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Sexual Dysfunction Following Cystectomy and Urinary Diversion

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Introduction

Cystectomy is a common urologic surgery performed for a number of indications, including muscle-invasive bladder cancer, recurrent and recalcitrant non-invasive bladder cancers, radiation injury, and severe, end-stage bladder dysfunction. Of the 73,000 men and woman who are diagnosed with bladder cancer each year, approximately 25% present with invasive or advanced stage disease and may be managed with cystectomy.^{1–4} In non-muscle-invasive cases, disease progression or failed endoscopic and/or intravesical management may also lead to cystectomy. Among men, cystectomy involves removal of the bladder, prostate, and seminal vesicles. In woman, cystectomy typically includes removal of the uterus, ovaries, fallopian tubes, cervix and the anterior portion of the vagina, although vaginal and organ-sparing procedures are performed in some cases. Radical resection with removal of adjacent structures is usually only required in cancer cases, and when performed for benign indications cystectomy frequently does not include removal of all anterior pelvic structures. Urinary diversion is performed in conjunction with cystectomy to redirect urine out of the body and is an attendant part of the surgery. Between 8,000 and 10,000 cystectomy and urinary diversions are performed each year in the US.⁵

As with other pelvic surgeries, cystectomy is associated with significant changes in sexual function for both men and women. For example, erectile dysfunction may affect up to 80% of men following cystectomy and urinary diversion.⁶ In addition to sexual consequences related to iatrogenic erectile dysfunction (ED) in men and physical changes (e.g. altered vaginal anatomy) in women, a number of other factors may also impair sexual function following cystectomy. Body alterations associated with urinary diversion and resulting changes in body image, emotional and psychological responses of both patients and their partners, as well as social concerns and stigma associated with urinary diversion may impair sexuality and sexual satisfaction, and strain intimate relationships. However, while postoperative sexual dysfunction has received considerable attention for some surgeries, such as radical prostatectomy, relatively little research has focused on sexual functional

outcomes following cystectomy. As a result, the full extent of sexual problems that follow bladder removal and urinary diversion are not completely understood. In this article, we will review the current literature regarding function and health related quality outcomes after cystectomy focusing, in particular, on sexual function and dysfunction.

Patient Reported Outcomes And Sexual Dysfunction

Measures of sexual function and dysfunction are variable, and may include subjective report, quantitative measures of the ability to engage in and frequency of sexual acts, or objective patient reported outcomes using reliable and validated quality of life assessments. Of these, patient reported outcomes typically provide the most accurate and reproducible information, and serve as the standard for how sexual function and dysfunction should be measured. A number of measures have been used to assess erectile function and recovery of sexual function after radical pelvic surgery. General inventories allow assessment of sexual function broadly across different medical conditions or surgeries, while condition or surgery-specific questionnaires provide more detailed information regarding the impact and outcomes associated with disease and treatment among specific patient populations. Although there are many sexual function assessment tools, most research regarding recovery of sexual function and sexual health among men after cystectomy has been conducted using the International Index of Erectile Function (IIEF) Erectile Function Domain (EFD), also known as the IIEF-6 or an abbreviated version of this questionnaire known as the Sexual Health Inventory for Men (SHIM). Each of these questionnaires has normal cutoffs (26 and 21 respectively) with lower scores separated into mild, moderate and severe erectile dysfunction. Because erectile function is only one component of sexual dysfunction seen after radical cystectomy, however, these surveys may not provide complete information or assessment of sexual dysfunction from a more comprehensive perspective. For women, the most commonly used counterpart questionnaire is the Female Sexual Function Index (FSFI). The Bladder Cancer Index (BCI), Vanderbilt Cystectomy Index (VCI), Functional Assessment of Cancer Therapy – Bladder (FACT-B), and EORTC-QOL-B20 are examples of bladder cancer specific questionnaires that include sexual function and dysfunction items, and have been increasingly used more recently to survey this population.

