

Sexual Dysfunction

Voiding and Sexual Function after Autonomic-Nerve-Preserving Surgery for Rectal Cancer in Disease-Free Male Patients

Dong Kil Lee, Moon Ki Jo, Kanghyon Song, Jong Wook Park, Sun-Mi Moon¹

Departments of Urology and ¹Surgery, Korea Cancer Center Hospital, Seoul, Korea

Purpose: We evaluated the effects of surgery for rectal cancer on postoperative voiding and sexual function over the course of time.

Materials and Methods: Data from 28 patients who underwent autonomic nerve preserving rectal cancer surgery were retrospectively analyzed. Operations were performed between October 2005 and July 2007 and all patients were followed-up for more than 3 years. Preoperatively, all patients underwent urodynamic studies including uroflowmetry, and filled out the International Prostate Symptom Score (IPSS). The evaluation of sexual function consisted of Erectile Function domain score in International Index of Erectile Function (IIEF-EFD) and Ejaculation domain score in Male Sexual Health Questionnaire (MSHQ-EjD). Data from uroflowmetry and questionnaires were examined.

Results: At 3 years postoperatively the prostate volume was similar to the preoperative value ($p=0.727$). There were no statistically significant postoperative changes in the average maximum flow rate (15.9 ml/s vs. 16.2 ml/s, $p=0.637$) and post-void residual urine volume (34.7 ml vs. 36.8 ml, $p=0.809$). No statistically significant differences were observed in the IPSS (13.2 vs. 12.2, $p=0.374$). However, although pelvic autonomic nerve preservation have been performed, a significant proportion of rectal cancer patients suffer from sexual dysfunction and the average of IIEF-EFD and MSHQ-EjD scores was decreased postoperatively until 3 years (25.1 vs. 16.1 and 28.3 vs. 14.2 respectively, $p < 0.001$).

Conclusions: Voiding function was not affected after autonomic nerve-preserving rectal cancer surgery, however sexual function was significantly aggravated. We recommend that the baseline genitourinary function should be evaluated before the treatment for male rectal cancer patients, and penile rehabilitation is necessary for their quality of life after treatment.

Key Words: Postoperative complications; Rectal neoplasms; Urination

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article History:

received 20 September, 2010

accepted 26 October, 2010

Corresponding Author:

Moon Ki Jo
Department of Urology, Korea Cancer Center Hospital, 215-4, Gongneung-dong, Nowon-gu, Seoul 139-706, Korea
TEL: +82-2-970-1299
FAX: +82-2-978-2005
E-mail: andrea@kcch.re.kr

INTRODUCTION

Voiding and sexual dysfunction are well-known complications after rectal resection for carcinoma, the main cause of which is injury to the autonomic nerves in the pelvis: the sacral splanchnic (parasympathetic) nerves and hypogastric (sympathetic) nerves [1-5]. These injuries may result from blunt pelvic dissection or undefined cutting during mobilization of the rectum.

As described by Heald in the 1980s, total mesorectal excision (TME) was introduced as the standard operative procedure for rectal cancer in combination with autonomic nerve preservation (ANP). Compared with conventional rectal cancer surgery, TME with ANP has been reported to reduce the incidence of complications of voiding and sexual function [3,6,7]. Despite the dramatic improvements in the surgical procedure for rectal cancer, the reported incidence of postoperative voiding issues and sexual dysfunction

tion still ranges from 0% to 12% and from 20% to 50%, respectively [1,3,4,8,9].

Because of the early detection and advances in the treatment of rectal cancer, survival rates have improved, and it is expected that an increasing number of patients will be living with its sequelae. Therefore, quality of life after treatment is regarded as an important outcome in addition to the traditional endpoints, such as survival and recurrence. However, only a few studies have been published to date presenting an objective evaluation of voiding and sexual function after rectal resection. Most studies have assessed postoperative functional outcome at only one time point, rather than longitudinally.

This study aimed to evaluate the changes in male voiding capability and sexual function within a consecutive series of patients who underwent autonomic-nerve-preserving surgery for rectal cancer at our institution.

MATERIALS AND METHODS

Of the total of 78 men who underwent TME with ANP for rectal cancer at the Korea Cancer Center Hospital between October 2005 and July 2007, 45 patients were evaluated preoperatively for genitourinary function. We retrospectively analyzed the data of 28 men who were followed up for more than 3 years.

