

## A Survey on the Impact of Operation Volume on Rectal Cancer Management

The rectal cancer management can be influenced by the surgeon's practice and the hospital. This study was to evaluate the differences according to the surgeon's operative volume and the level of the hospital. Questionnaires were sent out to the members of the 'Korean Society of Coloproctology', and the responses were evaluated according to the surgeon's operation volume, the surgeon's age, and the level of the hospital. Sixty responses were received during the three months' period (from August to October 2004). Thirty three respondents (55%) operated more than 50 cases of rectal cancer per year (high-volume surgeons), and 37 respondents (61%) worked at university hospitals or tertiary care facilities (high-level hospitals). The preoperative evaluation with endorectal ultrasonography (ERUS) was significantly different according to the surgeon's operation volume and the level of the hospital, whereas magnetic resonance imaging and positron emission tomography (PET) was significantly different only for the surgeon's operation volume. The preoperative radiation therapy was significantly different according to the surgeon's operation volume, the surgeon's age, and the level of the hospital. However, there was no significant difference found on the operative procedures or postoperative surveillance. The preoperative loco-regional evaluation and the preoperative radiation therapy could be considered as the factors that influence the volume-outcome relationship in rectal cancer treatment.

Key Words : Rectal Neoplasm; Surgery; Preoperative Care; Postoperative Care; Korea

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### INTRODUCTION

The management of colorectal cancer, especially that of rectal cancer, has changed in many aspects during the last few decades (1-3). Previous studies based on patients' clinical outcome and hospital data showed that a surgeon's operation volume and the level of the hospital influenced the treatment outcome, and the surgeon's operation volume has been suggested to be the most important contributing factor to the outcome (4-8). The volume-outcome association is more pronounced in rectal cancer than in colon cancer due to the high complexity of rectal surgery (6). Although the difference in surgical procedures has been known to be the most important influencing factor (6), more detailed differences have not been well evaluated. In the present study, therefore, we attempted to unravel the differences of rectal cancer management and then to compare the differences, based on the surgeons and the hospitals.

### MATERIALS AND METHODS

Questionnaires describing preoperative evaluation, operative procedure, and postoperative surveillance in 39 major

categories were sent out to the members of the 'Korean Society of Coloproctology', including the surgeons at 30 university hospitals, in August 2004. The surgeons who operated rectal cancer in their hospitals were requested to respond to the questionnaires. Sixty responses were received during the three months' period. After the data were coded blindly into the database, the results were compared according to the surgeon's annual operation volume, the level of the hospital, and the surgeon's age. Statistical analyses were performed by chi-square test using SPSS 11.0® (SPSS Inc., Chicago, IL, U.S.A.).

### RESULTS

#### Respondents

Thirty three respondents (55.0%) operated more than 50 rectal cancer cases (high-volume surgeons), and 37 respondents (61.6%) worked at university hospitals or in other tertiary care facilities (high-level hospitals) (Fig. 1). Twenty respondents (33.3%) were 40-yr old or younger (young surgeons), and the respondents' age was not significantly different according to the surgeon's operation volume or the level of the hospital.

Preoperative evaluation

Preoperative rigid sigmoidoscopy was used routinely by 40.0% of the respondents and selectively by 36.6% of the respondents, whereas 23.3% did not use the examination. Colonoscopy, however, was performed routinely by 88.3% of the respondents and selectively by 10.0% of the respondents. The surgeons participated in colonoscopic examination alone or together with endoscopist at 50% of the respondents' hospitals. Only 21.7% of the respondents routinely used barium enema, whereas 16.6% did not use this examination for preoperative evaluation. One respondent had a limitation for usage of magnetic resonance imaging (MRI) and positron emission tomography (PET) during their evaluation, while others performed the examinations without limitation in their hospital or neighboring institution. Liver imaging by computerized tomography (CT) was done by 96.7% of the respondents, and abdominal ultrasound was additionally used by 30% of the respondents. Significant differences were found in endorectal ultrasound (ERUS),

