

# Colorectal Anastomotic Leakage at the University Hospital of the West Indies

## An Analysis of Risk Factors

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### ABSTRACT

**Background:** Anastomotic leakage remains a concern in general surgical practice. The significance lies in the resultant abdominal sepsis, related morbidity and mortality, risk of anastomotic loss, permanent stoma creation and the effect on local recurrence and overall patient survival in colorectal cancer cases.

**Objectives:** This study serves to determine the leak rates and the mortality thereof related to colonic and rectal anastomoses at the University Hospital of the West Indies (UHWI) in Kingston, Jamaica. Independent factors contributing to anastomotic leaks in these patients will also be assessed and correlations determined.

**Methods:** A review of the medical records of one hundred and thirty-three cases of colonic and rectal anastomoses identified retrospectively over a three-year period provided relevant information for analysis.

**Results:** Anastomotic leaks were identified in twelve patients, providing a leak rate of 9.0%. No 30-day mortality related to anastomotic leakage was noted. Based on a multivariate analysis, male gender was identified as the sole independent factor related to anastomotic leakage.

**Conclusion:** Colorectal anastomotic leak rates at UHWI fell at the upper limit of leak rates typically quoted in the literature. No modifiable risk factor appeared to contribute to this leak rate. Early identification and intervention is critical in limiting mortality associated with colorectal anastomotic leakage.

**Keywords:** Anastomosis, colorectal, leakage, risk factors

# Fuga Anastomótica Colorrectal en el Hospital Universitario de West Indies

## Un Análisis de los Factores de Riesgo

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### RESUMEN

**Antecedentes:** La fuga anastomótica sigue siendo una preocupación en la práctica quirúrgica general. La importancia radica en la sepsis abdominal resultante, la morbilidad y mortalidad asociadas, el riesgo de pérdida anastomótica, la creación de estomas permanentes, y el efecto sobre la recidiva local así como en la supervivencia de los pacientes en general, en los casos de cáncer colorrectal.

**Objetivos:** Este estudio sirve para determinar las tasas de fuga y la mortalidad asociadas con ellas, en relación con las anastomosis colónicas y rectales en el Hospital Universitario de West Indies (HUWI) en Kingston, Jamaica. Asimismo, se evaluarán los factores independientes que contribuyen a las fugas anastomóticas en estos pacientes, y se determinarán las correlaciones.

**Métodos:** Una revisión de los registros médicos de ciento treinta y tres casos de anastomosis colónicas y rectales identificados retrospectivamente durante un período de más de tres años, proporcionaron la información relevante para el análisis.

**Resultados:** Se identificaron fugas anastomóticas en doce pacientes para una tasa de fuga de 9.0%. No se observó ninguna mortalidad de 30 días relacionada con fugas anastomóticas. Basado en un

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*análisis multivariante, se identificó el género masculino como el único factor independiente relacionado con la fuga anastomótica.*

**Conclusión:** *Las tasas de fuga anastomótica colorrectal en UHWI cayeron al límite superior de las tasas de fuga típicamente citadas en la literatura. Ningún factor de riesgo no modificable pareció contribuir a esta tasa de fuga. La intervención e identificación temprana es esencial a la hora de limitar la mortalidad asociada con la pérdida anastomótica colorrectal.*

**Palabras claves:** Anastomosis, colorrectal, fuga, factores de riesgo

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## INTRODUCTION

Leakage from a colorectal anastomosis is a surgical complication whereby intestinal contents contaminate the peritoneal cavity owing to a breach in the integrity of the anastomosis (1). Clinically significant leaks may result in abdominal sepsis with resultant mortality, anastomotic loss, the need for permanent stoma and the increased risk of local recurrence in colorectal cancer cases (2). The development of an anastomotic leak is considered a direct indicator of the quality of colorectal surgery (3).

Colorectal anastomotic leak rates vary in the literature. Overall rates of up to 39% have been quoted, though clinical leak rates typically range from 3%–9% (4, 5). Postoperative mortality associated with anastomotic complications varies from 6% to 22% (2, 5) though rates of up to 50% have been reported (6).

Several independent factors associated with an increased risk of colorectal anastomotic leak have been well-established and include male gender, smoking/alcohol abuse, diverticular disease, emergency surgery, intraoperative septic complications and most importantly, infraperitoneal anastomoses (4). Authors have proposed other risk factors, though the evidence is less concrete. These include diabetes mellitus, use of pelvic drains, surgery duration (7), preoperative chemoradiotherapy (8) and the operative experience of the surgeon (9).

