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Several studies have demonstrated that sexual function following treatment for colorectal cancer is adversely affected in survivorship.

Sexual Function in Colorectal Cancer Survivors

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Background: Findings from clinical and research studies suggest that the overall health-related quality of life of many colorectal cancer survivors is good. However, many survivors report significant sexual dysfunction after treatment that may adversely affect their quality of life in survivorship.

Methods: This article examines studies investigating sexual function in men and women treated for colorectal cancer. Also included are data on the prevalence and nature of sexual dysfunctions in colorectal cancer survivors, the impact of specific treatment modalities for colorectal cancer on sexual function, and the management of sexual dysfunction in men and women.

Results: Published studies investigating sexual dysfunction after colorectal cancer treatment generally have been limited conceptually and methodologically. However, findings suggest that the prevalence of sexual dysfunction among colorectal cancer survivors is high.

Conclusions: Sexual dysfunction is often a long-term and late effect of treatment for colorectal cancer. The assessment and management of sexual dysfunction in men and women treated for colorectal cancer should be standard practice throughout treatment and in survivorship.

Introduction

Colorectal cancer (CRC) is the third most common cancer among men and women in the United States.¹ Approximately 108,000 cases of colon cancer and nearly 41,000 cases of rectal cancer were diagnosed in 2008.¹ Prognosis varies with the extent of disease at diagnosis. The estimated overall 5-year survival rate for early localized disease is 90%, while the 5-year survival rate for patients with metastatic disease is 10%.¹ Mortality rates have declined significantly in the last two decades due to

advances in surgical techniques and adjuvant therapy.^{2,3} As a result, interest has shifted to include the treatment of long-term and late effects of CRC and its treatment. As well, national research goals include a focus on survivorship issues to improve health-related outcomes and enhance quality of life in survivorship.⁴

In general, descriptive cross-sectional and longitudinal studies among CRC survivors have concluded that overall health-related quality of life after treatment is good.⁵⁻¹⁰ However, many survivors, including those who report their health-related quality of life as good, also report significant difficulties related to sexual function. For example, in a longitudinal prospective study, Marijnen et al¹¹ assessed the quality of life of 990 patients with resectable rectal cancer who underwent rectal excision and were randomly assigned to short-term high-dose radiotherapy or no radiotherapy prior to surgery. Three months postsurgery, patients who underwent preoperative radiotherapy reported significantly fewer daily activities. Health-related quality of life was otherwise largely unaffected by radiotherapy

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during the 24 months following surgery. However, both men and women reported significant declines in sexual activity and significantly worse sexual function over the course of the study. These changes were significantly greater in patients who received preoperative radiotherapy. These results are consistent with a growing body of evidence suggesting that the prevalence of sexual dysfunction among men and women is high following treatment for CRC.

Prevalence and Assessment of Specific Sexual Dysfunctions in CRC Survivors

Previous studies have identified a wide variety of sexual dysfunctions experienced by CRC survivors. Among men, these include erectile dysfunction and ejaculatory disorders, including retrograde ejaculation and loss of or alterations in ejaculation.¹² Among women, specific sexual dysfunctions include decreased libido or sexual desire, dyspareunia, changes in genital arousal and lubrication, and altered orgasms.^{12,13} In addition, relatively nonspecific problems such as changes in level of sexual activity, a lack of sexual enjoyment, and alterations in body image have been identified in both men and women following treatment for CRC.^{14,15}

Prevalence rates for specific sexual dysfunctions in men and women vary widely. For example, in a study by Breukink et al,¹⁶ 39% of men reported erectile dysfunction and no men reported any ejaculatory disorder 15 months after short-term radiotherapy and rectal excision. In another study, Quah et al¹⁷ found a similar rate of erectile dysfunction, while 40% of men also reported an inability to ejaculate between 2 and 4 years after rectal excision. Among women, reported rates of dyspareunia vary from 6% at a median of 37 months after rectal excision¹⁸ to more than 60% following abdominoperineal resection (APR) at a median of 52 months previously.¹³ With respect to alterations in orgasm in women, rates range from 0% following segmental colectomy¹⁸ to more than 30% following APR.¹³ In a recent study among male and female CRC survivors who had undergone colon or rectal resection at least 1 year previously, 20% of colon cancer survivors and 5% of rectal cancer survivors reported sexual problems related to reduced sexual desire.¹⁹ Conversely, other studies have reported rates as high as 50% for reduced sexual desire in men and women following CRC treatment.^{13,20}