All of the operations were performed by two surgeons (DYH and SMM), both being experts in technique and colorectal surgery. TME was performed according to the principles described by Heald et al [7], and the pelvic autonomic nerves, including the hypogastric nerve and pelvic splanchnic plexus (nervi erigentes), were preserved in all patients [10,11].

Preoperatively, all patients underwent urodynamic studies including uroflowmetry and filled out the International Prostate Symptom Score (IPSS). Voiding function was measured objectively with maximum flow rate (Qmax) and postvoid residual urine volume (PVR). Prostate volumes, measured by computed tomography (CT) before and after the operation, were compared.

We used the erectile function domain score on the International Index of Erectile Function (IIEF-EFD) and the ejaculation domain on the Male Sexual Health Questionnaire (MSHQ-EJD), both of which have been widely used, to evaluate sexual function. Erectile dysfunction (ED) severity was classified into 3 categories: normal, 26 or more; mild to moderate, 17 to 25; and moderate to severe, 16 or less. Patient characteristics, including age, tumor stage, tumor size, and type of operation, were recorded. The patients were followed after surgery by use of uroflowmetry and the aforementioned questionnaires.

Patients with recurrent or metastatic disease, a history of urinary tract surgery, prior rectal surgery, or no preoperative urodynamic assessment were excluded.

Statistical analysis was performed with SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA), using the paired Student's t-test and Wilcoxon signed-rank test. Data were considered

to be statistically significant when the p-value was less than 0.05.

RESULTS

1. Patient characteristics

The characteristics of the patients are summarized in Table 1. The mean follow-up duration was 45.4 months (range, 37-53 months). The patients' mean age was 58.2 years (range, 41-72 years) and their mean body mass index (BMI) was 23.2 kg/m² (range, 18.3-27.6 kg/m²).

Tumor stage was determined on the basis of the Union International Contre le Cancer (UICC) classification. Sphincter-preserving rectal resection was performed in 22 patients, and the remainder received abdominoperineal resection (APR). There were 21 sexually active patients including 3 men who had moderate to severe ED. Eleven patients had received preoperative chemoradiotherapy.

2. Voiding function

Preoperatively, all patients showed normal detrusor pressure and seven patients showed an obstructive pattern in the urodynamic study. No patients demonstrated detrusor overactivity, and the mean functional bladder capacity was 276.3 ml. The mean PVR was 34.7 ml and only one patient had a PVR over 100 ml.

The results of the urinary function assessment over the 3-year study period are presented in Table 2. At 3 years

TABLE 1. Patient characteristics

Parameter	
No. of patients	28
Mean age at surgery (yr)	58.2 (41-72)
Mean body mass index (kg/m ²)	23.2 (18.3-27.6)
Tumor size (cm)	5.2 (1.1-10.0)
UICC stage (n)	
1	6
2	5
3	15
4	2
Operation type (n)	
LAR	22
APR	6
Comorbidity (n)	
Diabetes	7
Hypertension	8
Smoking (n)	
Nonsmoker	18
Current and ex-smoker	10
Sexual activity (n)	
Active	21
Not active	7
Neoadjuvant chemoradiotherapy	11
Adjuvant chemotherapy	17

UICC: Union International Contre le Cancer, n: No. of patients, LAR: low anterior resection, APR: abdominoperineal resection

postoperatively, the prostate volume was similar to the preoperative value ($p > 0.05$). There were no statistically significant postoperative changes in the average Qmax (15.9 ml/s vs. 16.2 ml/s, $p=0.637$) or PVR (34.7 ml vs. 36.8 ml, $p=0.809$). No statistically significant differences were observed in the IPSS (13.2 vs. 12.2, $p=0.374$). In eight patients (29%), the IPSS was worse at 3 months than at baseline. However, at 1 year after surgery, the scores had returned to the baseline values.

Six patients presented with mild postoperative voiding dysfunction that required alpha-blocker medication. Medical therapy was sufficient to achieve normal voiding and no patients needed catheterization during the follow-up period.

