

# Risk factors for anastomotic leakage after laparoscopic intracorporeal colorectal anastomosis with a double stapling technique

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## Abstract

*Objective:* This study aimed to identify the risk factors for anastomotic leakage after laparoscopic (intracorporeal) colorectal anastomosis with a double stapling technique at University Medical Center (UMC), Ho Chi Minh City.

*Patients and Methods:* Retrospective study. Between 2008 and 2014, a total of 227 patients underwent laparoscopic rectal resection including anterior and low anterior resection. We identified risk factors for anastomotic leakage after using double stapling technique in laparoscopic rectal resection by univariate analysis.

*Results:* There were 227 patients enrolled in study, male accounted for 51%, median age was 67. The location rate of a tumor above the anterior peritoneal reflection was 55.5%, stage III accounted for 91.6%. Anastomotic leakage rate was 4.8%. Anastomotic leakage rate of tumors located above anterior peritoneal reflection (Ra) was higher than those below anterior peritoneal reflection (Rb) ( $p=0.03$ ). Other factors such as tumor size, stage, neoadjuvant chemo-radiotherapy, protective ileostomy and number of stapler firings were not significantly associated with anastomotic leakage risk.

*Conclusion:* Anastomotic leakage rate after laparoscopic (intracorporeal) colorectal anastomosis with a double stapling technique was 4.8%. Tumor location was the risk factor of anastomotic leakage. Anastomotic leakage rate of tumors located above anterior peritoneal reflection was higher than those below, accounting for 7.9% and 1%, respectively.

## Introduction

Rectal cancer is a malignancy with a high incidence and mortality rates in the world as well as in Vietnam. Multimodal approaches in treatment for rectal cancer has applied for optimal effectiveness. Of which, surgery plays a center role [1], [2]. In 1982, Heald suggested the total mesorectal excision (TME) technique and neo-adjuvant radio-chemotherapy

helped to improve the rate of sphincter preservative surgery [3]. The introduction of auto-suture (staplers) has aided to make anastomosis at lower location with convenience.

In Vietnam, Nguyen Hoang Bac (2002) was the first to perform laparoscopic rectal resection with stapling anastomosis [4]. After that, this technique has been widely applied. Beside the advantages

well recognized such as quick recovery, postoperative less pain, esthetic aspect as well as optimal oncological results, however laparoscopic rectal resection with stapling anastomosis still has some limitations concerning about anastomosis. Anastomotic leakage is a severe complication, accounting for about 3 – 27% and might be life-threatening, affect the quality of life and reduce oncological treatment results [5], [6], [7].

Some authors thought that anastomotic leakage risk would be elevated when the rectal tumor located below the anterior peritoneal reflection and when more than 1 staple were used [7]. At Ho Chi Minh city University Medical Center, anastomotic leakage rate of laparoscopic rectal resection with stapling anastomosis was 11.2%. However, risk factors of this accident have not been described [8]. So, we conducted this study to investigate risk factors for anastomotic leakage after laparoscopic (intracorporeal) colorectal anastomosis with a double stapling technique

## Patients and methods

### Patients

#### *Inclusion criteria:*

Patients with rectal cancer who underwent laparoscopic (intracorporeal) colorectal anastomosis with a double stapling technique

Histopathology examination confirmed rectal cancer Stage of I, II, III or IV (liver metastasis with simultaneous hepatectomy)

#### *Exclusion criteria*

History of total colectomy

Concomitant cancer in both left and right colon

Recurrent rectal cancer

Open surgery conversion

#### *Site and Time of study*

From 2008 to 2014

At Ho Chi Minh city University Medical Center

### Methods

*Design: Retrospective descriptive study*

*Data collection: variables data was collected from medical records.*

Table 1. variables definition

Variables	Definition
Age	Unit: year(s) at the time of study or death
Gender	Male / female
BMI	Weight (kg)/ Height <sup>2</sup> (m)
Albumin (blood)	Unit: g/dL, quantified before surgery
Neo-adjuvant radio-chemotherapy	Protocol for long term treatment with 50 Gy / 25 days and surgery was performed in 4-6 weeks when completing.
Operation duration	Unit: minute(s), since incision to skin closure
Tumor location	Identified during operation as Ra if the lower border of the tumor located above the anterior peritoneal reflection or Rb if below
Stapler firings used	Number of stapler firings used for horizontal rectal transection
Blood loss	Unit: ml, measured by gauze weights and volume in the suction bottle
Anastomotic leakage	Defined as a discontinuity of digestive tract at the anastomotic position with clinical manifestations as abdominal pain, fever, feculent drainage, leukocytosis, elevated CRP and anastomotic discontinuity with fluid collection surrounding on the CT Scanner.