The variety in the nature of sexual difficulties reported and the broad range of prevalence rates associated with sexual dysfunctions are attributable, in part, to the modalities used to treat CRC.²¹ This variety is also attributable to methodological differences across studies, including the approaches used to assess and define sexual dysfunction, the timing of assessments, and the demographic and clinical characteristics of the survivors studied.

Different methods have been utilized to assess sexual function in CRC survivors. These include the development of study-specific self-report measures. For example, Mannaerts et al²² developed a questionnaire

to assess sexual function in men and women treated with multimodality therapy for locally advanced or recurrent rectal cancer. The measure included items assessing sexual activity, pain or discomfort during intercourse, orgasm in men and women, and erection and ejaculation in men. Quality of orgasm and erection also were assessed. No data were provided with respect to the validity and reliability of the measure, and no published norms using this particular approach are available that would enable comparison of these results to other studies.

A more defensible approach to assessment of sexual function is the use of a measure with established validity and reliability as well as published norms. A widely used measure that meets this standard is the CRC module (QLQ-CR38)²³ of the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 questionnaire.²⁴ The EORTC QLQ-C30 is a measure that assesses aspects of quality of life considered most relevant to cancer patients, and the EORTC QLQ-CR38 assesses additional aspects of quality of life considered particularly relevant to individuals with a diagnosis of CRC. The EORTC QLQ-CR38 consists of 38 questions: 19 are completed by all respondents and the remaining 19 are divided into groups of questions relevant for specific subgroups (ie, male or female, patient with or without a stoma). The measure is divided into four functional scales including body image, sexual functioning, and sexual enjoyment, and eight symptom scales including male and female sexual problems. The psychometric properties of the EORTC QLQ-CR38 have been well established in English-speaking and other language populations. Work is currently underway to characterize the psychometric properties of a newer version of the measure, the EORTC QLQ-CR29, that reflects changes in treatment since publication of the original measure.²⁵

While the widespread use of the EORTC QLQ-CR38 enables comparisons across a number of different international populations, it is important to note that the measure's assessments of sexual function and sexual problems are relatively limited. The sexual functioning scale consists of two items, one assessing "interest in sex" and one assessing "extent" of sexual activity "with or without intercourse." Male sexual problems are assessed via two questions, one concerned with difficulty getting or maintaining an erection and the other, a general question about "problems with ejaculation." The assessment of female sexual problems is limited to women who have had intercourse in the last 4 weeks and consists of two questions inquiring about vaginal dryness and pain with intercourse. Further, there are inherent limitations in using the EORTC QLQ-CR38 in studies of CRC survivors in the United States. Differences in clinical practice patterns, including the use of longer-term radiotherapy with lower dose fractions in North American vs short-term radiotherapy in Europe, make comparisons between US survivors and survivors in other countries somewhat suspect. In addition, generalizing the results of studies

using the EORTC QLQ-CR38 to men and women in the United States ignores the possibility of cross-cultural differences in sexual mores.

Increasingly, researchers are recognizing the need to use psychometrically sound gender-specific measures that assess the full range of sexual function in order to more accurately identify the effects of CRC and its treatment in survivors. To this end, two instruments have begun to be more widely utilized. The International Index of Erectile Dysfunction (IIEF)²⁶ is a 15-item self-report measure designed to assess sexual function in men. Scores are calculated for five domains: erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction. The psychometric properties of the IIEF have been established in a number of populations and the instrument has been used to evaluate sexual function in CRC survivors (for example, Liang et al²⁷). The Female Sexual Function Index (FSFI)²⁸ is a 19-item self-report measure designed to assess the multidimensional nature of female sexual function. Scores are calculated for six domains: desire, arousal, lubrication, orgasmic capacity, dyspareunia, and sexual satisfaction. A total scale score is obtained by adding the six domain scores. The psychometric properties of the FSFI have been demonstrated in a number of studies, and the instrument also has been used to evaluate sexual function in CRC survivors (for example, da Silva et al²⁹).

