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ORIGINAL ARTICLE

Male sexual function and lower urinary tract symptoms after laparoscopic total mesorectal excision

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Abstract
Background and aims The aim of this study was to investigate sexual function and the presence of lower urinary tract symptoms (LUTS) in male patients with rectal cancer following short-term radiotherapy and laparoscopic total mesorectal excision (LTME) by physical and psychological measurements.
Materials and methods Sexual function and LUTS were assessed by the use of questionnaires [International Index of Erectile Function (IIEF), International Prostate Symptom Score]. Sexual function was further assessed by the use of pharmaco duplex ultrasonography of the cavernous arterial blood flow and nocturnal penile tumescence and rigidity monitoring (NPTR). All investigations were performed prior to the start of preoperative radiotherapy and 15 months after surgery.
Results Nine patients (mean age 60 years) participated. Erectile function was maintained in 71% and ejaculation function in 89%. Compared with pre-operative scores on the IIEF, a significant deterioration in intercourse satisfaction was seen following radiotherapy and LTME (7.9 vs 10.3, p=0.042), but overall satisfaction remained unchanged (8.0 vs 7.0, p=0.246). NPTR parameters (duration of erectile episodes, duration of tip rigidity ≥60%) decreased following radiotherapy and LTME. Patients reported a deterioration in micturition frequency (2.0 vs 1.0, p=0.034) and quality of life due to urinary symptoms (8.0 vs 1.8, p=0.018).
Conclusion Based on these first preliminary findings, data suggest that 15 months after short-term radiotherapy and LTME in men with rectal cancer, objectively assessed sexual dysfunction was considerable, but overall sexual satisfaction had not changed.

Keywords Sexual function · Lower urinary tract symptoms · Laparoscopy · Colorectal cancer · Total mesorectal excision

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Introduction

Erectile dysfunction (ED), ejaculatory dysfunction (EJD) and lower urinary tract symptoms (LUTS) are well-known problems after total mesorectal excision for rectal cancer. These problems are related to damage to pelvic autonomic nerves caused by pre-operative radiotherapy and iatrogenic surgical injury [1, 2].

Laparoscopic total mesorectal excision (LTME) offers short-term advantages such as earlier diet re-establishment,

less postoperative pain, less narcotic use and shorter hospital stay [3–5]. Furthermore, the magnification effect of laparoscopy enhances the exposure of the pelvic cavity. This magnification facilitates sharp dissection of the lateral, anterior and presacral spaces, all being autonomic nerve locations. However, the technical demands of LTME may just predispose to nerve injury [6].

Until now, very little is known concerning sexual functioning and lower urinary tract symptoms after LTME on the long term [6, 7]. A retrospective, questionnaire-based study showed an ED incidence of 47% and an EJD incidence of 40% [7]. Another questionnaire-based study showed a non-significant trend towards more sexual dysfunction after LTME [6]. These two studies showed no differences with regard to LUTS after LTME or open TME (OTME).

In this study, we assessed sexual functioning by an international validated questionnaire, the International Index of Erectile Function (IIEF), repeated pharmaco duplex-ultrasonographic investigations of the cavernous arteries and nocturnal penile tumescence and rigidity (NPTR) monitoring. Lower urinary tract symptoms were assessed by the International Prostate Symptom Score (IPSS).

Materials and methods

The study was performed between July 2003 and January 2006. All patients underwent an elective LTME at Medical Centre Leeuwarden [8]. The patients were included if they were heterosexually active and if the LTME had a curative intention. Patients with advanced T3 (cT3b) or T4 carcinoma diagnosed on magnetic resonance imaging (MRI) were excluded. A tumour-free circumferential resection margin of at least 2.0 mm is defined as a R0-resection [9] and can be predicted with a high degree of certainty when the distance on MRI is at least 6.0 mm [10]. An advanced T3 tumour was defined when the MRI distance was less than 6.0 mm. According to the national Dutch protocol, all patients received a short preoperative course of 5×5 Gy radiotherapy.

The above-mentioned investigations (questionnaires, duplex ultrasonography of the cavernous arterial blood flow at rest and after intracavernous injection of vasoactive substances, and nocturnal erections monitoring) were done just before the start of the preoperative radiotherapy and at 15 months follow-up. At that time, the late side effects of radiotherapy and the natural restoration of both psychological and surgical factors reach their plateau phase.

