 ± 13.5 vs. 67 ± 12.6 years), a higher mean BMI (30.1 vs. 27) and a lower mean albuminemia (3.6 ± 0.7 vs. 4 ± 0.6 g/dl). Thirty-five percent of patients with AL had ASA 3-4 compared to 19% of those who did not present this complication.

In relation to overall mortality, 3 patients died in this series, of which 2 had AL, dying from other causes (e.g. septic shock).

Surgical time was on average greater than 3 hours in 57.1% of patients with AL and in 48.4% of those without AL.

Regarding the associated pathologies and toxic habits, Table 2 shows that arterial hypertension and smoking were the most frequent in both groups.

TABLA 1: PATOLOGÍAS Y HÁBITOS TÓXICOS POR GRUPO CON DA Y SIN ELLA

Pacientes sin DA		Pacientes con DA	
HTA	53	HTA	9
TBQ	21	TBQ	5
Transfusiones previas	12	DBT	4
DBT	11	OH	2
HDB	11	Hipotiroidismo	1
Hipotiroidismo	10	Epilepsia	1
DLP	9	IRC	1
ACV	3	FA	1
OH	2	ACV	1
IAM	2	HDB	1
FA	1		
Parkinson	1		
Epilepsia	1		

DISCUSSION

The 12.6% rate of AL in this series is within the international standard values, which range from 2 to 19%, as evidenced in various studies.[5,6] The colocolic anastomosis was the one that presented the highest incidence, reaching 7.2%; in ileocolic anastomoses it reached 1.8% and in low colorectal anastomosis 3.6%. It is noteworthy that different studies have shown a higher percentage of anastomotic fistula in the ileocolic anastomosis. Muñoz et al.,[7] reported leaks in 6.9% of ileocolic anastomosis compare to in 4.5% of the colocolic.

The diagnosis of AL was made between 2 and 7 days after surgery, which coincides with other reports.[7]

In our series, as in others in the literature, the male gender (57.1%) appears as a RF that shows a strong relationship.[8-11] This would probably be explained by the difficulty generated by the anatomy of the narrower male pelvis for performing, revising and/or reinforcing an adequate anastomosis.[10] At the time of surgery it is also important to take care of perfusion and microcirculation, since preserving the vascularization of the intestinal segment is essential for success. Special attention and meticulousness must be paid when manipulating the vascular arcades and also is necessary to avoid distension, twisting or unnecessary section of the vessels during surgery. The intraoperative use of dyes such as indocyanine green, conventional Doppler ultrasound or laser Doppler ultrasound have been described as aids to identify the site of best irrigation and guide the preparation of anastomoses; however, the availability of these tools remains a problem for their daily application.

Another recognized RF for AL is the height of the anastomosis, especially when analyzing the colorectal anastomosis. This coincides with most of the studies that focus on AL in this surgery.[5,11-16] According to Trencheva et al.,[16] an anastomosis less than 10 cm from the anal margin (AM) is related with 13.9% AL compared to 3% in those performed more than 10 cm from the AM. Rullier et al.,[12] reported that the risk of AL is six times higher in anastomoses that are less than 5 cm from the AM than in those above 5 cm. Among the reasons put forward to explain this association are the technical difficulty of working in the deep pelvis, the impossibility of placing reinforcement stitches in a very low anastomosis, the deleterious effect of total resection of the mesorectum on healing in addition to the need to cut more blood vessels to movilize the colon to the pelvis. High ligation of the inferior mesenteric artery increased the risk of AL by 3.8 times.[15] The 12.6% rate of AL in this series is within the international standard values, which range from 2 to 19%, as evidenced in various

TABLA 2: DATOS DE PACIENTES (BIODEMOGRÁFICOS)