Existing studies of CRC survivors have used a variety of research designs, and this also accounts for the variability in findings related to sexual dysfunction. A cross-sectional design, in which survivors are assessed at a single point in time, is one of the more commonly used designs. An example of this is a study by Guren et al¹⁵ in which 319 CRC survivors completed the EORTC QLQ-CR38. Survivors were a median of 64 months post-surgery; time since surgery ranged from 16 months to 112 months. It is not possible to ascertain whether sexual function has changed over time using a cross-sectional design, and the researchers did not examine the effect of time since surgery, so it is not clear whether, in general, time may have had a positive or negative effect on sexual function in survivorship. Many researchers have attempted to address this shortcoming by asking participants to provide retrospective assessments of their sexual function prior to a CRC diagnosis and to compare these with their current level of sexual function. For example, Hendren et al¹³ surveyed 180 rectal cancer survivors who had undergone surgical treatment a median of 7 years previously. Participants completed the EORTC QLQ-CR38, FSFI or IIEF, as appropriate, and additional questions related to their sexual history. Among the findings, 45% of men and 29% of women reported that surgery made their sex life worse, and 53% of men and women also reported a sexual problem that was present after surgery but not before. While results certainly suggest that CRC treatment is associated with sexual dysfunction, they also highlight the potential for retrospective bias. That is, survivors' recall of their sex-

ual function before their cancer diagnosis may be biased by their experiences since the diagnosis.

In order to more accurately assess whether sexual function changes over time following CRC treatment, a longitudinal design is necessary in which the same survivors are followed over time and assessed at multiple time points. An example of this approach is a study by Engel et al³⁰ in which survivors completed the EORTC QLQ-CR38 at 1, 2, 3, and 4 years after surgery for rectal cancer. Researchers made comparisons over time in sexual function and sexual problems between those who underwent different surgical procedures. Researchers noted that sexual function scores were generally quite low among all groups over the course of the study. Without a presurgical baseline, however, researchers were unable to determine the extent to which the specific differences between surgery groups and specific changes over time within each group were the result of rectal cancer or its treatment. In a longitudinal study by Jayne et al³¹ that included a pretreatment baseline assessment of sexual function, researchers compared laparoscopic-assisted surgery with conventional open surgery in men and women with CRC. Participants completed the EORTC QLQ-CR38 preoperatively and then at 2 weeks and 3, 6, 18, and 36 months postoperatively. Researchers reported no change from baseline in sexual function or enjoyment for both the laparoscopic-assisted and conventional open surgery arms and no change from baseline in sexual problems for women. Men in both arms reported significantly more problems with erectile and ejaculatory function after surgery, and these problems increased in severity over time.³² Body image was worse than at baseline from 2 weeks onward for all patients, suggesting that body image in particular was adversely affected as a result of surgical treatment for CRC.

There is no empirical evidence that an individual's sexual function may be adversely affected prior to the diagnosis of CRC; that is, symptoms such as erectile dysfunction or bleeding with intercourse are not typical precursors to a CRC diagnosis. However, physical symptoms such as fatigue or pain may be notable prior to a diagnosis, and these symptoms might affect one's ability to engage in activities of a sexual nature. This suggests that even a pretreatment baseline assessment may be an inaccurate measure of a survivor's premorbid sexual function. In this case, one approach to determine whether sexual dysfunctions are due to CRC or its treatment is to compare the sexual function of a sample of CRC survivors to a healthy comparison group matched on relevant demographic variables such as gender and age. To the best of our knowledge, this approach has not yet been used to examine sexual function in CRC survivors. Another approach is to compare the responses of CRC survivors on assessment measures to published norms. Whereas the EORTC QLQ-CR38 is not applicable to healthy noncancer controls, normative data are available on the FSFI and IIEF. The initial studies used to establish the psychometric properties of these instruments included normal con-

control samples, and some researchers have identified scores reported by CRC survivors that are more than one standard deviation below the mean of these control samples as indicative of sexual dysfunction.¹³ In addition, Wiegel et al³⁵ cross-validated the FSFI in several samples of women with mixed sexual dysfunctions and developed a diagnostic cut-off score for classifying potential sexual dysfunction.