Seeing that colorectal procedures represent some of the most common general surgical procedures, it is essential to establish the frequency and impact of colorectal anastomotic leakage within our institution. Plummer *et al* demonstrated 14% mortality in a group of patients requiring emergency colectomy for bleeding, the main contributing factor being anastomotic leak (10). This study serves to further evaluate the local experience with colorectal anastomotic leakage and to determine the factors contributing to leakage in this setting. The study was approved by the University Hospital of the West Indies/University of the West Indies/Faculty of Medical Sciences Ethics Committee.

## SUBJECTS AND METHODS

All adult patients undergoing colorectal surgical procedures requiring colo-colic, colo-rectal, ileo-colic or ileo-rectal anastomoses during the three-year period between January

2006 and December 2008 were identified from recovery room records. These also included reversals of end colostomies and other colostomies requiring colonic resection. Patients in whom colonic injuries were repaired primarily were excluded.

The records were obtained and examined for patient demographics, diagnosis, the development of anastomotic leak, its mode of management and ultimate outcome. A patient was deemed to have a clinical anastomotic leak when clinical features of diffuse or localized peritonitis, ileus or pyrexia were associated with the finding of anastomotic dehiscence at laparotomy or based on imaging studies revealing air and/or a collection in the vicinity of an anastomosis in the symptomatic patient. Risk factors for anastomotic leak were ascertained and included the following: the number of associated patient co-morbidities, the use of bowel preparation, the nature of the operation (emergency or elective, open or laparoscopic), the nature (handsewn or stapled) and location of the anastomosis, the start time and duration of the operation, the presence of contamination, the extent of blood loss, the need for intraoperative and postoperative inotropic support, the level of the participating surgeons.

Using version 17.0 of the Statistical Package for the Social Sciences (SPSS), the rate of anastomotic leakage and 30-day mortality rate were determined. Univariate and multivariate analyses using Chi-squared, *t*-test, Mann-Whitney test and logistic regression models were performed to ascertain the factors that independently impacted on the genesis of these anastomotic leaks.

## RESULTS

Over the three-year period, 133 procedures meeting the inclusion criteria were identified. The characteristics of patients in the series are summarized in Table 1. Procedures were performed on 77 (57.9%) female and 56 (42.1%) male patients with a median age of 60 (range 21–96) years. Nearly one-half the procedures were performed for cancer. The median operative duration was 180 (range 82.5–425) minutes. Emergency procedures were performed in 46 (34.6%) patients. The distribution of procedures included 41 right hemicolectomies, 27 sigmoidectomies, 14 ileocaecal resections, 16 left hemicolectomies, 14 subtotal colectomies, 12 anterior and low anterior resections, and nine colostomy

Table 1: Characteristics of patients

	Overall (n = 133)	
<b>Gender</b>		
Male	56 (42.1%)	
Female	77 (57.9%)	
<b>Age (years)</b>		
Mean	58 ± 18	
Range	21–96	
Median	60	
<b>Timing</b>		
Emergency	46 (34.6%)	
Elective	87 (65.4%)	
<b>Diagnosis</b>		
Cancer	66 (49.6%)	
Diverticular disease	11 (8.3%)	
Inflammatory/benign disease	17 (12.8%)	
Penetrating trauma	6 (4.5%)	
Colostomy closure	10 (7.5%)	
Others	23 (17.3%)	
<b>Number of co-morbidities</b>		
0	65 (48.9%)	
1	33 (24.8%)	
2	29 (21.8%)	
3	6 (4.5%)	
<b>Approach</b>		
Open	126 (94.7%)	
Laparoscopic	7 (5.3%)	

closures. Only a minority (5.3%) of procedures was performed by laparoscopy. One patient had proximal diversion. The overall anastomotic leak rate was 9.0% (12 out of 133).