Característica		n=111
Edad (años) media ± DS		66,7±12,9
Sexo n (%)	Masculino	62 (55,8 %)
	Femenino	59 (44,2 %)
ASA	I	6 (5,4 %)
	II	81 (72,9 %)
	III	21 (18,9 %)
	IV	3 (2,7 %)
IMC	< 20	4 (3,6 %)
	20-25	42 (37,8 %)
	26-30	32 (28,8 %)
	>30	33 (29,7 %)
Tipo de Cirugía	Electiva	100 (90 %)
	Urgencia	11 (9,9 %)
Tipo anastomosis	Manual	24 (21,6 %)
	Mecánica	87 (78,3 %)
Procedimiento	Hemicolectomía derecha	30 (27,02 %)
	Hemicolectomía izquierda	53 (47,4 %)
	Resección segmentaria	6 (5,4 %)
	Cirugía de Dixon	19 (17,1 %)
	Colectomía total	3 (2,7 %)
Patología	Cáncer colorrectal	83 (74,7 %)
	Enfermedad diverticular	18 (16,2 %)
	Enfermedad inflamatoria	7 (6,3 %)
	Sarcoma	1 (0,9 %)
	PAF	1 (0,9 %)
	GIST	1 (0,9 %)
Dehiscencia anastomosis	Global	14/111 (12,6 %)
	Ileocólica	2/111 (1,8 %)
	Colocólica	8/111 (7,2 %)
	Colorrectal baja	4/111 (3,6 %)

studies.[5,6] The colocolic anastomosis was the one that presented the highest incidence, reaching 7.2%; in ileocolic anastomoses it reached 1.8% and in low colorectal anastomosis 3.6%. It is noteworthy that different studies have shown a higher percentage of anastomotic fistula in the ileocolic anastomosis. Muñoz et al.,[7] reported leaks in 6.9% of ileocolic anastomosis compare to in 4.5% of the colocolic.

The diagnosis of AL was made between 2 and 7 days after surgery, which coincides with other reports.[7]

In our series, as in others in the literature, the male gender (57.1%) appears as a RF that shows a strong relationship.[8-11] This would probably be explained by the difficulty generated by the anatomy of the narrower male pelvis for performing, revising and/or reinforcing an adequate anastomosis.[10] At the time of surgery it is also important to take care of perfusion and microcirculation, since preserving the vascularization of the intes-

tinal segment is essential for success. Special attention and meticulousness must be paid when manipulating the vascular arcades and also is necessary to avoid distension, twisting or unnecessary section of the vessels during surgery. The intraoperative use of dyes such as indocyanine green, conventional Doppler ultrasound or laser Doppler ultrasound have been described as aids to identify the site of best irrigation and guide the preparation of anastomoses; however, the availability of these tools remains a problem for their daily application.

Another recognized RF for AL is the height of the anastomosis, especially when analyzing the colorectal anastomosis. This coincides with most of the studies that focus on AL in this surgery.[5,11-16] According to Trencheva et al.,[16] an anastomosis less than 10 cm from the anal margin (AM) is related with 13.9% AL compared to 3% in those performed more than 10 cm from the AM. Rullier et al.,[12] reported that the risk of AL is six times higher in anastomoses that are less than 5 cm from the AM than in those above 5 cm. Among the reasons put forward to explain this association are the technical difficulty of working in the deep pelvis, the impossibility of placing reinforcement stitches in a very low anastomosis, the deleterious effect of total resection of the mesorectum on healing in addition to the need to cut more blood vessels to mobilize the colon into the pelvis. High ligation of the inferior mesenteric artery increased the risk of AL by 3.8 times.[15]

The impact on hospital stay is very considerable. In our teamwork, patients with an uneventfull postoperative period had an average stay of 5 ± 4.7 days vs. 12.8 ± 9.2 days in patients with leaks. This length of stay is considerably shorter when compared to other centers, where it is prolonged from 10.7 days in patients without a leak to 27.9 days in those with a leak.[5-8]