Unfortunately, reliable estimates of sexual dysfunction following cystectomy may not be available, largely due to the relative limited availability (historically) and use (more recently) of psychometrically robust HRQOL questionnaires. In 2005, Porter and Pension published a systemic review of quality of life following cystectomy, noting that exceedingly few studies use bladder cancer specific HRQOL questionnaires. This review, together with others, also underscored the lack of sufficient HRQOL studies in bladder cancer, raising questions regarding the commonly held belief that continent urinary diversions are associated with better quality of life outcomes compared to ileal conduit diversion.^{7–11} Since then, several bladder cancer-specific questionnaires have been developed to more accurately quantify the hallmark changes associated with bladder cancer treatments.¹¹ The first of these, the FACT-BI is an extension of the validated general FACT questionnaire, and includes 10 additional items related to urinary, gastrointestinal, and sexual symptoms, and 2 questions for patients with ostomy appliances.^{12–13} The VCI is also based on the general FACT questionnaire, but includes 17 adjunct bladder cancer and diversion specific questions

that assess patient experiences after cystectomy.¹⁴ The Bladder Cancer Index (BCI) was the first bladder cancer specific QOL questionnaire not based on a previous general instrument and was developed through a series of iterative revisions based on repeat performance evaluations. It consists of 34 items that quarry urinary, bowel and sexual function and bother.^{15–16} More recently, the European Organization on Research and Treatment of Cancer (EORTC) developed a bladder cancer module based on the general EORTC QLQ-C30 questionnaire. The EORTC QLQ-BLM30 is currently in validation phases, but has not been used widely.^{17–18} Table 1 shows an overview of each these instruments.

Erectile Dysfunction After Cystectomy

Erectile dysfunction is a well known complication of extirpative pelvic surgery and has been previously described among both colorectal and urology patients.¹⁹ Although generally acknowledged as a frequent functional consequence of these procedures, definitions of recovery often vary and a standard practical definition for post-pelvic surgery erectile dysfunction has not been firmly established. This has, in part, contributed to wide ranges in reported rates of erectile dysfunction. For example, rates as high as 70% and as low as 20% have been reported after radical prostatectomy. Similarly, one of the challenges in evaluating erectile dysfunction after radical cystectomy relates to how erectile recovery is defined. While some surgeons and researchers consider erections adequate for intercourse or the ability to have and maintain erections as sufficient criteria for recovery of erectile function, others argue that quality of erections is also an important consideration. The tools used to assess erectile dysfunction highlight some of these challenges. Questionnaires such as the FACT-B and BCI often include only one questions regarding erectile function, while sexual function inventories such as IIEF and SHIM, although more specific for erectile function, may not closely correlate with functional outcomes or include items regarding quality of erections. Other factors that are often overlooked after surgery include quality and consistency of erections, loss of penile length, preoperative sexual function, psychological issues and partner issues.²⁰

Although erectile function has been more thoroughly studied in other urologic diseases (e.g. prostate cancer), some research has examined sexual and erectile function outcomes after radical cystectomy. Allareddy²¹ and Gilbert¹⁶ both outlined a negative impact of cystectomy on erectile function compared to other non cystectomy treatments among patients with bladder cancer.^{16,21} For example, Allareddy et al reported that 89% of patients treated with radical cystectomy could not maintain an erection following bladder removal compared to 32% of patients did not undergo cystectomy.²¹ Similarly, Gilbert and colleagues demonstrated worse patient reported sexual function among patients with more advanced disease and among patients managed with bladder removal compared to those who retained their bladder.^{15–16} Scores among men and women managed with endoscopic and/or intravesical treatments were approximately 20 points greater than those managed with cystectomy (BCI sexual function score 42.2 vs 20.0, respectively). Månsson and colleagues described marginal erectile function scores before surgery and significant declines after surgery among bladder cancer patients from Egypt and Sweden. Average Erectile Function scores, using the FACT-B decreased from 2.27/4 and 2.39/4 at baseline to 0.15/4 and 0.19/4 at 12 months following surgery, respectively.²² Furthermore, Karvinen et al surveyed

cystectomy patients with the FACT-B questionnaire and reported low patient-rated erectile function (1.4/4, $\pm$ 1.4) in 392 patients.²³ Other studies have also shown both low interest in sexual activity and inability to maintain erections after cystectomy.^{6,24}