Finally, the demographic and clinical characteristics of the survivors studied may account for the variability in the nature of sexual difficulties identified and the range of prevalence rates for sexual dysfunctions. For example, age, menopausal status, relationship status, and partner sexual health have been shown to be associated with sexual dysfunction in the general population.^{34,35} In studies of CRC survivors, the extent to which these characteristics differ within the sample will introduce variability that may be unrelated to CRC or its treatment. With respect to clinical characteristics, there is considerable evidence for treatment-related differences in the sexual function of CRC survivors.^{12,14,36,37} Thus, differences across studies in the types of treatments received by survivors might also account for some of the variability in prevalence rates across studies.

Relationship of Sexual Dysfunction to CRC Treatment

Despite advances in surgical technique, including total mesorectal excision (TME), CRC surgery may result in damage to the sympathetic and parasympathetic nerves.³⁸ Sexual dysfunction following surgery depends largely on the extent of this autonomic nerve damage as well as the anatomical site and components affected.^{21,39} In a study of laparoscopic pelvic autonomic nerve preservation surgery for sigmoid colon cancer,²⁷ there were no significant differences between preoperative and 6-month postoperative sexual function in men and women with successful nerve-sparing. The 1 man (out of 44) who failed nerve-sparing experienced retrograde ejaculation. The 3 women (out of 42) who failed nerve-sparing experienced problems with vaginal lubrication, dyspareunia, arousal, and orgasm. In general, nerve preservation is easier to achieve during sigmoid colon resection than rectal surgery, and previous studies indicate that men and women who undergo colonic resection for CRC are less likely to experience sexual dysfunction following surgery than those who undergo rectal excision.^{19,32,40,41}

Rectal cancer surgeries performed in accordance with the principles of TME and autonomic nerve preservation are believed to preserve sexual function.^{12,42} In a small prospective study, Pocard et al⁴³ reported no significant differences in sexual function before and at 3 months and 1 year after TME for rectal cancer in 4 sexually active women. Among the 9 sexually active men, 4 reported a reduced rigidity of erection at 3 months, but this did not impair ability for vaginal penetration and orgasms. This was resolved by year 1 follow-up. However, in a prospective longitudinal study of 52 patients, Breukink et al⁴⁴ found that sexual

function scores on the EORTC QLQ-CR38 decreased significantly from 3 months until 1 year postoperatively in men and women who underwent laparoscopic TME for rectal cancer. Similarly, in a retrospective study of sexual function in men 1 year after laparoscopic TME, sexual desire was maintained by 56%, the ability to engage in intercourse by 57%, and the ability to achieve orgasm and ejaculation by just 38%.⁴⁵ Despite such findings, research indicates that TME generally offers an advantage over conventional rectal cancer surgery in preserving sexual function.^{36,46}

In general, with respect to pelvic surgeries for rectal cancer, APR is associated with a higher risk of postoperative sexual dysfunction compared to sphincter preservation surgeries.^{47,48} In a prospective longitudinal study of 212 rectal cancer patients, Schmidt et al⁴⁹ found that APR patients had significantly worse sexual function and more distress related to sexual dysfunction than patients who underwent anterior resection (AR) at 3, 6, and 12 months following surgery. Bruekink et al⁴⁴ reported similar findings in their prospective longitudinal study. Sexual function decreased significantly for the sample as a whole, but AR patients had better sexual function than APR patients at 3 months and 1 year postoperatively. In the retrospective cross-sectional study by Guren et al¹⁵ mentioned previously, 35% of male AR patients reported sexual problems on the EORTC QLQ-CR38 at a median of 64 months after surgery compared with 61% of male APR patients. Male APR patients but not female APR patients reported significantly worse sexual function. In a similarly designed study by Vironen et al⁵⁰ of 82 survivors who were a median of 20 months postsurgery, 87% of male APR patients reported sexual dysfunction including reduced erectile function and retrograde ejaculation compared with 50% of male AR patients. Three of the 9 women who were sexually active after surgery reported changes in sexual function after surgery, but researchers noted it is difficult to draw any conclusions on sexual function outcome from such small numbers. Hendren et al¹³ found that among survivors who had undergone surgery a median of 7 years previously, female survivors who had undergone APR reported worse mean scores on all domains of the FSFI compared with survivors who had undergone AR or transanal excision. In addition, 45% of female APR survivors reported that "surgery made their sex life worse" compared with 23% and 11% of AR and transanal excision survivors, respectively.