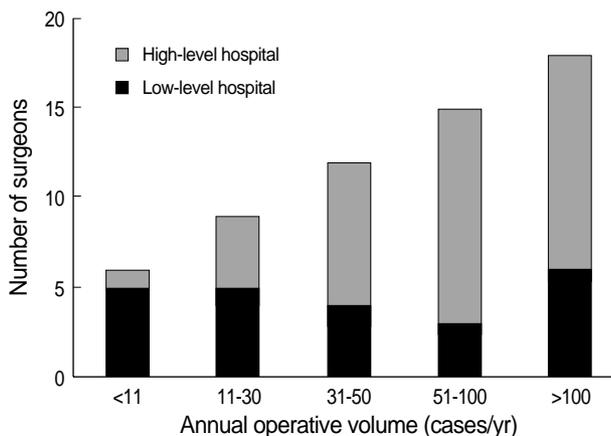


Fig. 1. Distribution of surgeons according to operation volume and level of hospital. High-level hospital: university hospitals or tertiary care facilities.

pelvic MRI, and <sup>18</sup>F-fluorodeoxyglucose-PET: ERUS and MRI were significantly different according to the surgeon's operation volume, and ERUS was also significantly different according to the level of the hospital (Table 1). The selective use of PET was significantly different according to the surgeon's operation volume (Table 1).

Preoperative radiation therapy

Preoperative radiation therapy was given fractionatedly in 4 to 6 weeks with the radiation dose ranging from 4,500 to 5,500 cGy. Forty six respondents (76.7%) performed preoperative radiation therapy, which was significant according to the surgeon's operation volume (90.9% of high-volume surgeons vs. 22.2% of low-volume surgeons), the level of the hospital (89.1% of high-level hospitals vs. 56.5% of low-level hospitals), and the surgeon's age (95% of young surgeons vs. 67.5% of aged surgeons). As for the purpose of preoperative radiation therapy, 80.4% of the 46 surgeons performed it for the purpose of sphincter preservation.

Operation

Total mesorectal excision (TME) was considered as the principle in rectal cancer surgery by 96.6% of the respondents, and 68.9% of them performed it only for mid and low rectal cancer. Inferior mesenteric artery was ligated at its root routinely by 26.6% and selectively by 68.3% of the respondents. Rectal irrigation was performed before dividing below a tumor by 81.6% of the respondents. During an operation, 2 cm of distal mucosal resection margin was considered as safe by 62.0% of the respondents; and 1 cm or less by 29.3% of the respondents. Paraaortic lymph node dissection was performed routinely (5%), selectively (75%), or never (20%); and lateral pelvic lymph node dissection was performed selectively (93.3%) or never (6.6%). Coloanal anastomosis was performed by 88.3% of the respondents, and the most pre-

Table 1. Preoperative evaluation of rectal cancer according to the surgeon volume and the level of hospital: endorectal ultrasound (ERUS), pelvic magnetic resonance imaging (MRI), and positron emission tomography (PET)

	Volume of surgeon's operation*			Level of hospital <sup>†</sup>		
	High (%)	Low (%)	p	High (%)	Low (%)	p
ERUS (n=60)						
Always	11 (33.3)	3 (11.1)	<0.05	8 (21.6)	6 (26.1)	<0.05
Selectively	20 (40.7)	11 (40.7)		24 (64.9)	7 (30.4)	
Never	2 (6.0)	13 (48.1)		5 (13.5)	10 (43.5)	
MRI (n=59)						
Selectively	24 (81.2)	9 (33.3)	<0.05	24 (66.7)	11 (47.8)	NS
Never	6 (18.8)	18 (66.7)		12 (33.3)	12 (52.2)	
PET (n=59)						
Selectively	16 (50.0)	4 (14.8)	<0.05	14 (37.8)	6 (27.3)	NS
Never	16 (50.0)	23 (85.2)		23 (62.2)	16 (72.7)	

\*High volume, who performs more than 50 operations of rectal cancer cases annually; <sup>†</sup>High level, university hospitals and tertiary care facilities. NS, not significant.