Patient age, baseline function and surgical factors, such as the use of nerve sparing and orthotopic diversion, appear to be associated with post-cystectomy erectile dysfunction. In one study, post-cystectomy erections were noted in only 1 of 31 men following ileal conduit and 6 of 26 following neobladder.¹³ Hedgepeth reported improvement in sexual function among patients managed with neobladder contrasted to declines in sexual functions scores following ileal conduit;²⁵ however, sexual function scores between groups were clustered close together and differences were not significant at any time point. Most importantly, this was not a randomized study so definitive conclusions are impossible to draw.²⁵ Although continent diversions may be associated with a higher likelihood of sexual recovery following cystectomy, confounding factors, such as younger patient age, cloud detecting a direct, causal link to the type of urinary diversion used. For example, neobladder patients were an average of 10 years younger than conduit patients in the Hedgepeth study (average age 61 years compare to 71 years). Other studies have also failed to reliably demonstrate a significant difference in health-related quality of life or sexual function between diversion groups.^{13, 16, 21, 23, 26, 27}

A summary of findings from a select subgroup of studies is shown in Table 2.

Female Sexual Dysfunction

Sexual dysfunction among female cystectomy patients typically results from neural injury and changes in pelvic anatomy that reduce vaginal capacity either from vaginal foreshortening or narrowing, or alter lubrication and vaginal compliance. These changes generally lead to dyspareunia. Other factors, such as body image and age related changes in libido and sexual interest may also contribute to female sexual dysfunction. Alterations in the surgical approach to female cystectomy, such as nerve-sparing and vaginal-sparing, may limit the vaginal changes typically associated with cystectomy in women. Vaginal-sparing procedures should, however, only be pursued in appropriate cases for oncologic reasons, and are generally contraindicated in patients with urethral, trigone, bladder neck and/or bladder base/posterior bladder wall involvement. While several reports of vaginal-sparing cystectomy have been published in recent years, little information regarding sexual function in this subgroup of patients is available, as most reported functional outcomes have focused on urine control and continence.^{28,29} One study did report that 80% of women remained sexually active following vaginal-sparing cystectomy.³⁰ Nerve-sparing cystectomy among woman has also been promoted as an alternative approach to limit the sexual side-effects of surgery.³¹ Zippe and colleagues reported on female sexual function using the self-administered Female Sexual Function Index, and noted a decrease in total score from 17.4 $\pm$ 7.2 to 10.6 $\pm$ 6.6 on average two years after cystectomy. The most common complaints were inability to achieve orgasm (45%), decreased lubrication (41%), decreased sexual desire (37%) and dyspareunia (22%). Less than half of the women were able to partake in sexual intercourse and most reported decreased satisfaction their in sex life overall.³²

A recent survey of women with gynecological or breast cancer noted that although 42% of women were interested in receiving information about sexual dysfunction only 7% asked practitioners for help.³³ Barriers extended beyond reluctance among women to ask for help; 62% of women surveyed in the study reported that no physician ever asked about the sexual side effects of their cancer and treatment. Another study demonstrated that 39% of female patients after radical cystectomy reported worse relationships with their husbands than before surgery, with 26% reporting that they were no longer sexually active.³⁴ Again similar complaints of absent libido, dyspareunia, and lack of orgasms were noted. These data suggest that practitioners caring for female cancer patients, particularly those with bladder cancer, must be willing to ask about sexual dysfunction and provide counseling resources to help overcome these barriers.

