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ORIGINAL ARTICLE

# Does circumferential tumor location affect the circumferential resection margin status in mid and low rectal cancer?

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**KEYWORDS**
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**Summary** *Background/Objective:* The purpose of this study was to assess the impact of circumferential tumor location on circumferential resection margin (CRM) status and the depth of tumor invasion in mid and low rectal cancer.
*Methods:* We retrospectively analyzed whole-mount slides of 58 patients who underwent total mesorectal excision for mid and low rectal cancer. The rate of tumor-positive CRM was compared according to the circumferential tumor location. In 31 patients, morphometric analyses of whole-mount specimens were performed to measure the depth of tumor invasion according to circumferential tumor location.
*Results:* Among 58 patients, 50% of tumors were anterior tumor and 50% were nonanterior. A tumor-positive CRM was more observed frequently in anterior tumors than in nonanterior tumors (41.1% vs. 10.3%, $p = 0.007$). In a multivariate analysis, anterior tumor was the only independent risk factor for a positive CRM (odds ratio 4.725, 95% confidence interval 1.102 −20.261, $p = 0.037$). In a morphometric analysis of 31 patients, the depth of tumor invasion from the muscularis mucosa was greater (11.9 mm vs. 6.6 mm, $p = 0.028$) in those with anterior tumors.

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*Conclusion:* Anterior tumors are associated with a higher risk of tumor-positive CRM and tend to exhibit deeper invasion in mid and low rectal cancer.


## 1. Introduction

Rectal cancer should be treated by removal of tumor-bearing rectum with securing of an adequate safety margin and en bloc removal of the surrounding mesorectal package containing regional lymph nodes.[1] However, radical resection of rectal cancer is problematic because the rectum is confined within the narrow bony pelvis; exact dissection along the embryonic plane is technically challenging, and such tumors readily invade the adjacent pelvic wall or levator ani muscle. Therefore, achieving a sufficient radial margin from the tumor is essential, especially in extraperitoneal rectal cancer. The circumferential resection margin (CRM) is a predictive factor of local recurrence (LR) after radical surgery for rectal cancer[2–4].

CRM status is affected by the depth of tumor invasion and mesorectal lymph node metastasis. Therefore, we hypothesized that the volume of mesorectum surrounding the rectal tube would affect the CRM status. The volume of mesorectum differs depending on the circumferential direction, and the rate of tumor-positive CRM could be influenced by the circumferential location of the tumor. Anteriorly located tumors in which the mesorectum is smaller and thinner than that of tumors in other locations should be treated carefully, and the exact dissection plane should be determined. However, few studies have evaluated CRM invasion in anteriorly located tumors. The aim of this study was to identify the impact of circumferential tumor location on CRM status and depth of tumor invasion in mid and low rectal cancer. To avoid radiation-induced tumor modulation effect, we only included rectal cancer patients who did not receive preoperative radiation.

## 2. Methods

This retrospective study included patients with extraperitoneal rectal adenocarcinoma who underwent surgery with curative intent without preoperative radiation. From October 2004 to August 2009, total mesorectal excision (TME) was performed in 58 patients with mid to lower rectal cancer at Kyung Hee University Hospital. Patients who received preoperative radiation, emergent surgery, synchronous colorectal cancer, and carcinoma *in situ* were excluded. The reason why the patient did not receive preoperative radiation as they refused to undergo preoperative therapy.

All the surgeries were performed by two experienced surgeons who had completed more than 200 surgeries for rectal cancer. The surgeons evaluated the quality of TME and confirmed that the mesorectum was complete in all cases. All specimens from eligible patients were prepared as whole-mount sections. Tumor location was classified into four quadrants as follows: right lateral, posterior, left lateral, and anterior, which correspond to the 3, 6, 9, and 12 o'clock directions, respectively. When the tumor occupied a single quadrant, that quadrant was defined as the location of tumor. If the mass was located in more than two quadrants, the location was defined as the quadrant with the deepest extent of tumor invasion. A circumferential tumor was defined as a tumor involving over 75% of the circumference. Furthermore, tumor location was recategorized as anterior or nonanterior: tumors in the anterior or circumferential quadrant were categorized as anterior tumors, and tumors in the lateral or posterior quadrant as nonanterior tumors. We compared the rate of tumor-positive CRM depending on two positions. Tumors that invaded the CRM or were less than 1 mm from the CRM were defined as a positive CRM.[5] In addition, to identify risk factors for a positive CRM, CRM status was compared according to sex, body mass index (BMI), operation name [low anterior resection (LAR) or abdominoperineal resection (APR)], type of operation (laparoscopic or open surgery), distance of tumor from the anal verge, circumferential location, tumor differentiation, tumor size, and pathologic T (pT) category and N (pN) category.

### 2.1. Morphometric analysis of whole-mount sections

In 31 patients, whole-mount specimens were subjected to morphometric analysis by a single pathologist (Y.K.P) using a Bioquant Image Analyzer (R&M Biometrics, Inc. Nashville, TN). The deepest tumor invasion from the muscularis mucosa and the shortest distance between the tumor and CRM, termed the CRM length, were measured. Furthermore, the depth of tumor invasion and CRM length were compared between anterior and nonanterior tumors. Also, mesorectum thickness and area were measured in each quadrant. Mesorectum thickness was determined by measuring the distance from the muscularis propria to the CRM in the 12, 3, 6, and 9 o'clock directions, and mesorectum area was calculated by summing the subareas after dividing each quadrant into 2—14 pieces (Figure 1). The mesorectum thickness and area in each quadrant were compared. In addition, the correlation between the degree of obesity and the mesorectum area in each quadrant was calculated.

### 2.2. Data collection and statistical analysis

After being approved by the Institutional Review Board, patient and tumor data were collected by the review of

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