The study was approved by the Committee on Medical Research Ethics, and all patients provided written informed consent.

Questionnaires

The patients completed two questionnaires: the International Index of Erectile Function [11] and the International Prostate Symptom Score [12].

The IIEF was used to assess psychological male sexual function in short. In this questionnaire, 15 items are checked, including erectile frequency, erection firmness, penetration ability, maintenance frequency, maintenance ability, intercourse frequency, intercourse satisfaction, intercourse enjoyment, ejaculation frequency, orgasm frequency, desire frequency, desire level, overall satisfaction, relationship satisfaction and erection evidence. The IIEF can only be used for heterosexual men.

The scoring systems are from 0 to 5 (0, none; 1, almost; 2, a few; 3, sometimes; 4, most times; 5, almost always) on the first ten items and from 1 to 5 (1, very low; 2, low/a few; 3, moderate; 4, most/high; 5, very high/almost always) on the last five items.

The IIEF is subdivided into five response domains (erectile function, orgasmic function, intercourse satisfaction, sexual desire, overall satisfaction). The domain scores are computed by adding the scores of individual items in each domain.

Complete ED is defined as an erectile function domain score <10 and partial ED as a score <17 but ≥10.

The international validated IPSS was used to assess bladder function. The IPSS is subdivided into seven items which include incomplete bladder emptying, frequency, intermittency, urgency, weak stream, straining and nocturia. The scoring system is based on a 0 to 5 scale, as follows: 0, not at all; 1, less than one time in five; 2, less than half the time; 3, about half the time; 4, more than half the time; and 5, almost always. The total score is calculated by adding the item scores. Quality of life is also classified on the IPSS and ranges from delighted to terrible (0, delighted; 1, pleased; 2, mostly satisfied; 3, mixed about equally satisfied and dissatisfied; 4, mostly dissatisfied; 5, unhappy; 6, terrible).

Duplex ultrasonography of the cavernous arteries

Peak flow velocities within the cavernous arteries were measured by duplex ultrasonography before and at 1, 5, 10 and 15 min after injection of 0.25 ml Androskat® (3.75 mg papaverinehydrocloride plus 0.125 mg phentolamine; Byk, Zwanenburg, The Netherlands). All investigations were performed by the same examiner using a 5-MHz pulsed Doppler linear array transducer with B-mode colour images and pulsed-wave Doppler. The Doppler angle-correction cursor was adjusted to match the correct axis of flow. The average systolic peak flow of left and right cavernosal artery was used for further analysis.

Nocturnal penile tumescence and rigidity measurements

To assess physical, erectile function, nocturnal penile tumescence and rigidity were measured at home during two consecutive nights using the RigiScan (RigiScan®, Dacomed, Minneapolis, USA). Evaluation of nocturnal erectile activity is typically performed while differentiating between physical and psychogenic causes of erectile dysfunction. NPTR testing takes advantage of the fact that men with normal erectile function have four to six episodes of involuntary nocturnal erections lasting 20–50 min during 6–8 h sleep cycle. These erections occur mostly during rapid eye movement (REM) sleep. The sensitivity of the RigiScan is 90.6%, and the specificity is 88.1% [13].

The RigiScan recorded changes in penile tumescence and radial rigidity during the whole duration of each night. Unfortunately, we were not able to add axial rigidometric measurements. At the end of the, study data were analysed with the new RigiScan Plus® software (version 4.0, Urohealth, USA). Analysis of the recordings was focused on the following parameters: (1) number of erectile episodes, (2) duration of erectile episodes, (3) duration of erectile episode with ≥60% tip rigidity [14].

Statistics

The IIEF and IPSS questionnaires were scored according to the guidelines. Scale scores are presented as means with standard deviations. Differences in systolic blood flow velocities were analyzed with the Wilcoxon signed rank test, comparing postoperative score to pre-operative score. The comparison of questionnaires and NPTR before and after LTME was also assessed by the Wilcoxon signed rank test.

Erectile dysfunction scored on IIEF was compared with parameters of NPTR testing using Mann–Whitney *U* test. Differences were considered to be statistically significant when $p<0.05$.