3. Sexual function

Preoperatively, 10 of the patients were specified as having moderate to severe ED, including 7 men who were not sex-

ually active. We evaluated the 18 sexually active men who had no moderate to severe ED. Their mean age was 54.6 years (range, 41-68 years). Changes in sexual parameters are summarized in Table 3. The average IIEF-EFD and MSHQ-EjD scores had significantly decreased 3 months postoperatively ($p < 0.001$). This difference was still significant at 1 and 3 years. Reductions in the IIEF-EFD and MSHQ-EjD scores were observed in 11 (61%) and 13 (72%) men, respectively. The number of patients who belonged to the moderate to severe ED group gradually increased (Table 4). Eight men experienced a complete loss of erectile function and stated that their sexual life became worse after surgery.

DISCUSSION

Postoperative voiding and sexual dysfunctions frequently develop after pelvic surgery. These complications result from thermal damage, ischemic injury, nerve stretching, and the local inflammatory effects to the hypogastric nerve and the sacral splanchnic plexus during pelvic dissection. Injury to the sympathetic supply results in detrusor instability and ejaculatory difficulties, whereas injury to the parasympathetic supply results in poor detrusor contraction and ED [1,7,10,12].

Even though comparisons between studies are difficult

TABLE 2. Postoperative changes in voiding parameters

		p-value vs. preoperation
No. of patients		28
Prostate volume (ml)		
Preoperation	27.6±8.3	
3 mo	N/A	
1 yr	N/A	
3 yr	27.9±10.0	0.727
Qmax (ml/s)		
Preoperation	15.9±6.7	
3 mo	14.7±7.2	0.566
1 yr	14.8±6.8	0.455
3 yr	16.2±6.1	0.637
PVR (ml)		
Preoperation	34.7±16.5	
3 mo	37.5±12.4	0.795
1 yr	37.0±16.9	0.844
3 yr	36.8±13.6	0.809
IPSS		
Preoperation	13.2±8.6	
3 mo	11.4±5.0	0.332
1 yr	11.8±5.8	0.292
3 yr	12.2±6.3	0.374

Qmax: maximum flow rate, PVR: postvoid residual urine volume, IPSS: International Prostate Symptom Score

TABLE 3. Postoperative changes in sexual parameters

		p-value vs. preoperation
No. of patients		18
IIEF-EFD		
Preoperation	25.1±2.6	
3 mo	18.0±8.7	0.001
1 yr	16.9±7.5	<0.001
3 yr	16.1±8.2	<0.001
MSHQ-EjD		
Preoperation	28.3±5.2	
3 mo	17.4±14.0	0.001
1 yr	14.7±9.3	0.001
3 yr	14.2±10.3	<0.001

IIEF-EFD: erectile function domain score in the International Index of Erectile Function, MSHQ-EjD: ejaculation domain score in the Male Sexual Health Questionnaire

TABLE 4. Postoperative changes in erectile dysfunction severity

	Preoperation	Postoperation		
		3 months	1 year	3 years
Erectile function				
Normal (26 or more)	56	11	17	11
Mild to moderate (17-25)	44	50	44	39
Moderate to severe (16 or less)	0	39	39	50

Values are presented as percentage.

TABLE 5. Studies on voiding and sexual function after autonomic-nerve-preserving rectal cancer surgery

Author	Year	No. of patients	Voiding dysfunction (%)	Erectile dysfunction (%)	Ejaculatory dysfunction (%)
Kim et al [1]	2002	68	26	25	38
Pocard et al [2]	2002	9	0	44	11
Nesbakken et al [3]	2000	49	13	28	43
Maas et al [5]	1998	47	28	11	42
Sterk et al [13]	2005	49	23	38	0.7
Ameda et al [18]	2005	52	30	88	83

due to differing exclusion criteria and outcome measures, widely varying rates of voiding and sexual dysfunction after rectal surgery have been reported in the literature (Table 5). During rectal surgery, the ANP procedure causes less impairment of genitourinary function [8,13,14]. The functional benefits of ANP were confirmed in previous studies that evaluated the impact of ANP on rectal cancer by use of questionnaires [3,5,6]. Since the awareness of ANP, voiding complications appear to have diminished to a level of 0% to 4% [15]. For example, Nesbakken et al and colleagues reported that, when comparing results before and 3 months after the operation in 49 patients, rectal cancer surgery with pelvic autonomic nerve preservation showed no significant changes in voiding capacity [3]. Similarly, our study showed no significant complications related to voiding. Based on our data, rectal cancer surgery with ANP showed excellent preservation of voiding function; even 3 years after surgery, the results of the IPSS did not change significantly.

The transient decrease in Qmax might be explained by postoperative inflammatory changes in the perivesical tissues and the possible resolution of partial nerve damage with time, resulting in improvement and even complete recovery [13].

