




# Impact of the Vertical Division of the Rectum on the Decrease in Reloading of the Endostapler for a Complete Division in Colorectal Cancer

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J Coloproctol 2022;42(4):286–289.

## Abstract

**Background** Despite several improvements in surgical techniques, the intracorporeal division of the distal end of the rectum is still challenging, particularly when it is too deep in a narrow pelvis. Even though it helps avoid spillage, the double-stapling technique (DST) raises concerns regarding safety and anastomotic leakage if multiple stapler firings are essential to complete the rectal division.

**Objective** To assess the feasibility of vertically dividing the rectum and its impact in reducing the number of reloads essential for that division in non-low rectal cancer patients undergoing total mesorectal excision (TME).

**Materials and Methods** A retrospective study.

**Results** From January 2017 to November 2021, a total of 123 patients with sigmoid and rectal cancers were enrolled in the present study; their data were collected and analyzed, and 21 patients were excluded. The remaining sample of 102 subjects was composed of 47 male (46%) and 55 female (54%) patients with a median age of 54 years (range: 30 to 78 years). Only 1 reload was enough to complete the rectal division in 82 (80.39%) cases, and 2 reloads were used in the remaining 20 (19.61%) patients. Anastomotic leakage was clinically evident in 4 cases (3.9%). No statically significant difference was observed when firing one or two staplers. No 30-day mortality was recorded in this series.

**Conclusion** Our early experience indicates that this type of division has a real advantage in terms of decreasing the number of reloads needed and, in turn, lowering the incidence of anastomotic leakage after partial mesorectal excision (PME) or TME when applied with proper patient selection.

## Keywords

- rectal cancer
- vertical division

received  
March 10, 2022  
accepted after revision  
September 15, 2022

DOI <https://doi.org/10.1055/s-0042-1757771>.  
ISSN 2237-9363.

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Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

## Introduction

Despite the several improvements in surgical techniques, the intracorporeal division of the distal end of the rectum is still challenging, particularly when it is too deep in a narrow pelvis. First reported in 1980 by Knight and Griffen,<sup>1</sup> the double-stapling technique (DST) uses linear and circular staplers, thus eliminating the need for a tedious deeply-sited colorectal anastomosis and avoiding spillage as the distal end of the rectum is now closed. Still, DST raises some concerns regarding safety and anastomotic leakage if multiple stapler firings are required to complete the rectal division.<sup>2-5</sup>

No doubt, the advances in the technology behind stapler devices with the articulating system helps a lot to straighten the line of division, even though this also involved the way in which the stapler is applied. The modified DST with vertical division of the rectum (IO-DST) was first described in 2009 by Maeda et al.,<sup>6</sup> who reported that it is much more helpful than the conventional horizontal application, particularly for very low anastomoses or for patients with a narrow pelvis.

The present study was conducted to assess the feasibility of performing IO-DST and its impact in reducing the number of reloads essential for that division in non-low rectal cancer patients undergoing total mesorectal excision (TME) and those with rectosigmoid or sigmoid cancer undergoing partial mesorectal excision (PME).

## Patients and Methods

From January 2017 to November 2021, patients attending the National Cancer Institute of Cairo University, Shefa Orman Cancer Hospital, in Luxor, and Dar Al Fouad Hospital, in Giza, Egypt, and undergoing high or low laparoscopic anterior resection for sigmoid, upper and mid-rectal cancers were included. It is a retro-prospective study that was conducted on a prospectively-maintained database. All cases were treated by one team of two colorectal surgeons. The present study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.<sup>7</sup> The inclusion criteria were patients with sigmoid cancer, rectosigmoid/upper rectal cancer, and mid-rectal cancer up to 7 cm from the anal verge. The exclusion criteria were mid-rectal cancer more than 7 cm from the anal verge, low rectal cancer, and cases converted to the open approach.

Baseline demographics (age, gender, Eastern Cooperative Oncology Group [ECOG] score, smoking, DM, and Body Mass Index [BMI]), and cumulative score) and preoperative data (distance of the tumor from the anal verge) were collected and analyzed. Preoperative chemoradiotherapy (CRT) is routinely administered for mid-rectal lesions greater than T3a, and it is usually a long course. The intraoperative data (operative time, estimated blood loss, technical mishaps, number of stapler firings, performing a covering ileostomy or not) and immediate postoperative outcomes (complications, if any, such as anastomotic leakage, ileus, wound problems, rate of reoperation, and 30-day mortality) were analyzed as well.

## Technical Notes

We usually preserve the left colic artery after regional lymph node dissection, particularly in elderly patients, except for mid- and low lesions in which high inferior mesenteric artery (IMA) ligations are performed to ensure a tension-free anastomosis. The performance of TME was usually institutionalized for patients with mid rectal cancer in this series; otherwise, PME was performed; however, in both cases we try to mobilize the rectum as much as possible. Meticulous defatting at the planned site of division of the rectum is essential, by cutting through the avascular plane between the rectal wall and its mesorectum using a sealing device.

The specimen is usually extracted through a Pfannenstiel incision before that another port is inserted at the proposed Pfannenstiel incision for stapling. Through which the stapler is applied in a vertical fashion while the hips are extended and the trunk is stretched via Trendelenberg position.

We used the Echelon 60 mm or 45 mm (Ethicon Endo-Surgery, Inc., Cincinnati, OH, United States) stapler to divide the rectum, always with a vertical application. After that, a Pfannenstiel incision is made by widening the suprapubic port site 2 cm on each side, through which the specimen is extracted. Finally, the DST is completed intracorporeally.

## Ethical Issues

Before the beginning of the present study, we obtained approval from the Institutional Review Board of the National Cancer Institute (under number: 220151003).

