

Original Article

A Transanal Technique for Accurately Measuring Distal Resection Margin in Rectal Cancer

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Key Words

Rectal cancer;

Distal margin resection;

Transanal

Purpose. Adequate distal resection margin (DRM) is an important factor determining the outcome of rectal cancer surgery. Traditionally, DRM is measured intra-abdominally after mesorectal excision. We proposed a new method to achieve sufficient DRM and avoid tumor cell exfoliation caused by surgical over-manipulation of the rectum involved with tumor.

Material and Methods. Between October 2013 and February 2014, 17 patients (seven males, 10 females; median age: 71.1 yrs (range: 44-85 yrs) with rectal cancer who underwent low anterior resection (15 patients) or colo-anal anastomosis (two patients) received our intra-operative transanal technique. We used a plastic anoscope to expand the anal canal and allow the use of a plastic ruler to measure the distal tumor margin. We then performed purse string suture ligation of the distal margin with 3-0 vicryl leaving a sufficient length to use as a guide during surgery. During the colectomy, we performed the resection below the suture site.

Results. The average *in vivo* DRM was 43.8 mm +/- SD of 12.7 mm (range: 20-80 mm). Average *ex-vivo* DRM was 32.7 mm +/- SD of 8.85 mm (range: 20-60 mm). The shrinkage rate, comparing *in vivo* with *ex vivo*, was 25.3%. The average DRM, as measured by the pathologist (i.e., *in vitro*), was 24.9 mm (range: 15-53 mm). The average shrinkage rate at pathology was 41.9%.

Conclusions. Our transanal suture ligation method offers an optimal method to avoid insufficient DRM and tumor cell exfoliation caused by surgical over-manipulation of the rectum involved with tumor.

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The preservation of anal sphincter function is an important issue in low rectal cancer surgery, especially when defining the optimal distal resection margin (DRM). Currently, total mesorectal excision (TME) and circumferential resection margin (CRM) are advocated in cases of low rectal cancer. However, the optimal DRM is still an important factor in local

recurrence rate. A histologically positive resection margin on final pathology report could lead to a local recurrence rate approaching 40% (HR (hazard ratio): 16.8, 95% CI: 4.8-5.9) and a decreased 5-year survival rate (HR: 2.35, 95% CI: 1.08-5.11).¹ In addition, impairment of rectoanal function occurs in approximately 22-32% of patients who receive low anterior

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resection or colo-anal anastomosis.²⁻⁴

Although no difference between local and systemic recurrence rates was found in patients with a DRM ≤ 5 mm vs. > 5 mm who received neoadjuvant or adjuvant chemoradiotherapy,⁵ in patients who did not receive radiotherapy, a safe margin of at least 2 cm is still recommended.⁶ In addition, there is a strong possibility of tumor seeding of the anastomosis when manipulating the tumor during colectomy. Therefore, the goal of the current study was to balance functional outcome and oncologic safety by determining an accurate DRM using our transanal method, while avoiding tumor cell exfoliation.

Subjects and Methods

Between October 2013 and February 2014, 17 patients (seven males and 10 females; median age: 71.1 yrs (range: 44-85 yrs) with rectal cancer who underwent low anterior resection or colo-anal anastomosis at Kaohsiung Veterans General hospital received our intraoperative transanal technique. Patients underwent colectomy and pre-operative evaluation at our institution and some patients also received preoperative radiochemotherapy. The pre-operative evaluation included chest X-ray, abdominal sonography, CT of the abdomen and pelvis, or MRI of abdomen and pelvis, and laboratory examinations.

Our procedure was performed in 16 patients before colectomy and devascularization and was performed during colectomy in one patient due to the high position of their tumor (> 10 cm from the anal verge).

Surgical technique

Each patient was hospitalized and prepped for colon surgery a few days prior to surgery by soap solution enema. Our procedure can be performed during the operation or before the operation after general anesthesia. A plastic anoscope of varying sizes provided good visualization of the operative field for our transanal technique. The anoretractor, or anoscope, and ruler used for measuring the DRM are shown in Fig. 1.