In contrast with the preservation of voiding function, sexual dysfunction remains a significant problem after rectal cancer surgery. Previous studies suggested that partial preservation of the pelvic autonomic nerves was sufficient to attain eventual functional recovery in voiding function [16,17]. The main cause of postoperative sexual dysfunction is intraoperative injury to the neurovascular bundles; partial dissection of the pelvic plexus can also affect sexual function [18].

Results of studies on male sexual function after rectal cancer surgery show impotence rates varying from 20% to 50% [3,9,13]. Ameda et al reported that postoperative ED was a serious complication, even in complete nerve preservation [18]. Hendren et al also reported that a high rate of sexual dysfunction is detected after rectal cancer excision, despite the use of nerve-preserving techniques [19].

The incidence of ED depends on the extent of resection, which may be reduced with nerve preservation [7,11]. In this study, all patients underwent bilateral ANP. The results of our study show that a significant proportion of rectal cancer patients suffer from sexual dysfunction after surgery. Overall, eight men (29%) experienced a complete

loss of erectile function. These patients did not improve throughout the follow-up period. Therefore, it is likely that the crucial cause of postoperative sexual dysfunction is unrecognized nerve injury rather than neurapraxia. The intimate anatomic relationship of the superior hypogastric nerve, the bilateral inferior hypogastric plexus, and the bilateral cavernosal nerves to the rectum and prostate explains their possible risk of injury. The nerve damage might have occurred after the nerve to the bladder had branched off in the deep narrow pelvis where precise dissection may be more difficult. The high incidence of sexual dysfunction may be due to the vulnerability to nerve damage.

Although many factors influence postoperative sexual dysfunction, we could not determine a statistically significant relationship between sexual dysfunction and well-known adverse factors such as patient's age, stage, type of operation, smoking, chemoradiotherapy, and comorbidities because of the relatively small number of patients in this study.

With the relatively small number of patients and the retrospective nature of this study, our results are bound to be underpowered. Because the study population was "rectal cancer patients who are free of recurrence," the results may not be generalizable to all patients undergoing rectal cancer surgery. Despite the limitations of the data, however, the strength of our study is its long-term assessment with preoperative evaluation.

Preservation and maintenance of sexual function are guaranteed to be challenges to urologists in the future. In order to improve patient's quality of life, urologists will need to make an effort to detect patients who suffer from sexual dysfunction and treat them by cooperating and collaborating with surgeons. Also, patients need to be properly informed about possible adverse effects connected to the operation and how these adverse effects can be treated if they arise.

Although no standardized regimen exists, post-prostatectomy rehabilitation of sexual function or ED prophylaxis has become a common practice among urologists [20]. Interestingly, Lindsey et al reported that erectile function was satisfactorily improved by use of sildenafil (Viagra) only in 79% of male patients with ED after rectal excision for either rectal cancer or inflammatory bowel disease [21]. Likewise, baseline measurement and enthusiastic penile rehabilitation after rectal cancer surgery must be con-

sidered.

CONCLUSIONS

Voiding dysfunction after rectal cancer surgery and radiotherapy can be avoided in most patients by the preservation of pelvic autonomic nerves. However, although pelvic autonomic nerve preservation has been performed, a significant proportion of these surgical rectal cancer patients will still suffer from sexual dysfunction after surgery.

Larger prospective randomized comparative studies are necessary to confirm our results, which were limited because of the small number of patients. Urologists should investigate sexual function before surgery to generate meaningful outcomes for counseling patients before and after treatment, and penile rehabilitative treatment after rectal cancer surgery must be considered.

Conflicts of Interest

The authors have nothing to disclose.