Table 2: Univariate analysis of preoperative variables

Variable	No leak	Leak	p-value
<b>Gender</b>			
Male	46 (82.1%)	10 (17.9%)	
Female	75 (97.4%)	2 (2.6%)	0.002
<b>Age (years)</b>			
Mean	59 (17)	57 (27)	
Range	18 – 93	18 – 94	
Median	60	61	0.804
<b>Diagnosis</b>			
Cancer	62 (93.9%)	4 (6.1%)	
Other	59 (88.1%)	8 (11.9%)	0.237
<b>Number of co-morbidities</b>			
0	59 (91.6%)	6 (9.4%)	
1	28 (84.8%)	5 (15.2%)	
2	28 (96.6%)	1 (3.4%)	
3	6 (100%)	0 (0%)	0.363
<b>Bowel preparation</b>			
None	111 (90.2%)	12 (9.8%)	
Oral	1 (100%)	0 (0%)	
Enema	8 (100%)	0 (0%)	0.617

The perioperative (30-day) mortality rate was 0%. Eleven patients required re-laparotomy for control of sepsis, while one patient was managed conservatively with percutaneous radiological drainage and systemic antibiotic therapy.

Table 3: Univariate analysis of operative variables

Variable	No leak	Leak	p-value
<b>Timing</b>			
Emergency	37 (80.4%)	9 (19.6%)	
Elective	84 (96.6%)	3 (3.4%)	0.002
<b>Type of approach</b>			
Open	114 (90.5%)	12 (9.5%)	
Laparoscopic	7 (100%)	0 (0%)	0.837
<b>Type of anastomosis</b>			
Ileocolic/ileorectal	65 (92.9%)	5 (7.1%)	
Colocolic/colorectal	57 (88.7%)	7 (11.3%)	0.715
<b>Anastomotic technique</b>			
Handsewn	82 (87.2%)	12 (12.8%)	
Stapled	35 (100%)	0 (0%)	0.026
<b>Operation start time</b>			
Before 10 pm	110 (92.4%)	9 (7.6%)	
After 10 pm	10 (76.9%)	3 (23.1%)	0.06
<b>Surgeon-Assistant level</b>			
Consultant-Consultant	43 (97.7%)	1 (2.3%)	
Consultant-Resident	20 (90.9%)	2 (9.1%)	
Resident-Resident	57 (86.4%)	9 (13.6%)	0.459
<b>Faecal contamination</b>			
No	121 (94.2%)	7 (5.8%)	
Yes	6 (54.5%)	5 (45.5%)	0.000
Blood loss (ml) [mean]	424	611	0.260
Operative time (min) [mean (SD)]	188 (66)	226 (63)	0.056
<b>Vasopressor use</b>			
No	117 (93.2%)	8 (6.8%)	
Yes	15 (73.3%)	4 (26.7%)	0.012

In univariate analysis (Tables 2 and 3), the following parameters were associated with an increased risk of anastomotic leak: male gender ( $p = 0.002$ ), emergency procedures ( $p = 0.002$ ), handsewn anastomoses ( $p = 0.026$ ), faecal contamination ( $p = 0.000$ ) and vasopressor use ( $p = 0.012$ ).

In multivariate analysis (Table 4), male gender (OR = 0.136; 95% CI 0.025, 0.744,  $p = 0.021$ ) was the only factor significantly associated with a higher risk of anastomotic leak.

Table 4: Multivariate analysis of variables having bivariate association with anastomotic leakage

Variable	OR	95% CI	p-value
Gender (M/F)	0.136	0.025, 0.744	0.021
Emergency vs elective	2.910	0.550, 15.396	0.209
Stapled vs handsewn	0.000	0.000	0.997
Vasopressor	2.071	0.330, 13.005	0.437
Faecal contamination	0.146	0.614, 26.936	0.146

## DISCUSSION

Anastomotic leakage from colorectal anastomoses carries the potential for significant burden on surgical healthcare services. Although the overall rates quoted are low, the potential for mortality and often more significantly, morbidity, exists. The risk of permanent stoma creation, with its psychological and functional impact, is realistic (11). The financial costs associated with anastomotic leakage are significant, often related to prolonged hospital stay, need for intensive care support and other supportive services (12). For developing countries, the latter represents a concern of utmost importance.

The data presented in this paper indicate that the clinical anastomotic leak rate for colorectal procedures at a single institution in a developing country is 9%, with no peri-operative mortality. The only risk factor identified for this complication was male gender.