Table 1 Patients, treatment and tumour characteristics ($N=9$)

Parameter	Values
Age [mean (range)]	60 (50–78)
Type of resection	
Low anterior resection	6
Abdominoperineal resection	3
Tumour status (T)	
1	1
2	3
3	5
N status (N)	
0	5
1	2
2	2

Table 2 Changes in IIEF domain score pre- and postoperative

	Preoperative		Postoperative		*p*
	Mean	SD	Mean	SD	
Erectile function	21.0	10.7	15.2	11.8	0.104
Orgasmic function	7.2	3.9	6.4	4.6	0.465
Intercourse satisfaction	10.3	4.6	7.9	5.7	0.042
Sexual desire	6.8	2.1	6.6	2.5	0.932
Overall satisfaction	8.0	1.3	7.0	2.4	0.246
Total score	53.3	20.8	43.1	25.7	0.407

SD Standard deviation, *IIEF* International Index of Erectile Function

Results

Nine patients were included. Table 1 shows the characteristics of the patients, their treatments and histopathological tumour staging.

After treatment, eight out of the nine patients (88%) regained their sexual activities. According to the IIEF, two of the nine patients (22%) already demonstrated complete ED in the pre-treatment phase (defined as domain score <10); none demonstrated partial ED (a score <17 and ≥10) in this phase. According to the IIEF scores, erectile function was maintained in five out of the seven (71%) patients at 15 months follow-up, so there were two "new" patients with ED. However, the differences between preoperative and postoperative scores were not significant (Table 2).

All but one of nine patients were able to ejaculate, but that problem already existed preoperatively. Intercourse satisfaction significantly had decreased from 10.3 preoperatively to 7.9 postoperatively ($p=0.042$).

Total mean IPSS score was 7.7±5.9 preoperatively vs 10.9±5.1 postoperatively ($p>0.05$; Table 3). Quality of life due to urinary symptoms significantly decreased after LTME ($p=0.018$). With regard to specific symptoms, only frequency significantly worsened ($p=0.034$). All other IPSS scores (incomplete bladder emptying, intermittency, urgency, weak stream, straining and nocturia) did not show significant changes at 15 months follow-up (Table 3).

No statistically significant differences were observed comparing the individual systolic peak flow velocities pre- and postoperatively.

With regard to the NPTR parameters at 15 months follow-up, the duration of erectile episodes (56 vs 87, $p=0.008$, Fig. 1) and duration of tip rigidity ≥60% (14 vs 31, $p=0.021$) were decreased (Fig. 2). Figure 3 shows an example of NPTR measures before and after treatment.

Comparison of the IIEF erectile domain scores with NPTR parameters shows no significant differences ($p>0.05$).

Table 3 Changes in IPSS before and after laparoscopic total mesorectal excision

	Preoperative		Postoperative		*p*
	Mean	SD	Mean	SD	
Incomplete emptying	0.6	0.9	0.7	0.7	0.739
Frequency	1.0	1.3	2.0	1.5	0.034
Intermittency	1.1	1.3	1.7	1.7	0.262
Urgency	0.4	0.7	0.6	1.0	0.914
Weak stream	1.3	1.7	1.6	1.2	0.726
Straining	1.6	2.0	0.9	1.6	0.336
Nocturia	1.7	1.0	2.0	1.4	0.618
Total IPSS	7.7	5.9	10.9	5.1	0.312
Quality of life due to urinary symptoms	1.8	1.0	8.0	5.1	0.018

SD Standard deviation, *IPSS* International Prostate Symptom Score

Discussion

Radiotherapy and TME can compromise both the vascular and the nervous system in the lower pelvis. To our knowledge, this is the first study assessing both somatic and psychological factors determining sexual functioning of male patients after TME. In our view, duplex ultrasonography of the cavernous arteries, NPTR and validated questionnaires offer the opportunity for a better understanding of specific causes of sexual dysfunction in these patients.

Fifteen months after treatment, intercourse satisfaction, frequency of micturition and quality of life due to urinary symptoms had deteriorated. Although nearly all patients (eight out of nine) had resumed sexual activities, we observed significant decrease of NPTR parameters. These findings suggest a partial parasympathetic nerve injury,