## Results

From January 2017 to November 2021, a total of 123 patients with sigmoid and rectal cancers were potential candidates for high or low laparoscopic anterior resection. Overall, 21 of them were excluded because of conversion to the open approach due to multivisceral resection or adhesions (13 cases), stapler failure (1 case), or conversion to transanal TME (8 cases) for mid-rectal cancers due to the difficulty in ensuring an adequate distal margin via the abdominal approach. In total, 19 patients with mid-rectal cancer were beyond T3a; in these cases upfront CRT and a covering stoma were adopted. The remaining 3 patients in this group were T3a or less, with non-threatened CRM, and underwent upfront surgery with no covering stoma. All eligible patients with sigmoid or rectosigmoid cancers were directly submitted to surgery. The remaining sample of 102 subjects was composed of 47 male (46%) and 55 female (54%) patients with a median age of 54 years (range: 30 to 78 years); their data were collected and analyzed. The demographic and operative data are shown in (► **Table 1**). In total, 79 patients underwent PME, and 23 underwent TME (► **Table 2**). Only 1 reload was enough to complete the rectal division in 82 cases (80.39%), and 2 reloads were used in the remaining 20 (19.61%) patients (► **Table 3**). Anastomotic leakage was clinically evident in 4 cases (3.92%): three of them had their IMA highly ligated, and there was 1 case of low ligation. The

**Table 1** Demographic and operative data

	N = 102	
Gender	47	46.1%
■ Male	55	53.9%
■ Female		
Age in years (median and range)	54	30–79
Eastern Cooperative Oncology Group (ECOG) score	93	
■ 0 or 1	9	
■ 2		
Body Mass Index	77	78.4%
■ < 30	25	21.6%
■ > 30		
Operative time (hours)	68	
■ < 3.5	34	
■ > 3.5		
Estimated blood loss (mL)	87	
■ < 200	15	
■ > 200		
Incidence of anastomotic leakage	4	3.92%

conservative management was successful in one patient, two cases underwent reexploration, peritoneal lavage, completion of the partly disrupted anastomoses together with a Hartman procedure, and one patient had a small leak in the anastomotic site, which was over-sutured and covered by a defunctioning ileostomy. No 30-day mortality was recorded in the present series.

## Discussion

One of the main differences between open and laparoscopic surgery for left-sided colorectal cancer is how the rectum is divided. In the open approach, one straight line of division is always performed, but the laparoscopic intracorporeal division may end up in multiple and oblique lines. A narrow pelvis, bulky tumors, and the space the endo-instruments themselves occupy in the pelvis are usually matters of concern; thus, our policy for tumors 6 cm or less from the anal verge are directed to Ta TME approach mainly for two reasons: the application of the endo-GIA too deep in the pelvis in the presence of a low tumor is often difficult, stressful and may jeopardize the quality of the TME; and what is difficult from above is much easier from below.

There is no controversy regarding the fact that the pelvic morphology together with the patient's BMI are major difficulty determinants for laparoscopic intrapelvic surgery.<sup>8</sup> Even though half or the patients in the present study were overweight or obese (mean BMI: 28 kg/m<sup>2</sup>), and cases of narrow pelvis were not infrequent in our sample, vertical rectal division was a non-stressful step.

No doubt that the traditional intracorporeal rectal division through the lower right port in a horizontal fashion is technically demanding even with the advances in surgical devices, frequently resulting not only in multiple stapler firings, but also in a nonuniform staple line. In the present study, we

**Table 2** Stapling data

	Partial mesorectal excision	Total mesorectal excision
Length of reloads (mm)	79/79	12/23
■ 60	0/79	13/23
■ 45		
Number of reloads	68/79	14/23
■ 1	11/79	9/23
■ 2		
Covering ileostomy	0/79	

**Table 3** Number of reloads and rate of anastomotic leakage

	Anastomotic leakage	
	(n)	(%)
One reload	3/84	3.57
Two reloads	1/20	5

standardized every step in the procedure, paying attention and devoting time to prepare the proposed site for rectal division to get a skeletonized rectal wall under the stapler. This preparation together with the vertical application often results in complete division, with one firing in a smooth step.

Anastomotic leakage is a serious event in laparoscopic colorectal cancer surgery, resulting in considerable morbidity and mortality. Moreover, a permanent stoma and impaired oncological safety are not far-fetched consequences.<sup>9–11</sup> The rate of anastomotic leakage remains between 6.3% and 13.7%,<sup>4,12–16</sup> even with the great advances in terms of instruments and improved surgical techniques. We do believe that the low rate of anastomotic leaks in the present study (3.9%) is mainly due to: direction of tumors less than 7 cm from the anal verge to Ta TME because of the toilsome top-down approach in such cases, the standard laparoscopic steps adopted, the properly prepared defatted site for rectal division, the vertical application, which required only one staple firing in over 90% of the cases, and the fixed surgical team, whose laparoscopic learning curve had plateaued out.

The straight uniform line of division facilitated by the vertical application could be the reason why no statistically significant differences were observed with one or two stapler firings.

It is worth mentioning that one of the main limitations of the present work is the small sample size. Additionally, it has been conducted in a retrospective fashion, which might prevent us from drawing more powerful conclusions. On the other hand, the homogeneous sample of patients and the fact that the procedures were performed by one surgical team, from our perspective, are important strengths.

## Conclusion

To our knowledge, the present is the first work from our region to study the feasibility of laparoscopic vertical

division of the rectum and its impact in reducing the number of reloads essential for that division. Our early experience indicates that this fashion of division has real advantages in terms of decreasing the number of reloads needed and lowering the incidence of anastomotic leakage after PME or TME when applied with proper patient selection.

#### Conflict of Interests

The authors have no conflict of interests to declare.

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