Organic and Non-Organic Causes of Sexual Dysfunction

Although erectile function is the dominant factor driving sexual function, other important components of normal sexual function include sexual desire and orgasmic function.³⁵ HRQOL questionnaires like the FACT-B do ask about interest in sex while the BCI goes further to ask about desire, arousal, sensation, and orgasm. Orgasm dysfunction has not been well studied among cystectomy patients, however, absence of orgasms (anorgasmia), changes in intensity, climacturia and pain with orgasm (dysorgasmia) may be significant problems in this population as they are among men treated with prostatectomy for prostate cancer. Hypogonadism may be another influential factor that has been incompletely studied among cystectomy patients.³⁵ Symptomatic hypogonadism affects an estimated 5.6% of men between 30 and 79 and increases with age, and 18.5% of men older than 60 experienced symptomatic hypogonadism.³⁶

Successful management of sexual dysfunction following cystectomy depends largely on identifying and addressing the underlying reasons contributing to impaired or suboptimal function. Among men, erectile dysfunction may be the most likely and targetable cause; however, other causes of sexual dysfunction, such as depression or anxiety related to changes in body image should be evaluated and managed if present. Similarly, the resulting physical and physiologic changes associated with cystectomy in women may not be the only contributor to sexual dysfunction. Other sources, such as depression, body image issues, distress regarding partner reaction to an altered body, as well as life course changes and re-prioritization of an individual's sexuality may all play important roles. Sexual function and dysfunction can be categorized into several domains, and dysfunction may be due to organic, iatrogenic, psychological, partner-centered causes or life course-centered changes, such as re-prioritization of sexuality or waning sexual interest. Such disparate etiologies may require different management strategies.

Iatrogenic erectile dysfunction

As noted previously, iatrogenic causes of sexual dysfunction are common following extirpative pelvic surgery, largely as a result of injury to the cavernous nerves located within the neurovascular bundle. Proposed mechanisms of erectile dysfunction include direct nerve injury, neuropathy, inflammation and fibrosis, hormonal changes and ischemia.³⁷ Among women, collateral vaginal changes resulting in diminished capacity, compliance and

lubrication play a major role in female sexual dysfunction following cystectomy. While nerve and vaginal-sparing procedures can be performed in suitable candidates, recovery of sexual dysfunction is not guaranteed and is rarely complete. Even among men who regain some function, erections may not be firm enough for intercourse. Studies have documented low rates of return of erectile function following cystectomy and urinary diversion.³⁸

Although a large majority of patients experience sexual and erectile dysfunction following cystectomy and urinary diversion, surgical approaches such as nerve-sparing and prostate-sparing may limit some to the deleterious consequences associated with bladder removal. In fact, nerve-sparing cystectomy has been shown to improve sexual function scores following surgery. Hekai and colleagues examined nerve-sparing cystectomy as a strategy to improve sexual function after cystectomy and demonstrated spontaneous complete tumescence in 54.5% (12/21) of patients managed with nerve-sparing. An additional five patients achieved erections with the use of oral PDE5 inhibitors (PDE5i), while four others had return of erections with intracavernosal injection therapy. All patients treated with non-nerve sparing cystectomy required injection therapy.³⁹ In 2004, Zippe et al evaluated 49 sexually active men who underwent nerve sparing or non sparing cystectomy, showing that only 18.4% (9/49) men overall had erections adequate for penetration. Eight of these nine men had undergone nerve-sparing cystectomy; accordingly, half of the 16 men managed with nerve-sparing cystectomy were able to maintain erectile function, compared to 1/33 (3%) treated with non-nerve-sparing radical cystectomy.³⁸ Schoenberg reported similar oncologic outcomes following nerve-sparing and non-nerve-sparing radical cystectomy, but a greater chance of recovery of erectile function among nerve-sparing patients. Notably, however, return of erectile function was directly related to patient age, suggesting an interaction between age and pre-cystectomy function that might explain, or at least partially contribute to, the observed differences between nerve-sparing and non-sparing cases.⁴⁰ Nevertheless, nerve-sparing cystectomy is an excellent option in appropriately selected patients, particularly those interested improving the chance of regaining erectile function postoperatively.