**Table 2.** Postoperative surveillance until the 5th postoperative year

Examinations (per year)	Surgeons (%)	
	First 2 yr	3 to 5 yr
Abdominal CT		
Once	42	81
Twice	52	12
Chest X-ray		
Once	19	47
Twice or more	76	45
CEA		
Once	1	26
Twice or more	98	70

CT, computed tomography; CEA, carcinoembryonic antigen.

ferred type was straight form (77.4%), J-pouch (15.1%) and coloplasty (7.5%). Diverting stoma was performed routinely (20.8%) or selectively (54.7%) during coloanal anastomosis, however, 24.5% did not fashion diverting stoma during coloanal anastomosis.

Operative procedures were not significantly different according to the surgeon's operation volume, the age, or the level of the hospital.

### Postoperative management

Adjuvant chemotherapy was given by surgeons in 73.3% of the respondents' hospitals and by medical oncologists in 15.0% of the respondents' hospitals. In 11.7% of the respondents' hospitals, chemotherapy was given by surgeons or medical oncologists according to the patients. Postoperative radiation therapy was given according to the stage: 21.6% of the respondents routinely for T3N0 and 50.0% for T3N1 or T3N2.

Carcinoembryonic antigen (CEA), abdominopelvic CT, chest radiography, and colonoscopy were the main surveillance tools after operation. There were no significant differences in the use of these tools according to the surgeon's operation volume, the level of the hospital, or the surgeon's age (Table 2). Colonoscopy was performed annually (66%) or biannually (28%) by 95% of the respondents for the following five years after operation. On the other hand, rigid sigmoidoscope was used only by 43.3% of the respondents. While the regular follow-up during the 5 yr postoperative period was not significant, the regularity of follow up after the initial 5 yr was significantly different showing 90% of high-volume surgeons and 62% of low-volume surgeons regularly performed it every one or two years ( $p < 0.05$ ).

## DISCUSSION

This study examined the differences in the rectal cancer management by the surgeons in Korea. Rectal cancer has been

increasing in Korea, including 5,865 new cases reported in 2002. We strongly believe that more than 4000 operations of rectal cancer cases are performed annually by the surgeons who are included in this study. Therefore, considering resectability (9), it is quite possible that this study covers more than 70% of the rectal cancer operations in Korea.

The previous studies with oncologic outcome defined the minimal volume for the experienced surgeon as one or two operations per month, and the cutoff value of other studies was about 15 cases or less (4-7). On the other hand, the studies with operative technique and outcome defined the cutoff value as 50 or 75 operations per year (10-12). In this study, the high operation volume was defined as more than 50 operations per year, and the majority of the surgeons (75%) operated more than 30 rectal cancer cases per year. It was possible that many surgeons with a low annual volume were not included in this study.

Recent advances in the management of rectal cancer include improved preoperative pelvic imaging, preoperative chemoradiation therapy, and improved rectal dissection (1, 2, 9, 13). In the present study, significant differences have been found in the preoperative evaluation with ERUS, MRI, and PET. ERUS has been used for more than 20 yr and is known to be accurate for the early stage. On the other hand, MRI is more informative for the advanced stage and especially for the mesorectal fascia which is important for keeping safe circumferential resection margin during pelvic dissection (14-17). PET is increasingly used for both local evaluation and distant metastasis (18). In the present study, these preoperative evaluations have been found to be different according to the surgeon's operation volume, yet only ERUS has been found to be significantly different according to the level of the hospital.

There were general agreements among the surgeons on the operative procedure (more than 75% of the respondents agreed): TME as the primary technique in rectal cancer surgery; selective use of paraaortic and pelvic lymph node dissection; rectal irrigation; and coloanal anastomosis for sphincter preservation. On the other hand, the operation of upper rectal cancer was controversial among the surgeons, which was also noted in other studies (1, 19-21). Controversies on diverting stoma for low rectal cancer operation (20, 22, 23) were also noted in this study. Regardless of the general agreements or the controversies, a significant difference was not found according to the surgeon's operation volume, the surgeon's age, or the level of the hospital.