According to Rullier et al.,[12] obesity is associated with AL. Converserly, Choi et al.,[17] and also Vignali et al.,[18] in prospective studies that included almost 3,500 patients undergoing colorectal resection, did not find obesity as a RF. The discrepancy between these studies could be related to the inclusion of low rectal anastomoses. It seems logicalthat the risk of AL increases due to the difficulties involved in proper cleaning of the proximal end, as well as the tension and ischemia generated by a short and thick mesocolon.[16]

In 2018, Zaimi et al.[19] carried out a study on patients undergoing primary resection of colorectal cancer, in which they reported that patients older than 80 years of age presented leakage in 4.9% and those younger than 60 years of age in 6.4%, concluding that advanced age exerts a protective effect on anastomotic leakage, which does not agree with the results of our study.

As in this study, different investigations have shown that hypoalbuminemia (albumin <3.5 g/dL) is an independent RF for AL.[12-14,20,21] Some reserchers demonstrated a better surgical outcome in malnourished patients with an adequate enteral caloric intake for 7 to 10 days before the operation, which highlights the importance of preoperative nutritional optimization.[15]

Regarding the ASA score, Buchs et al.[22] found in the univariate analysis that an ASA ≥ 3 is associated with an increased risk of AL. On the contrary, for Muñoz et al.,[7] there were no statistically significant differences in the risk when evaluating the ASA score, which has historically been considered a RF of surgical complication. Therefore, using the ASA score as a predictive factor could become controversial.

In our study, an overall mortality rate of 4.5% (5/111 patients) was evidenced, which for patients with AL reached 14.8% (2/14 patients) and for those without AL 3% (3/99 patients). Muñoz et al.[7] reported a mortality of 28 vs. 0.4%, respectively.

In our series, 57.1% of patients who developed AL had a surgical time > 3 hours, a higher percentage than that of the patients who did not have AL, who exceeded 3 hours of surgery in 48.4% of cases. This finding agrees with other international study, which report a surgical time greater than 186 minutes in most patients with AL vs. 172 minutes in those without AL.[7]

In our experience, as in various studies, no relationship has been found with previous pathologies and/or toxic habits of the patient.

CONCLUSIONS

In this study, hypoalbuminemia, male gender, longer surgical time, and BMI >30 were positive predictors of AD development.

It is necessary to implement the measurement of the height of the anastomosis to be able to study in the future what other studies have already shown on the decrease in the rate of anastomotic leaks the greater the distance from the anastomosis to the anal margin.

It is important to be able to count on a protocolized pre-surgical laboratory from admission (including albumin, total proteins), in addition to basic data such as height and weight, in order to have a more complete database, to increase the number of individuals to be included in future studies.

It would be interesting to establish a national database in order to carry out a more in-depth study of the rate of dehiscence in our setting.