The impact of pelvic radiotherapy for CRC on sexual function has rarely been systematically evaluated. Previous studies include CRC survivors who have received radiotherapy, but few compare those who have and have not received radiotherapy in order to carefully examine its effects. Nevertheless, previous reviews^{21,36,51} suggest that radiotherapy is associated with significant impairment in sexual function in both male and female CRC survivors. In men, sexual dysfunction after pelvic radiotherapy may result from dam-

age to pelvic nerves and blood vessels and also from slowing of testosterone production. In a large prospective study by Lange et al⁵² of men and women treated with TME and randomized to receive short-term high-dose preoperative radiotherapy or no preoperative radiotherapy, increases in general sexual dysfunction, erectile dysfunction, and ejaculatory problems were reported by 76%, 80%, and 72% of male patients, respectively, 24 months after surgery. Receipt of radiotherapy was associated with general sexual dysfunction and ejaculatory problems but not erectile dysfunction.

Marijnen et al¹¹ found that compared to men who did not receive short-term high-dose radiotherapy prior to surgery, irradiated men experienced erectile dysfunction that worsened significantly over time. They also reported significantly more ejaculation disorders 24 months after surgery. Men who received preoperative radiotherapy also experienced a significantly larger decline in sexual activity. In a longitudinal prospective study of men undergoing surgical resection for rectal cancer, Heriot et al⁵³ found that 4 to 6 weeks of radiotherapy combined with surgery had an adverse effect on the ability to obtain and maintain an erection, achieve orgasm, and ejaculate, as well as the likelihood of being sexually active in comparison to surgery alone. Maximal deterioration in sexual function occurred 8 months after surgery with subsequent slow and incomplete recovery over the course of the 4-year follow up. Similarly, in a study of male CRC survivors, Bonnel et al⁵⁴ found that men who received predominantly short-term high-dose radiotherapy prior to surgery a median of 20 months previously had greater impairment of ejaculatory function after surgery than those who did not receive preoperative radiotherapy. There were no differences between the two groups, however, in spontaneous erection, stimulated erection, and rigidity of erection.

Sexual dysfunction in women after pelvic radiotherapy is generally the result of alterations in vaginal anatomy and decreased vaginal lubrication. Radiation to the whole pelvis is likely to result in ovarian failure and thus radiation-induced menopause in premenopausal women. Although the effect of premature ovarian failure on sexual function in female CRC survivors has not been widely examined, there is ample evidence of its adverse impact on sexual function in other groups of cancer survivors, including breast cancer survivors.³⁷ Previous studies of the impact of radiotherapy for CRC on sexual function are few in number and generally include small sample sizes. Further, studies have often been plagued by female respondents' reluctance to answer questions about sexual function.^{32,55,56} In the study by Lange et al⁵² cited previously, increases in general sexual dysfunction, dyspareunia, and vaginal dryness were reported by 62%, 59%, and 57%, respectively, and short-term high-dose preoperative radiotherapy was associated with general sexual dysfunction but not dyspareunia or vaginal dryness nearly 2 years after treatment. Similarly, in the longitudinal prospective study by Marijnen et al,¹¹ there were no differences in vaginal

dryness and dyspareunia between women who received short-term preoperative radiotherapy and those who did not; however, irradiated women reported significantly worse overall sexual function over the course of the 24-month study. Conversely, in a study of quality of life and functional outcome after AR or APR for rectal cancer a median of 64 months previously, Guren et al¹⁵ found that women who received long-term radiotherapy reported significantly more vaginal dryness and pain with intercourse. More recently, Breukink et al⁵⁷ compared the sexual function of 4 women who underwent short-term preoperative radiotherapy and rectal excision at least 15 months previously to an age-matched group of 18 healthy women. Sexual function was assessed by vaginal photoplethysmography to evaluate vaginal blood flow and also by a validated questionnaire and an in-depth interview. There were comparable changes in vaginal vasocongestion between the two groups in response to sexual stimulation, although 3 of the 4 CRC survivors demonstrated lower levels of vaginal blood flow. Researchers hypothesized that this may be explained by autonomic nerve damage caused by radiotherapy or surgery. Subjective sexual arousal also did not differ between the two groups.