Unlike the operative procedure, preoperative radiation therapy was significantly different according to the surgeon's operation volume, the level of the hospital, and even the surgeon's age, and it was the only significant factor according to the surgeon's age. Postoperative surveillance varied among surgeons and was performed differently according to the patient's condition. Colonoscopy was frequently used rather than sigmoidoscopy because of the comparable expense of

these medical examinations in Korea (24). The surveillance system is affected by socioeconomic factors or by insurance systems, which could be different according to the country. These days, intensive surveillance is increasing for the early detection of metastatic or recurrent diseases, and the examinations were found more frequent in this study than in other recommendation (25).

This study was conducted by using a questionnaire, and several limitations were present. The questionnaire was completed by the surgeons themselves and many low-volume surgeons did not reply. All the complexities and the individualized treatments could not be assessed only by this questionnaire. The relationship between the surgeon's actual practice and the clinical outcome could not be proved with this study. Nevertheless, the surgeon's intention and behavior during the treatment of rectal cancer have accurately been evaluated by this study, and the recent trends of rectal cancer operation were also revealed.

In conclusion, preoperative loco-regional evaluation was significantly different according to the surgeon's operation volume, and preoperative radiation therapy was significantly different according to the surgeon's operation volume and the level of the hospital. These results could be considered as the factors to influence volume-outcome relationship in rectal cancer treatment.