Prostate-sparing and prostate capsule-sparing cystectomy have also been proposed by some surgeons as a means to preserve erectile function. Initially described among patients undergoing bladder removal for non-cancerous indications, prostate-sparing and capsule-sparing cystectomy are somewhat controversial in the setting of bladder cancer.⁴¹ Nevertheless, a number of studies report improved recovery of erectile function among men managed with prostate sparing cystectomy. In one study of 44 patients, functional erections were maintained in 77.5% of patients following prostate sparing cystectomy.⁴² Similarly, Ong et al reported 79% erectile function recovery following seminal vesicle sparing cystoprostatectomy with or without oral erectile aid medication.⁴³ More recently, Basiri and colleagues reported mean International Index of Erectile Function-5 scores of 19.8 and 5.7 among men receiving a prostate-sparing cystectomy and radical cystoprostatectomy, respectively.⁴⁴ However, some surgeons caution broad application of prostate and prostate capsule sparing approaches, citing concerns and reports of compromised oncologic outcomes.⁴⁵

Age and health related organic sexual dysfunction

Age related erectile and sexual dysfunction play an important role in the likelihood of recovery following cystectomy given the advance age and prevalence of medical comorbidities among the cystectomy population. Organic sexual dysfunction and its underlying causes, such as diabetes, hypertension, cardiovascular disease, are prevalent in the United States. According to data from the National Health and Nutrition Examination Survey (NHANES), a cross sectional study of non institutionalized individuals who are interviewed and examined regarding various health issues, erectile dysfunction affects a significant proportion of American men across age groups. Over 18% of men over the age of 20 years suffer from erectile dysfunction. As men age and develop other medical conditions, such as hypertension and diabetes, erectile dysfunction becomes even more common, affecting 50% of men with a history of diabetes or cardiovascular disease.⁴⁶ The prevalence of erectile dysfunction among men ages 70 years and older is estimated to be as high as 70%.⁴⁶ Results from the Massachusetts Male Aging Study report an incidence of 25.9 cases per 1,000 man-years for men between the ages of 40–69 years, in addition to a four time risk of erectile dysfunction in men 60–69 years compared to men between the ages of 40–49 years. As in other studies, the Massachusetts Male Aging Study researchers also noted increasing incidence with self reported diabetes and treatment for either hypertension and heart disease.⁴⁷ The majority of bladder cancer patients treated with cystectomy and urinary diversion fall within these at-risk age groups and/or suffer from competing risks for organic erectile dysfunction, such as hypertension, diabetes and smoking-related peripheral vascular disease. Consequently, baseline sexual and erectile dysfunction, as well as the presence of medical conditions associated with erectile dysfunction should be considered in the evaluation of post-cystectomy sexual dysfunction.

Psychological causes of sexual dysfunction

Psychological distress is relatively common among bladder cancer patients in the perioperative period.⁴⁸ In addition to daily concerns regarding recurrence and disease status, bladder cancer patients treated with cystectomy and urinary diversion may also face additional stressors related to the consequences of surgery, such as an altered body image. The presence of and adaptation to a urinary stoma, for example, may not only result in body image issues but also be a source of additional stress and/or depression. Even among neobladder patients, who do not undergo the same degree of body alteration as ileal conduit patients, poor urine control and incontinence can be significant stressors that may limit interest in sexual activity. While neobladders have largely been adopted to avoid external body changes (e.g. presence of a stoma) and re-establish volitional urinary function after bladder removal, their ability to preserve, or improve body image has not been clearly demonstrated. Although Gerherz et al reported higher scores for physical strength, mental capacity, social competence and leisure activities among neobladder patients,⁴⁹ Hedgepeth and colleagues failed to identify higher body image scores among 139 surveyed neobladders patients compared to 85 ileal conduit patients.²⁵

Mansson et al studied men after cystectomy with either continent cutaneous diversion or orthotopic bladder substitution using the FACT-B and Hospital Anxiety and Depression Scale (HADS). Scores for both depression and anxiety were low and fell within normal

range. There also were no significant differences in scores between types of reconstruction.¹³ Clearly, however, questions related to function and care of stoma were applicable to those with ileal conduits.^{13,47} Nevertheless, the psychological consequences of cystectomy and reconstructions are still relatively poorly understood. Studies conflict and most previous research does not specifically address the psychological consequences associated with cystectomy. Perhaps related, recent research among men with prostate cancer suggests that causes of sexual dysfunction extend beyond the physiologic inability to achieve an erection. For example, Wittmann and colleagues explored the psychological aspects of erectile dysfunction after prostatectomy, noting a loss of interest in sexual activity after surgery in some men because of erectile dysfunction related distress, as well as impaired intimacy and spontaneity resulting from the required use of erectile aids.⁵⁰