Varying rates of anastomotic leak have been quoted (2, 4, 6, 13). What is considered an acceptable leak rate has not been well established. This is due to the fact that the term 'anastomotic leakage' is not well defined. As such, it is difficult to make accurate comparisons of rates between studies and institutions (14). Overall leak rates of up to 39% have been quoted (4), while clinical leak rates in the range of 3%–9% are deemed acceptable (4, 5). Acceptable leak rates vary based on the location of the anastomosis, with higher leak rates being well established for low pelvic anastomoses [8%–12%] (4, 5, 15). The clinical colorectal anastomotic leak rate in the present study represents the upper limit of rates typically quoted in the literature. The absence of post-operative mortality related to anastomotic leakage is encouraging. Although low mortality rates are not uncommon in both small and large series (16, 17), mortality rates of approximately 10% are well established (18). Our low mortality is likely attributable to early identification, through clinical acumen and adjunctive investigations, aggressive intervention and improvements in supportive care.

As seen in the present study, male gender has consistently been identified as a risk factor for anastomotic leak on multivariate analysis (5, 15, 19–22). The gender risk has been related predominantly to low rectal procedures and the male's narrow pelvis (20). It has also been postulated that hormonal differences in men influence intestinal micro-circulation and may contribute to higher risk of anastomotic failure in this group (23). Our study showed no clinical anastomotic leaks in the group of patients undergoing rectal procedures. However, the overall number of rectal procedures in the present study was low. As such, specific analysis of pelvic procedures as a risk factor for anastomotic leakage could not be undertaken.

Despite handsewn anastomoses being identified as a risk factor for anastomotic leak on univariate analysis, this was not supported by multivariate analysis. Meta-analyses have shown that stapled anastomoses are safer and associated with less leakage, with respect to ileocolic anastomoses (24).

For colorectal (left-sided) anastomoses, no difference has been found between the two groups (25). The pooling of data for right and left-sided anastomoses may be responsible for the lack of significance of this parameter in the present study. Future prospective studies should focus on separate evaluations for right and left-sided anastomoses.

Emergency surgery should inherently place patients at risk for anastomotic leak. Often, the patient's general condition and conditions of the bowel are suboptimal. Choi *et al* (26) identified emergency procedures as a significant risk factor for anastomotic leak on both univariate and multivariate analysis. This, however, has not been consistently demonstrated (4). Similarly, in the present study, emergency surgery was deemed to be a risk factor for anastomotic leak on univariate analysis but this did not remain significant on multivariate analysis. In fact, the safety of primary anastomoses in emergency colonic procedures for trauma, inflammatory processes, gastrointestinal bleeding and colonic obstruction have been clearly documented (27–29).

A few studies have demonstrated, on univariate and multivariate analysis, that faecal contamination is an independent predictor of colorectal anastomotic leakage (22, 30). Speculated to relate to the extension of peritoneal infection (31), the true association remains debatable. The present study showed a strong association between faecal contamination and anastomotic leak on univariate analysis ( $p = 0.000$ ), but failed to remain significant on multivariate analysis. Only 8.3% ( $n = 11$ ) of patients in the study population had faecal contamination. This low number may have limited the statistical power of this assessment in the analysis, thus impacting on the lack of significance noted on multivariate analysis.

The use of vasopressors is often essential in cases where significant cardiovascular instability has developed. This is often related to emergency procedures with significant preceding blood loss. An adverse effect of vasopressors may be compromise of the blood supply to the anastomosis due to constriction of the splanchnic circulation. Zakrisson *et al* (32) demonstrated a three-fold dose-dependent increased risk of gastrointestinal anastomotic leakage in patients admitted to the intensive care unit on vasopressor support. This was independent of the severity of the illness of the patient. The present study demonstrated an association between vasopressor use and anastomotic leak on univariate, but not multivariate analysis. Again, low numbers of patients placed on vasopressors ( $n = 19$ ) may have limited the statistical power in this analysis.

This study demonstrates that reasonable anastomotic leak rates can be achieved, although the anastomotic leak rates are at the upper limit of typically acceptable leak rates and reasonable outcomes, particularly related to mortality, can be achieved in a low-volume centre in a developing country. Male gender, a non-modifiable risk factor, was the only independent factor identified as potentially contributing to anastomotic leak. Despite this, continued vigilance in

optimizing patient care is critical. The retrospective nature and the lower patients compared to similar published studies represent inherent limitations of the present study. Further prospective evaluation, bearing in mind potential risk factors identified in the present study, is warranted.

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