REFERENCES

1. Bruce J, Krukowski ZH, Al-Khairy G, Russell EM, Park KGM. Systematic review of the definition and measurement of anastomotic leak after gastrointestinal surgery. Br J Surg 2001;88:1157-68.
2. Frasson M, Flor-Llorente B, Ramos JL, Granero-Castro P, Hervás D, Álvarez MA, et al. Risk factors for anastomotic leak after colon resection for cancer. Ann Surg 2015;262:321-30.
3. McDermott FD, Heeney A, Kelly ME, Steele RJ, Carlson GL, Winter DC. Systematic review of preoperative, intraoperative and postoperative risk factors for colorectal anastomotic leaks. Br J Surg 2015;102:462-79.
4. Parthasarathy M, Greensmith M, Bowers D, Groot-Wassink T. Risk factors for anastomotic leakage after colorectal resection: a retrospective analysis of 17 518 patients. Colorectal Dis 2017;19:288-98.
5. Bannura G, Cumsille M, Barrera A, Contreras. J, Melo C, Soto D, et al. Factores asociados a la dehiscencia clínica de una anastomosis intestinal grapada: análisis multivariado de 610 pacientes consecutivos. Rev Chil Cir 2006;58:341-46.
6. López-Köstner F, Cerda C, Wainstein C, Kronberg U, Larach A, Larach J, et al. Impacto de las filtraciones anastomóticas en cirugía colorrectal. Rev Chi Cir 2016;68:417-21.
7. Muñoz N, Rodríguez MG., Pérez-Castilla A, Campaña N. y Campaña GV. Evaluación de factores de riesgo asociados a dehiscencia anastomótica en cirugía colorrectal. Análisis multivariado de 748 pacientes. Rev Cir 2019;71:136-44.
8. Pacheco MA, Aldana GE, Martínez LE, Forero JC, Gómez CA, Coral EM, et al. Incidencia de falla anastomótica en intestino delgado, colon y recto. Rev Colomb Cir 2017;32:269-76.
9. Kirchhoff P, Clavien P, Hahnloser D. Complications in colorectal surgery: Risk factors and preventive strategies. Patient Saf Surg 2010;4:1-13.
10. Lipska M, Bissett I, Parry B, Merrie A. Anastomotic leakage after lower gastrointestinal anastomosis: Men are at a higher risk. ANZ J Surg 2006;76:579-85.
11. Matthiessen P, Hallbook O, Andersson M, Rutegard J, Sjodahl R. Risk factors for anastomotic leakage after anterior resection of the rectum. Colorectal Dis 2004;6:462-69.
12. Rullier E, Laurent C, Garrelon L, Michel P, Saric J, Parneix M. Risk factors for anastomotic leakage after anterior resection of rectal cancer. Br J Surg 1998;85:355-58.
13. Telem D, Chin E, Nguyen S, Divino C. Risk Factors for anastomotic leak following colorectal surgery. Arch Surg 2010;145:371-76.
14. Hennessey D, Burke J, Ni-Dhonochu T, Shields C, Winter D, Mealy K. Preoperative hypoalbuminemia is an independent risk factor for the development of surgical site infection following gastrointestinal surgery. Ann Surg 2010;252:325-29.
15. Kingham TP, Pachter HL Colonic anastomotic leak: risk factors, diagnosis, and treatment. J Am Coll Surg 2009;208:269-78.
16. Golub R, Golub RW, Cantu R Jr, Stein HD. A multivariate analysis of factors contributing to leakage of intestinal anastomoses. J Am Coll Surg 1997;184:364-72.
17. Mäkelä JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left-side colorectal resection with rectal anastomosis. Dis Colon Rectum 2003;46:653-60.
18. The Veterans Affairs Total Parenteral Nutrition Cooperative Study Group. Perioperative total parenteral nutrition in surgical patients. N Engl J Med 1991;325:525-32.
19. Zaimi I, Sparreboom CL, Lingsma HF, Doornebosch PG, Menon AG, Kleinrensink G-J. et al.; on behalf of the Dutch ColoRectal Audit Group. The effect of age on anastomotic leakage in colorectal cancer surgery: a population-based study. J Surg Oncol 2018;118:113-20.
20. Trencheva K, Morrissey KP, Wells M, Mancuso CA, Lee SW, Sonoda T, et al. Identifying important predictors for anastomotic leak after colon and rectal resection: prospective study on 616 patients. Ann Surg 2013;257:108-13.
21. Choi HK, Lav WL, Ho JW. Leakage after resection and intraperitoneal anastomosis for colorectal malignancy: analysis of risk factors. Dis Colon Rectum 2006;49:1719-25.
22. Vignali A, Elmore U, Lemma M, Guarnieri G, Radaelli G, Rosati R. Intracorporeal versus extracorporeal anastomoses following laparoscopic right colectomy in obese patients: A case-matched study. Dig Surg 2018;35:236-42.
23. Buchs NC, Gervaz P, Secic M, Bucher P, Mugnier-Konrad B, Morel P. Incidence, consequences, and risk factors for anastomotic dehiscence after colorectal surgery: A prospective monocentric study. Int J Colorectal Dis 2008;23:265-70.