*Data analysis:* Data was collected and analyzed by SPSS 25.0 software. Identify related factors of anastomotic leakage complication in laparoscopic rectal resection with stapling anastomosis by univariate analysis.

## Results

From 2008 to 2017, there were 227 patients who underwent laparoscopic (intracorporeal) colorectal anastomosis with a double stapling technique. The male/female ratio was nearly 1/1. The mean age was 67 with the youngest of 23 years old and the oldest of 109 years old. In most of cases, tumors located above the anterior peritoneal reflection and mostly were of stage III accounting for 91,6%. Neo-adjuvant

radio-chemotherapy was performed in 2,2% cases. All patients were with the blood concentration of albumin below 3 g/dL. The rate of protective ileostomy in the below anterior peritoneal reflection group was 4 times higher than above group (89,1% vs. 19,8%, respectively).

Table 2. Characteristics of study subjects

Characteristics		N = 227 (%)
Gender	Male	116 (51%)
	Female	111 (49%)
Mean age (year)		67 ± 13 (23-109)
BMI (kg/m <sup>2</sup> )		21,7 ± 3,3 (13,3-33,8)
Tumor location	Ra	126 (55,5%)
	Rb	101 (45,5%)
Stage	I	1 (0,4%)
	II	7 (3,1%)
	III	207 (91,6%)
	IV	11 (4,9%)
Neo-adjuvant radio-chemotherapy	Yes	5 (2,2%)
	No	222 (97,8%)
Albumin (g/dL)		4,2 ± 0,6 (3,0-9,6)
Tumor size (cm)		4,5 ± 1,9 (1-10)
Protective ileostomy	Ra	25/126 (19,8%)
	Rb	90/101 (89,1%)
Anastomotic leakage		11 (4,8%)

Anastomotic leakage complication happened in 11 cases, accounting for 4,8%. Among them, most of cases were above anterior peritoneal reflection tumors. A majority of anastomotic leakage were in non-ileostomy group (7/11 cases). A univariate analysis showed a higher anastomotic leakage rate in the above anterior peritoneal reflection group in comparison with below group (p=0,03).

The anastomotic leakage rate of more than one staple group was 5.1%, not higher than group with one staple used 4.8%. Other factors such as over 70 years of age, male, BMI over 25, albumin

concentration in blood over 3.5 g/dL, tumor stage T3-4, tumor size over 5 cm, regional lymph node metastasis, neo-adjuvant radio-chemotherapy, non-ileostomy, operating duration over 300 minutes, blood loss more than 100 ml did not affect the anastomotic leakage rate.

Table 3. Univariate analysis results

Descriptions	Anastomotic leakage				p	
	Total	Yes	No	%		
Age	< 70	132	5	127	3,8	0,5
	≥ 70	95	6	89	6,3	
Gender	Female	111	2	109	1,8	0,06
	Male	116	9	107	7,8	
BMI	< 25	193	11	182	5,7	0,4
	≥ 25	34	0	34	0	
Albumin	< 3.5	30	3	27	10	0,2
	≥ 3.5	197	8	189	4,1	
Tumor location	Rb	101	1	100	1	0,03
	Ra	126	10	116	7,9	
Tumor size	< 5cm	162	10	152	6,2	0,2
	≥ 5cm	65	1	64	1,5	
T	T1-2	27	1	26	3,7	1
	T3-4	200	10	190	5	
N	N0	138	6	132	4,3	0,7
	N(+)	89	5	84	5,6	
nCRT	No	222	11	211	5	1
	Yes	5	0	5	0	
Number of staples	1	168	8	160	4,8	1
	≥ 2	59	3	56	5,1	
Ileostomy	No	112	7	105	6,3	0,4
	Yes	115	4	111	3,5	
Operating time	< 300 min	217	11	206	5,1	1
	≥ 300 min	10	0	10	0	
Blood loss	< 100 ml	223	11	212	4,9	1
	≥ 100 ml	4	0	4	0	