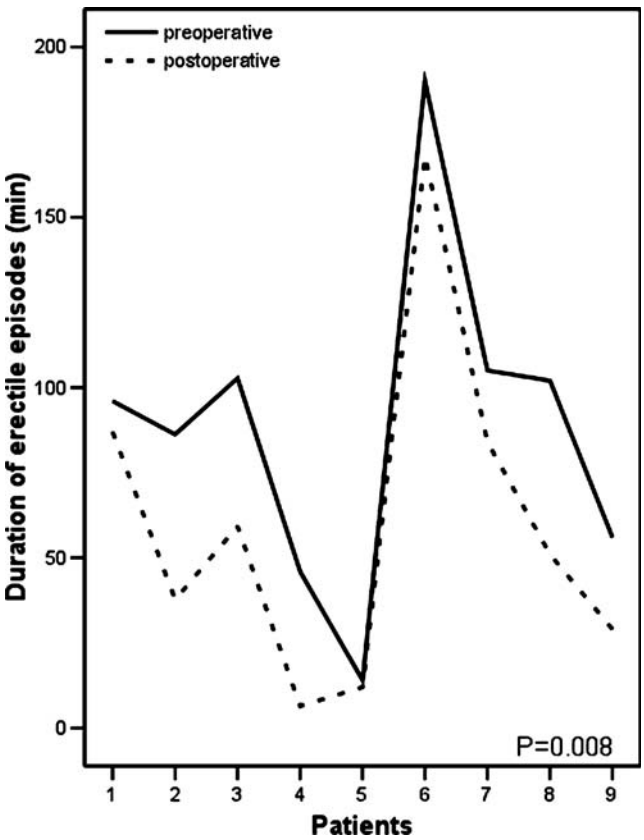

Fig. 1 Duration of erectile episodes (minutes) observed preoperatively and postoperatively. *x-axis* represents the individual patients; *y-axis* represents the duration of erectile episode in minutes

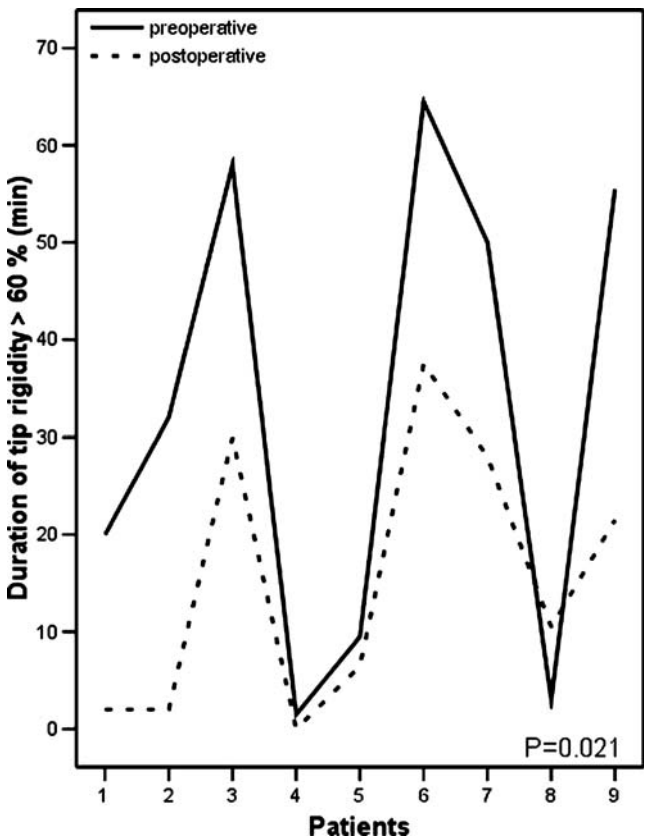

Fig. 2 Duration of tip rigidity ≥60% preoperatively and postoperatively. *x-axis* represents the individual patients; *y-axis* represents the duration of tip rigidity ≥60%