If the procedure was to be performed before the

colon-rectal surgery, the patient was placed in the lithotomy position after general anesthesia was achieved. If our procedure was performed during the operation, the patient was placed in the modified-lithotomy position.

During anoscopy, a plastic ruler was applied to the anal region and the DRM length was measured. If the measured DRM was at least 2 cm distal to the lowest portion of the tumor, it was marked with 3-O vicryl using a purse string suture ligation, retaining enough suture material to allow us to identify the suture site and drag it (Fig. 2). After devascularization and resection of the mesorectum, a low anterior clamp was applied below the site of the purse string suture. The previously retained stitches enabled us to drag the suture site to ensure a correct margin for resection. However, if the tumor was located beyond 10 cm from the anal verge, this procedure was difficult to perform due to poor visualization of the suture material.

DRM closure was achieved by a running suture or separated stitches. The *ex-vivo* DRM was measured 30 min after the specimen was removed and the *in vitro* DRM was measured after fixation in formalin by the pathologist.

Results

The clinicopathologic characteristics of the 17 patients who underwent resection of their rectal cancer are shown in Table 1. There was a slight female to male predominance (59%). Three patients were pre-



Fig. 1. Plastic anoscopes of varying sizes and ruler used for evaluating the distance to the tumor.



Fig. 2. Sutures used to identify the DRM during the operation.

operative stage I, four were stage II, nine were stage III and one was stage IV. The average age was 71.1 yrs (range: 44-85 yrs). One patient's rectal cancer was located high in the rectum (12 cm from the anal verge) while the other 16 patients had cancers located at the mid or lower rectum.

The DRM distance and pathology specimen characteristics are shown in Table 2. The average *in vivo* DRM was 43.8 mm +/- SD of 12.7 mm (range: 20-80 mm). Average *ex-vivo* DRM was 32.7 mm +/- SD of 8.85 mm (range: 20-60 mm). The shrinkage rate, comparing *in vivo* with *ex vivo*, was 26.7%. The average DRM, as measured by the pathologist (i.e., *in vitro* DRM), was 24.9 mm +/- SD of 9.28 mm (range: 15-53 mm). The average shrinkage rate, comparing *ex vivo* with *in vitro*, was 25.3%. Comparing *in vivo* with *in vitro*, the average shrinkage rate, at pathology, was 41.9%.

Discussion

The optimal method for determining a safe DRM

Table 1. Clinicopathologic characteristics of 17 patients who underwent both low anterior resection and high resection of rectal cancer

Age (y), mean (SD)	71.1 (9.68)
Sex, n (%)	
Male	7 (41.2%)
Female	10 (58.8%)
Tumor location, n (%)	
Upper rectum (≥ 10 cm from anal verge)	1 (6.25%)
Mid-low rectum (< 10 cm from anal verge)	16 (93.75%)
Pre-OP stage, n (%)	
I	3 (17.6%)
II	4 (23.5%)
III	9 (52.9%)
IV	1 (6%)

Table 2. Distal resection margin distance and pathology specimen characteristics

Distal margin (in vivo) (mm), mean (SD)	43.8 (12.7)
Median of distal margin (in vivo)	40
Distal margin (ex vivo) (mm), mean (SD)	32.7 (8.85)
Median of distal margin (ex vivo)	33
Distal margin (pathology) (mm), mean (SD)	24.9 (8.85)
Median of distal margin (pathology)	22
Subtract of distal margin (in vivo and ex vivo) (mm), mean (SD)	11.1 (5.93)
Subtract of distal margin (in vivo and pathology) (mm), mean (SD)	18.9 (8.06)
Subtract of distal margin (ex vivo and pathology) (mm), mean (SD)	7.9 (3.05)
Shrinkage of specimen (ex vivo) (%)	25.3
Shrinkage of specimen (pathology) (%)	41.9