More potent and effective chemotherapeutic agents are now being used in conjunction with pelvic radiotherapy and surgery for CRC. Although these agents provide significantly better local control within the pelvis, they have significant side effects that may impair quality of life. However, examining the impact of chemotherapy independent from the impact of surgery and pelvic radiotherapy in these multimodality regimens is challenging.²¹ Recent European and North American clinical trials investigating the efficacy of these newer treatment strategies have not examined the independent effects of chemotherapy on sexual function. Urso et al⁵⁸ evaluated the quality of life of 22 patients who received preoperative chemotherapy and pelvic radiotherapy, surgery, and postoperative chemotherapy. Patients completed the EORTC QLQ-CR38 before and after preoperative chemotherapy and radiation and at least 8 months after surgery. Results suggested no impairment in quality of life; however, sexual function and symptom subscales were not reported separately. Thus it is difficult to draw any conclusions related to sexual function outcomes. Despite the lack of available data, however, one can reasonably conclude that chemotherapy, which is often administered with supportive medications that may themselves result in sexual dysfunction, may be associated with reduced sexual function, at least temporarily. In men, erections and sexual desire may decrease after each cycle, recovering in the period between cycles. Some chemotherapeutic agents may cause permanent damage to the nerves that control erection and emission. In women, chemotherapeutic agents may result in transient or permanent amenorrhea. Women who continue to menstruate or who recover their cycles may incur the risk of premature ovarian failure in the long term.

In summary, although some studies have suggested that the impact of CRC treatment on sexual function is minimal, the majority of studies have demonstrated that sexual function in men and women is adversely affected in survivorship. Studies examining the impact of different treatment modalities on sexual function in CRC survivors have been limited conceptually by failing to inquire about the full range of male and female sexual function and methodologically by the heterogeneity of participant characteristics, use of small sample sizes, retrospective design, and lack of validated assessment tools. Nevertheless, findings suggest that sexual dysfunction is often a long-term and late effect of multimodality therapy.

Management of Sexual Dysfunction in CRC Survivors

Previous research indicates that the majority of CRC survivors consider sexual function an important functional outcome, have an expectation that treatment will not disturb their sex life, and are often distressed by sexual dysfunctions that may result.^{13,52,59,60} Thus, education and counseling related to sexual dysfunction following CRC treatment should take place initially at diagnosis, throughout treatment, and during the follow-up period as necessary to provide information and facilitate realistic patient expectations.

A number of therapies are available to address sexual dysfunction in men. Testosterone replacement therapy is often effective in increasing sexual desire and may improve erectile function in men with clinically low levels of serum testosterone. Oral therapy with phosphodiesterase type 5 (PDE5)-inhibiting drugs is considered first-line treatment for erectile dysfunction.⁴⁷ Standard second-line therapies for erectile dysfunction include intracavernosal injections with prostaglandin E₁ alone or in combination with papaverine and phentolamine. Injections have been shown to produce an erection sufficient for vaginal penetration in up to 70% of men.³⁸ Side effects include pain at the injection site, penile fibrosis, and corporal plaque, and many patients switch to oral medications or discontinue injections because of these side effects or because they find injections cumbersome and inconvenient.⁴⁷ Intraurethral prostaglandin E₁ delivered with the medicated urethral system for erection (MUSE) represents an alternative for those not willing to consider injections; research indicates that compliance is higher with MUSE than with injections but that its efficacy is lower. Vacuum constriction devices are one of the oldest treatments available for erectile dysfunction, and efficacy rates have been reported as high as 80%.⁴⁷ Side effects with these devices are rare, and the device represents a one-time cost that is relatively inexpensive compared to other available therapies. However, this is a less appealing option for many men due to the lack of spontaneity with their use as well as their labor-intensive nature. Finally, implanted silicone rods or inflatable penile implants are used when there is a clearly identi-

fied medical cause for erectile dysfunction and erections are not likely to improve. Cancer survivors who have had nerve-sparing surgical procedures are encouraged to wait at least 1 year before considering a penile prosthesis because surgery to implant the prosthesis destroys one's own capacity for erection.