REFERENCES

1. Kim NK, Aahn TW, Park JK, Lee KY, Lee WH, Sohn SK, et al. Assessment of sexual and voiding function after total mesorectal excision with pelvic autonomic nerve preservation in males with rectal cancer. *Dis Colon Rectum* 2002;45:1178-85.
2. Pocard M, Zinzindohoue F, Haab F, Caplin S, Parc R, Turet E. A prospective study of sexual and urinary function before and after total mesorectal excision with autonomic nerve preservation for rectal cancer. *Surgery* 2002;131:368-72.
3. Nesbakken A, Nygaard K, Bull-Njaa T, Carlsen E, Eri LM. Bladder and sexual dysfunction after mesorectal excision for rectal cancer. *Br J Surg* 2000;87:206-10.
4. Maas CP, Moriya Y, Steup WH, Klein Kranenbarg E, van de Velde CJ. A prospective study on radical and nerve-preserving surgery for rectal cancer in the Netherlands. *Eur J Surg Oncol* 2000;26:751-7.
5. Maas CP, Moriya Y, Steup WH, Kiebert GM, Kranenbarg WM, van de Velde CJ. Radical and nerve-preserving surgery for rectal cancer in the Netherlands: a prospective study on morbidity and functional outcome. *Br J Surg* 1998;85:92-7.
6. Havenga K, Enker WE. Autonomic nerve preserving total mesorectal excision. *Surg Clin North Am* 2002;82:1009-18.
7. Heald RJ, Moran BJ, Ryall RD, Sexton R, MacFarlane JK. Rectal cancer: the Basingstoke experience of total mesorectal excision, 1978-1997. *Arch Surg* 1998;133:894-9.
8. Shirouzu K, Ogata Y, Araki Y. Oncologic and functional results of total mesorectal excision and autonomic nerve-preserving operation for advanced lower rectal cancer. *Dis Colon Rectum* 2004;47:1442-7.
9. Havenga K, Maas CP, DeRuiter MC, Welvaart K, Trimbos JB. Avoiding long-term disturbance to bladder and sexual dysfunction in pelvic surgery, particularly with rectal cancer. *Semin Surg Oncol* 2000;18:235-43.
10. Bruheim K, Guren MG, Dahl AA, Skovlund E, Balteskard L, Carlsen E, et al. Sexual function in males after radiotherapy for rectal cancer. *Int J Radiat Oncol Biol Phys* 2010;76:1012-7.
11. Parc Y, Zutshi M, Zalinski S, Ruppert R, Fürst A, Fazio VW. Preoperative radiotherapy is associated with worse functional results after coloanal anastomosis for rectal cancer. *Dis Colon Rectum* 2009;52:2004-14.
12. Keating JP. Sexual function after rectal excision. *ANZ J Surg* 2004;74:248-59.
13. Sterk P, Shekarriz B, Günter S, Nolde J, Keller R, Bruch HP, et al. Voiding and sexual dysfunction after deep rectal resection and total mesorectal excision: prospective study on 52 patients. *Int J Colorectal Dis* 2005;20:423-7.
14. Schmidt C, Daun A, Malchow B, Küchler T. Sexual impairment and its effects on quality of life in patients with rectal cancer. *Dtsch Arztebl Int* 2010;107:123-30.
15. Havenga K, Enker WE, McDermott K, Cohen AM, Minsky BD, Guillem J. Male and female sexual and urinary function after total mesorectal excision with autonomic nerve preservation for carcinoma of the rectum. *J Am Coll Surg* 1996;182:495-502.
16. Hojo K, Vernava AM 3rd, Sugihara K, Katumata K. Preservation of urine voiding and sexual function after rectal cancer surgery. *Dis Colon Rectum* 1991;34:532-9.
17. Mitsui T, Kobayashi S, Matsuura S, Kakizaki H, Mori T, Minami S, et al. Vesicourethral dysfunction following radical surgery for rectal carcinoma: change in voiding pattern on sequential urodynamic studies and impact of nerve-sparing surgery. *Int J Urol* 1998;5:35-8.
18. Ameda K, Kakizaki H, Koyanagi T, Hirakawa K, Kusumi T, Hosokawa M. The long-term voiding function and sexual function after pelvic nerve-sparing radical surgery for rectal cancer. *Int J Urol* 2005;12:256-63.
19. Hendren SK, O'Connor BI, Liu M, Asano T, Cohen Z, Swallow CJ, et al. Prevalence of male and female sexual dysfunction is high following surgery for rectal cancer. *Ann Surg* 2005;242:212-23.
20. Montorsi F, Briganti A, Salonia A, Rigatti P, Burnett AL. Current and future strategies for preventing and managing erectile dysfunction following radical prostatectomy. *Eur Urol* 2004;45:123-33.
21. Lindsey I, George B, Kettlewell M, Mortensen N. Randomized, double-blind, placebo-controlled trial of sildenafil (Viagra) for erectile dysfunction after rectal excision for cancer and inflammatory bowel disease. *Dis Colon Rectum* 2002;45:727-32.