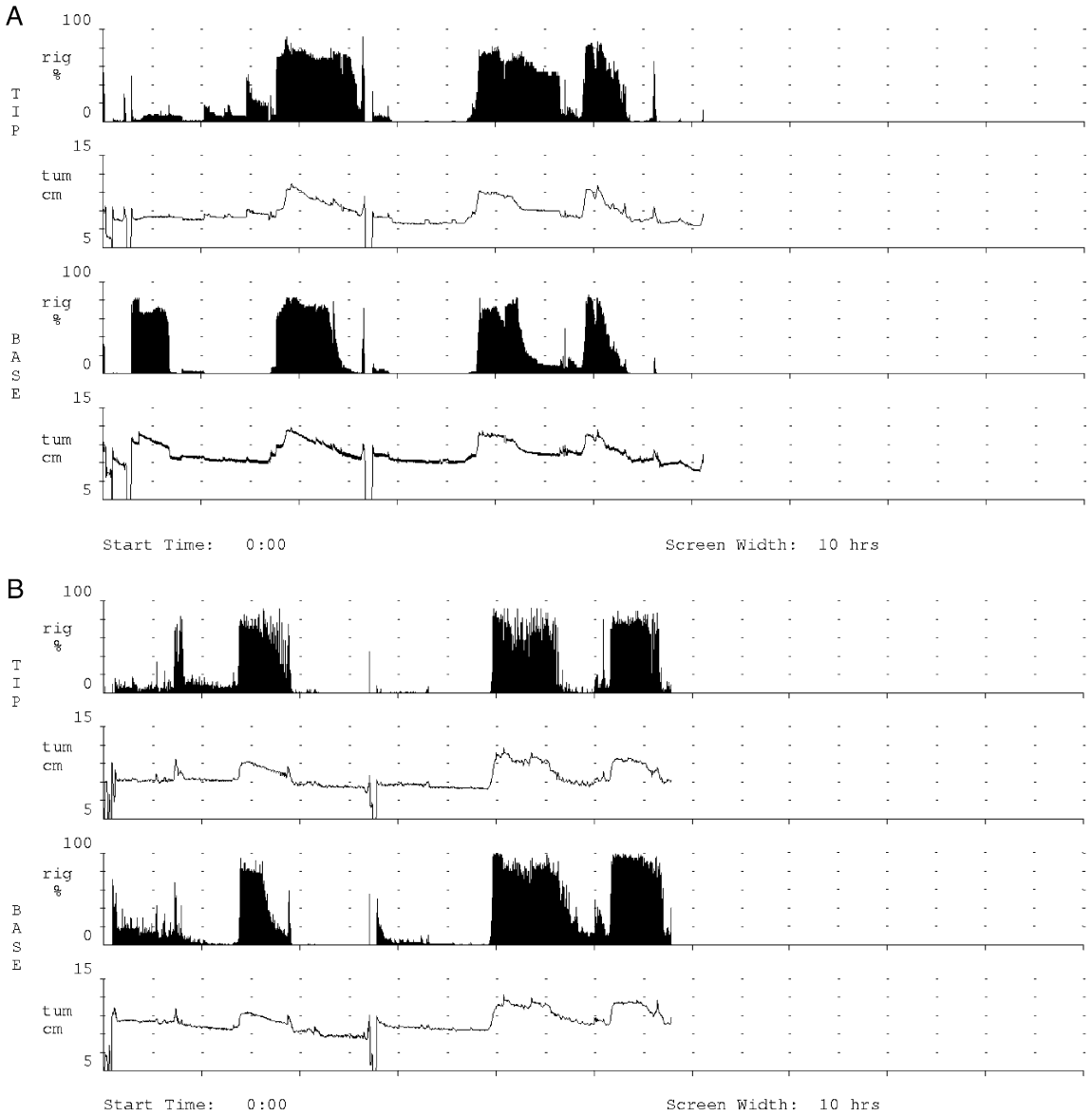

Fig. 3 RigiScan traces of nocturnal erections. **a** Nocturnal erections before laparoscopic total mesorectal excision; **b** nocturnal erections after LTME. *TIP* One loop is placed around the tip of the penis; *BASE* the other loop is placed around the base of the penis. *x-axis* represents time (start=0 min, end=10 h); *y-axis*: *Rig* rigidity of penis is expressed as percentages ranging from 0% to 100%; *Tum* tumescence is expressed in centimetres, ranging from 5 cm to −15 cm

corresponding with similar results reported in patients with rectal cancer or inflammatory bowel disease undergoing rectal surgery [15].

The pelvic parasympathetic nerves may be damaged at a number of points during rectal surgery. Excessive traction on the rectum during posterior mobilization can result in neuropraxia or even avulsion of sacral roots 2, 3 and 4. The pelvic plexus itself is most at risk during lateral dissection at the level of the middle haemorrhoidal vessels, to which it is intimately related. In abdominoperineal resection, neural injury may also occur during the perineal phase. It is contentious to imply that the nerves are visible after division of the rectourethralis muscle, although they are undoubtedly vulnerable in that area.