Although these therapies have been evaluated in prostate cancer survivors with good effect,⁶¹ to the best of our knowledge, these therapies have rarely been systematically evaluated in male CRC survivors. Lindsey et al⁶² examined the efficacy of the PDE5-inhibitor sildenafil for erectile dysfunction in a randomized, double-blind, placebo-controlled trial with crossover in 32 men who underwent rectal excision for cancer or inflammatory bowel disease a median of 5.6 years previously. Among the men who received sildenafil, 79% reported a significant improvement in erectile function compared with 3% of men who received placebo, and there was a significant improvement from baseline in mean total IIEF scores after 4 weeks of sildenafil therapy but not after placebo. All of the men who received placebo initially and crossed over to sildenafil reported significant improvement in erectile function and mean total IIEF scores. Subgroup analysis revealed that 78% of rectal cancer patients had a positive response to sildenafil compared with 93% of patients with inflammatory bowel disease, but this difference was not significant. Side effects of the medication were not uncommon but were mild, well tolerated, and often temporary. Despite the small size and heterogeneity of the sample in terms of diagnosis and surgical procedures, the researchers concluded that sildenafil represents an excellent chance of improvement in erectile dysfunction after rectal excision. More recently, in a study of CRC patients after rectal excision with TME, Sterk et al⁶³ reported that therapy with sildenafil was not effective in 8 men who had been potent preoperatively and who reported erectile dysfunction 3 and 6 months postoperatively, while intracavernous pharmacological therapy resulted in an erection sufficient for sexual intercourse in 5 of 8 men.

Available treatment options for sexual dysfunction in women are relatively fewer in number and, to the best of our knowledge, none of these have been systematically evaluated in female CRC survivors. Water- or silicone-based vaginal lubricants⁶⁴ and vaginal moisturizers⁶⁵ are routinely recommended to combat vaginal dryness. When these are not sufficient to alleviate dyspareunia, low-dose vaginal estrogen preparations may be considered.^{66,67} Pelvic floor muscle training and vaginal dilators are recommended as a prophylactic measure after pelvic radiotherapy to prevent vaginal stenosis.⁶⁸ However, evidence for the effectiveness of these therapies among cancer survivors is limited.^{61,68} With respect to vaginal dilation in particular, there is a lack of consistency in patient education regarding this therapy,⁶⁹ and compliance rates for vaginal dilation are universally low.^{70,71} In general, there are limited efficacy and safety data for testosterone therapy for low desire associated with ovarian failure, and it is not recommended.^{72,73}

Research among cancer survivors, including those treated for CRC, strongly suggests that sexual dysfunctions are multifactorial in nature, and factors such as an individual's age, emotional well-being, partner relationship quality, and sexual health history may play a role in the development and maintenance of sexual dysfunctions after cancer.^{13,29,41,67,74} Thus, efforts to address sexual dysfunctions in CRC survivors should begin with a comprehensive assessment. It is important to identify the specific nature of the sexual dysfunction as well as factors that may be perpetuating the dysfunction. Relatively simple sexual problems can often be dealt with by providing information and suggestions for behavior change. More complex and severe problems require more intensive intervention, and efforts that combine medical and psychological therapies are likely to be most effective.

Conclusions

In general, studies examining health-related quality of life in CRC survivors have concluded that overall quality of life is good. However, many survivors report significant sexual dysfunction after treatment. Although prevalence rates of reported sexual dysfunctions vary according to study design and treatment modality, the empirical evidence is such that the assessment and management of sexual dysfunction in men and women with CRC should be standard practice throughout treatment and in survivorship.

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