## Discussion

Anastomotic leakage is a severe complication of laparoscopic rectal resection with stapling anastomosis with the rate of approximately 3 – 27%, sometimes causes were not identified even during re-operation because it depends on many factors [5], [6], [7]. Some studies showed factors relating to anastomotic complications such as: aging, male, diabetes mellitus, obesity, neo-adjuvant radio-chemotherapy, ileostomy, tumor size, number of staples, stage [9], [10]. Studies with univariate and multivariate analysis showed that the number of staples used for rectal transection was an independent risk factor of anastomotic leakage complication. Using multiple staples would increase the risk of gap between intersections leading to anastomotic leakage [11], [12]. Ito conducted a retrospective study on 180 cases of laparoscopic rectal resection with stapling anastomosis and reported that the anastomotic leakage rate of using 3 and more staples group was 5 times higher than group of using 2 or less staples (15% vs. 3%) [11]. Using multiple staples for rectal resection were often male, with narrow pelvis and large tumor located below the anterior peritoneal reflection. Ito noted that number of staples using in low anterior resection was 2.2 times higher than in anterior resection only [11]. Balciscueta conducted a meta-analysis of 1267 cases of laparoscopic rectal resection with stapling anastomosis and reported 52% of using 2 staples. The anastomotic leakage rate of this group was 6.7%, higher than 3.5% of using 1 staple ( $p < 0,003$ ) [7]. In our study, there was no significant difference between groups of using 2 and more staples with group of 1 staple used

Tumor location was identified during the operation based on the correlation of the tumor's lower border and peritoneal reflection. For those below the anterior peritoneal reflection, a total mesorectal excision was performed. Recent studies showed that less than 25% of cases using 1 staple could completely resect the rectum when tumor located below the anterior peritoneal reflection. In most of cases, 2 or more staples were used.

As a result, anastomotic leakage risk was higher when tumor located below the anterior peritoneal reflection [13], [14]. Hamabe studied on 296 cases of laparoscopic rectal resection with stapling anastomosis and reported the anastomotic leakage rate, 3 times higher when tumors located below 7 cm from the anal margin [15]. The anastomotic leakage rate in our series for above anterior peritoneal reflection tumors was 7,9%, higher than 1% for those below. The rate of ileostomy in below group was 89,1%, remarkably higher than 19.8% in above group. Protective ileostomy did not reduce the anastomotic leakage complication, but might reduce its manifestation [15]. So, clinical anastomotic leakage was not recorded in cases of low anterior resection with ileostomy.

Recently some studies of using fluorescent dye of Indocyanine green (ICG) to assess the blood circulation of the anastomosis in order to reduce the risk of anastomotic leakage complication [16]. Boni conducted a paired study on 42 cases of laparoscopic low anterior resection with per-operative ICG using and reported 2 cases of changing anastomotic position, 2 cases of anastomotic leakage in control group without any leakage case in case group of using ICG [17]. Application of ICG technique helped to assess poor circulation of the low rectal anastomosis in 30%, to change the anastomotic position in high rectum. [16]. However, the role of fluorescent dye ICG still be controversial and randomized controlled clinical trials with large sample sizes are required.

## Limitation

An important limitation of our study was retrospective design and the diagnostic criteria of anastomotic leakage [18]. Anastomotic leakage cases were mostly of grade C and maybe cases of grade A and B were missed.

## Conclusion

The anastomotic leakage of laparoscopic (intracorporeal) colorectal anastomosis with a

double stapling technique was 4.8%. Tumor location was the risk factor of this complication. Tumor's location above the anterior peritoneal reflection has high rate of anastomotic leakage in comparison with group of below the anterior peritoneal reflection (7,9% vs. 1%, respectively).

**Medical Ethics:** This study was approved by Medical Ethics Committee of University of Medical and Pharmacy of Ho Chi Minh City.

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