According to prospective studies, ED and EJD rates after TME, respectively, vary from 4% to 28% and 5% to 8% [16–19], so the results with respect to postoperative sexual functioning vary widely between surgeons and institutions.

According to the IIEF scores, erectile function was maintained in five out of our seven patients (71% of the patients), whereas EJD was reported by only one (11%). Although sexually active, two out of the nine patients already had ED before treatment; adequate vaginal intromission was almost never possible.

Our findings suggest that after LTME, parasympathetic nerves are more at risk than sympathetic. Quah and co-workers, reporting on 15 men after LTME and 22 men after OTME, found similar results concerning ED (33%) but described just a very high EJD rate after LTME (40%) [7]. The EJD in their OTME patients was only 5%.

Based on IPSS scores, our patients had high micturition frequencies and worse quality of life 15 months after treatment. Especially in the pre-treatment phase, it was, for logistic and emotional reasons, obviously not possible to combine extended urodynamic investigations with duplex ultrasonography and NPTR. In general, bladder dysfunction is difficult to assess in elderly men, who may have associated prostatic pathology, but extended urodynamic investigations may prove neurogenic bladder disease. In contrast with previous studies reporting on LTME, our results suggest that also with LTME the hypogastric plexus is still at risk resulting in neurogenic bladder dysfunction [6, 7]. The most recent studies reporting on OTME show at hospital discharge bladder dysfunction rates of 3.8% to 10.7% [20, 21]. Another study reporting about 6 months after OTME shows a percentage of 10 [19].

Currently, pharmaco duplex ultrasonography is generally accepted as the most sensitive method for evaluation of the functional status of the penile vascular system. Using this method, we found no relevant differences in cavernous arterial blood flow velocities before and after LTME. These results suggest no major vascular damage, due either to short-term preoperative radiotherapy or to LTME.

In most cases, ED following TME is neurogenic in origin. However, ligation of the anterior division or distal branches of the internal iliac artery is sometimes necessary.

As all patients in our study received short-term radiotherapy, we could not distinguish which of the two treatments, radiotherapy or LTME, was the major causative factor for sexual or bladder dysfunction 15 months postoperatively.

Concerning the late side effects of preoperative short-term radiotherapy in TME patients, there are only few studies available. Recently, data from the Dutch Colorectal Cancer Group analysed 990 patients (497 in the radiation + TME group and 493 in the TME only group) in terms of health-related quality of life and sexual function. The TME group only reported more male sexual dysfunction than the irradiated patients, but this did not lead to significant worse overall quality of life [1].

There are some limitations to our study. As this is a limited study of nine non-consecutive patients, the results are possibly subject to selection bias and therefore must be evaluated with caution. In future, these preliminary findings should be checked in larger series with an open control group in a randomized controlled trial.

Despite these shortcomings, our data suggest that, in spite of better visualization of the autonomic nerves, the occurrence of neurogenic sexual dysfunction and LUTS after LTME are comparable to the results found in studies after OTME [1, 2].

Despite objectively assessed physical sexual deterioration, our patients had unchanged overall sexual satisfaction. This corresponds with findings in patients treated for testicular cancer [22] and with data of women treated for gynaecological cancer [23]. This suggests that physiological factors play probably a more determining role than physical variables in sexual functioning in male patients after LTME.