## REFERENCES

- MacFarlane JK, Ryall RD, Heald RJ. *Mesorectal excision for rectal cancer*. *Lancet* 1993; 341: 457-60.
- Hool GR, Church JM, Fazio VW. *Decision-making in rectal cancer surgery: survey of North American colorectal residency programs*. *Dis Colon Rectum* 1998; 41: 147-52.
- Botterill ID, Blunt DM, Quirke P, Sebag-Montefiore D, Sagar PM, Finan PJ, Chalmers AG. *Evaluation of the role of pre-operative magnetic resonance imaging in the management of rectal cancer*. *Colorectal Dis* 2001; 3: 295-303.
- Hermanek P, Hohenberger W. *The importance of volume in colorectal cancer surgery*. *Eur J Surg Oncol* 1996; 22: 213-5.
- Harmon JW, Tang DG, Gordon TA, Bowman HM, Choti MA, Kaufman HS, Bender JS, Duncan MD, Magnuson TH, Lillemoe KD, Cameron JL. *Hospital volume can serve as a surrogate for surgeon volume for achieving excellent outcomes in colorectal resection*. *Ann Surg* 1999; 230: 404-11.
- Schrag D, Panageas KS, Riedel E, Cramer LD, Guillem JG, Bach PB, Begg CB. *Hospital and surgeon procedure volume as predictors of outcome following rectal cancer resection*. *Ann Surg* 2002; 236: 583-92.
- Meyerhardt JA, Tepper JE, Niedzwiecki D, Hollis DR, Schrag D, Ayanian JZ, O'Connell MJ, Weeks JC, Mayer RJ, Willett CG, MacDonald JS, Benson AB 3rd, Fuchs CS. *Impact of hospital procedure volume on surgical operation and long-term outcomes in high-risk curatively resected rectal cancer: findings from the Intergroup 0114 Study*. *J Clin Oncol* 2004; 22: 166-74.
- McGrath DR, Leong DC, Gibberd R, Armstrong B, Spigelman AD. *Surgeon and hospital volume and the management of colorectal cancer patients in Australia*. *ANZ J Surg* 2005; 75: 901-10.
- Glimelius B. *Chemoradiotherapy for rectal cancer--is there an optimal combination?* *Ann Oncol* 2001; 12: 1039-45.
- Hannan EL, Wu C, Walford G, King SB 3rd, Holmes DR Jr, Ambrose JA, Sharma S, Katz S, Clark LT, Jones RH. *Volume-outcome relationships for percutaneous coronary interventions in the stent era*. *Circulation* 2005; 112: 1171-9.
- Kelly J, Tarnoff M, Shikora S, Thayer B, Jones DB, Forse RA, Hutter MM, Fanelli R, Lautz D, Buckley F, Munshi I, Coe N. *Best practice recommendations for surgical care in weight loss surgery*. *Obes Res* 2005; 13: 227-33.
- Geubbels EL, Wille JC, Nagelkerke NJ, Vandenbroucke-Grauls CM, Grobbee DE, de Boer AS. *Hospital-related determinants for surgical-site infection following hip arthroplasty*. *Infect Control Hosp Epidemiol* 2005; 26: 435-41.
- Ortholan C, Francois E, Thomas O, Benchimol D, Baulieux J, Bosset JF, Gerard JP. *Role of radiotherapy with surgery for T3 and resectable T4 rectal cancer: evidence from randomized trials*. *Dis Colon Rectum* 2006; 49: 302-10.
- Kim NK, Kim MJ, Yun SH, Sohn SK, Min JS. *Comparative study of transrectal ultrasonography, pelvic computerized tomography, and magnetic resonance imaging in preoperative staging of rectal cancer*. *Dis Colon Rectum* 1999; 42: 770-5.
- Garcia-Aguilar J, Pollack J, Lee SH, Hernandez de Anda E, Mellgren A, Wong WD, Finne CO, Rothenberger DA, Madoff RD. *Accuracy of endorectal ultrasonography in preoperative staging of rectal tumors*. *Dis Colon Rectum* 2002; 45: 10-5.
- Mackay SG, Pager CK, Joseph D, Stewart PJ, Solomon MJ. *Assessment of the accuracy of transrectal ultrasonography in anorectal neoplasia*. *Br J Surg* 2003; 90: 346-50.
- Bipat S, Glas AS, Slors FJ, Zwinderman AH, Bossuyt PM, Stoker J. *Rectal cancer: local staging and assessment of lymph node involvement with endoluminal US, CT, and MR imaging--a meta-analysis*. *Radiology* 2004; 232: 773-83.
- Gearhart SL, Frassica D, Rosen R, Choti M, Schulick R, Wahl R. *Improved staging with pretreatment positron emission tomography/computed tomography in low rectal cancer*. *Ann Surg Oncol* 2006; 13: 397-404.
- Lopez-Kostner F, Lavery IC, Hool GR, Rybicki LA, Fazio VW. *Total mesorectal excision is not necessary for cancers of the upper rectum*. *Surgery* 1998; 124: 612-7.
- Law WL, Chu KW. *Anterior resection for rectal cancer with mesorectal excision: a prospective evaluation of 622 patients*. *Ann Surg* 2004; 240: 260-8.
- Phang PT. *Total mesorectal excision: technical aspects*. *Can J Surg* 2004; 47: 130-7.
- Gastinger I, Marusch F, Steinert R, Wolff S, Koeckerling F, Lippert H; Working Group 'Colon/Rectum Carcinoma'. *Protective defunctioning stoma in low anterior resection for rectal carcinoma*. *Br J Surg* 2005; 92: 1137-42.
- Wong NY, Eu KW. *A defunctioning ileostomy does not prevent clin-*

- ical anastomotic leak after a low anterior resection: a prospective, comparative study. Dis Colon Rectum 2005; 48: 2076-9.*
24. Park SM, Yun YH, Kwon S. *Feasible economic strategies to improve screening compliance for colorectal cancer in Korea. World J Gastroenterol 2005; 11: 1587-93.*
25. Desch CE, Benson AB 3rd, Somerfield MR, Flynn PJ, Krause C, Loprinzi CL, Minsky BD, Pfister DG, Virgo KS, Petrelli NJ. *American Society of Clinical Oncology. Colorectal cancer surveillance: 2005 update of an American Society of Clinical Oncology practice guideline. J Clin Oncol 2005; 23: 8512-9.*