for low anterior resection or abdominal perineal resection (APR) of rectal cancer is still a controversial topic. Preoperative chemoradiotherapy is reserved for patients with high risk of local recurrence of tumor.^{7,8} However, when we attempt to preserve anal sphincter function, the cosmetic appearance of the anus, and attempt to avoid permanent ostomy, tumor located within the low rectum may result in short DRM.¹ Thus, it is important to estimate the risk of local recurrence from short DRM when performing an APR. However, determination of a safe DRM length when performing colectomy for rectal cancer is difficult. The United States National Cancer Institute (NCI) and the European Society for Medical Oncology (ESMO) have

proposed anoptimal DRM measuring between 2 and 5 cm for mid to high rectal cancers and 1 cm for low rectal cancer.^{9,10}

We applied our transanal technique for measuring DRM to 17 patients who received rectal cancer resection in our hospital. In this group, one patient's rectal cancer was located high in the rectum (12 cm from the anal verge) while the other 16 patients had cancers located at the mid or low rectum. Our results revealed an average specimen shrinkage rate at pathology of 41.9%. Therefore, to preserve anal sphincter function and avoid APR surgery, it is important to judge the risk of short DRM using our technique. To achieve the optimal DRM (> 1 cm) in cases of low rectal cancer, the length from the cutting end to the tumor should be > 2.39 cm.

Our study had several limitations. In addition to the small cohort of patients in our study (17 patients), not all the patients received our technique before exploratory laparotomy and devascularization. In addition, we found it difficult to apply this technique to rectal tumors located > 10 cm from the anal verge. However, when this method was applied to cases of mid to low rectal cancers (i.e., < 10 cm from the anal verge), we were able to avoid insufficient DRM and tumor cell exfoliation which can occur from surgical over-manipulation of the rectum involved with tumor. Future studies are needed to determine a method which can be used to measure the DRM at > 10 cm from the anal verge to enable comparative outcomes and evaluation of our method.

In conclusion, our transanal suture ligation method offers an optimal method to measure DRM in order to avoid insufficient DRM and avoid tumor cell exfoliation during surgery. However, this method is only applicable for mid to low rectal cancers (i.e., tumors < 10 cm from the anal verge).

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原 著

經由肛門精確量測直腸癌病患遠端切緣的長度

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目的 直腸癌病患遠端切緣的長度對於病患是一個重要的預後因子。但是如何準確的量測足夠的切緣長度仍是一個令人困擾的問題，我們在此提出一個手術的方法，使我們可以在直腸癌手術中得到足夠的遠端切緣的長度。

方法 從 2013 年 10 月至 2014 年 2 月之間，我們共選取 17 名罹患直腸癌的病患，並且於手術進行中利用肛門鏡及 3-O vicryl 縫線，利用量尺量測我們設定的遠端切緣（至少距離腫瘤大於 2 公分）並縫合肛門出口，並留下一段縫線長度使我們可以於手術之中利用來確認遠端切緣，之後利用相關統計方法分析各種情況下遠端的切緣長度。

結果 我們共選取 17 位接受低前位切除的直腸癌病患，並比較手術術前量測、標本離體，以及病理福馬林定型後的遠端切緣長度之間的關係。

我們發現到經由我們提出的方法量測到的活體距離平均約 43.8 公厘並且於離體量測時縮減到 32.7 公厘（縮減比率約 25.3%），兩者之間的縮減長度約為 11.1 公厘。這個縮減的長度在經由福馬林的處理定型後，還會再度縮減平均 7.9 公厘，進而達到定型後的平均遠端切緣長度為 24.9 公厘。所以在活體的遠端切緣長度經由福馬林的定型處理後，整體的縮減長度大約為為切除之前的活體長度的 41.9%。

結論 對於直腸癌的病患，我們提供了一種可以量測遠端切緣的方式，可以減少遠端切緣不足的可能性，以及減少為了量測足夠的切緣造成的腫瘤過度操作。

關鍵詞 直腸癌、遠端切緣、經肛門。