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References

1. Marijnen CA, van de Velde CJ, Putter H, van den BM et al (2005) Impact of short-term preoperative radiotherapy on health-related quality of life and sexual functioning in primary rectal cancer: report of a multicenter randomized trial. J Clin Oncol 23:1847–1858
2. Bonnel C, Parc YR, Pocard M et al (2002) Effects of preoperative radiotherapy for primary resectable rectal adenocarcinoma on male sexual and urinary function. Dis Colon Rectum 45:934–939
3. Lacy AM, Garcia-Valdecasas JC, Pique JM et al (1995) Short-term outcome analysis of a randomized study comparing laparoscopic vs open colectomy for colon cancer. Surg Endosc 9:1101–1105
4. Weeks JC, Nelson H, Gelber S, Sargent D, Schroeder G (2002) Short-term quality-of-life outcomes following laparoscopic-assisted colectomy vs open colectomy for colon cancer: a randomized trial. JAMA 287:321–328
5. Breukink SO, Pierie JP, Grond AJ, Hoff C, Wiggers T, Meijerink WJ (2005) Laparoscopic versus open total mesorectal excision: a case-control study. Int J Colorectal Dis 20:428–433
6. Jayne DG, Brown JM, Thorpe H, Walker J, Quirke P, Guillou PJ (2005) Bladder and sexual function following resection for rectal cancer in a randomized clinical trial of laparoscopic versus open technique. Br J Surg 92:1124–1132
7. Quah HM, Jayne DG, Eu KW, Seow-Choen F (2002) Bladder and sexual dysfunction following laparoscopically assisted and conventional open mesorectal resection for cancer. Br J Surg 89:1551–1556
8. Breukink SO, Pierie JP, Hoff C, Wiggers T, Meijerink WJ (2006) Technique for laparoscopic autonomic nerve preserving total mesorectal excision. Int J Colorectal Dis 21:308–313
9. Breukink SO, Grond AJ, Pierie JP, Hoff C, Wiggers T, Meijerink WJ (2005) Laparoscopic versus open total mesorectal excision for rectal cancer: An evaluation of the mesorectum's macroscopic quality. Surg Endosc 19:307–310
10. Beets-Tan RG, Beets GL, Vliegen RF et al (2001) Accuracy of magnetic resonance imaging in prediction of tumour-free resection margin in rectal cancer surgery. Lancet 357:497–504
11. Rosen RC, Riley A, Wagner G, Osterloh IH, Kirkpatrick J, Mishra A (1997) The international index of erectile function (IIEF): a multidimensional scale for assessment of erectile dysfunction. Urology 49:822–830
12. Barry MJ, Fowler FJ Jr, O'Leary MP et al (1992) The American Urological Association symptom index for benign prostatic

hyperplasia. The Measurement Committee of the American Urological Association. J Urol 148:1549–1557
13. Shabsigh R, Kimoto Y, Amar E et al (2004) Economical aspects of sexual dysfunctions. In: Sexual Medicine. Eds. T.F Lue, R. Basson, R. Rosen, F. Giuliano, S. Khoury, F. Montorsi. 2nd International Consultation on Sexual Dysfunctions, Paris, 2004. ISBN 0-9546956-0-7, p149.
14. Hatzichristou DG, Hatzimouratidis K, Ioannides E, Yannakoorgos K, Dimitriadis G, Kalinderis A (1998) Nocturnal penile tumescence and rigidity monitoring in young potent volunteers: reproducibility, evaluation criteria and the effect of sexual intercourse. J Urol 159:1921–1926
15. Lindsey I, Cunningham C, George BD, Mortensen NJ (2003) Nocturnal penile tumescence is diminished but not ablated in postproctectomy impotence. Dis Colon Rectum 46:14–19
16. Nesbakken A, Nygaard K, Bull-Njaa T, Carlsen E, Eri LM (2000) Bladder and sexual dysfunction after mesorectal excision for rectal cancer. Br J Surg 87:206–210
17. Kim NK, Aahn TW, Park JK et al (2002) Assessment of sexual and voiding function after total mesorectal excision with pelvic autonomic nerve preservation in males with rectal cancer. Dis Colon Rectum 45:1178–1185
18. Pocard M, Zinzindohoue F, Haab F, Caplin S, Parc R, Tiret E (2002) A prospective study of sexual and urinary function before and after total mesorectal excision with autonomic nerve preservation for rectal cancer. Surgery 131:368–372
19. Sterk P, Shekarriz B, Gunter S et al (2005) Voiding and sexual dysfunction after deep rectal resection and total mesorectal excision: prospective study on 52 patients. Int J Colorectal Dis 20:423–427
20. Junginger T, Kneist W, Heintz A (2003) Influence of identification and preservation of pelvic autonomic nerves in rectal cancer surgery on bladder dysfunction after total mesorectal excision. Dis Colon Rectum 46:621–628
21. Kneist W, Heintz A, Junginger T (2005) Major urinary dysfunction after mesorectal excision for rectal carcinoma. Br J Surg 92:230–234
22. Jonker-Pool G, Van de Wiel HB, Hoekstra HJ et al (2001) Sexual functioning after treatment for testicular cancer—review and meta-analysis of 36 empirical studies between 1975–2000. Arch Sex Behav 30:55–74
23. Weijmar Schultz WCM, van de Wiel HBM, van de Haan DEE, van Driel MF (1993) Sexuality and cancer in women. Ann Rev Sex Res 3:151–200