Life course and partner centered sexual dysfunction

Patients with bladder cancer managed with cystectomy may experience changes in both relationships and life priorities. Mansson studied post operative adjustments in patients after cystectomy, and found that although relationships with friends were unchanged, relationships with spouse or partner were disturbed by sexual problems.⁵¹ Somani and colleagues interviewed 32 patient pre and post cystectomy to identify the most important factors contributing to quality of life. In their study patients consistently noted family, relationships, health, and finance as important determinants of quality of life.⁵² Thus social and life course factors play an important role in patient quality of life and should therefore be addressed during patient counseling. Partner response to the presence of an external appliance, stoma or catheterizable channel may also strain intimate relationships and contribute to a dysfunctional sex life. Although partner response and repulsion has been better studied among patients with colostomies, the partner's view and response to an altered body after cystectomy may also limit intimacy and interest in sexual activities.⁵³

Treatment of Sexual Dysfunction

While a detailed description of the management of sexual dysfunction associated with cystectomy and urinary diversion is beyond the scope of this review, several medical interventions are available for the management of post-cystectomy erectile dysfunction. As following other pelvic surgeries, erectile dysfunction associated with cystectomy can be managed with phosphodiesterase-5-inhibitors(PDE5I), intracorporal injection (ICI), transurethral suppositories or vacuum pump devices. Among patients for whom medical therapy is not effective, surgical management with penile prosthesis placement is an alternative effective, albeit invasive approach. However, while the majority of the literature on ED after pelvic surgery has been derived from prostatectomy patients, the efficacy of these ED algorithms have not been well studied in cystectomy patients.⁵⁴⁻⁵⁷ Sexual counseling may serve as an adjunctive therapy to help with adherence to ED therapy. Sexual counseling increases efficacy of ICI treatment, decreases dropout rates, and increases the number of patient who responded to only PDE5I.⁵⁸ Counseling from a multi-disciplinary approach to address both male and female factors of sexual dysfunction may be required. Appropriate education about the availability and use of the use of assistive devices is needed to regaining sexual function.⁵⁹ As described in earlier sections of this review, a

comprehensive approach to uncovering and managing the numerous factors, both organic and non-organic, that can contribute to sexual dysfunction following cystectomy and urinary diversion may be necessary when counseling this patient population.

Conclusion

Cystectomy is a commonly performed surgery with significant effects on quality of life. HRQOL surveys attempt to understand the challenges that face patients after surgery but face limitation. Sexual impairment and dysfunction is a significant problem for men and women following cystectomy. Sexual dysfunction results from a combination of organic factors and iatrogenic factors from surgery. These combined with psychological stressors such as body image changes, all contribute to sexual dysfunction. Surgical strategies such as nerve sparing or vaginal sparing cystectomy in appropriately selected patient may provide the best chance for potency after surgery and also best chance of success with oral medication. Sexual dysfunction and quality of life is similar regardless if continent or incontinent diversion is performed. Better understanding of sexual dysfunction and algorithms to aid recovery are areas of continued exploration.

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Table 1

Summary of Available Bladder Cancer QOL Questionnaires

Questionnaire	Item Number	Domains/Characteristics	Psychometric Performance Statistics
Bladder Cancer Index (BCI)	36	Bowel, sexual, and urinary function and bother	IC 0.77–0.99 T-RT 0.73–0.95
EORCT-BLM30	30	Urinary and bowel symptoms, sexual function, urostomy problems, catheter problems, body image	Reliability and validity testing in progress
FACT-BI	40	General FACT domains (physical well-being, social/family well-being, emotional well-being, functional well-being) + additional 13 items covering urinary and bowel function, sexual interest, body image and ostomy concerns	Reliability and validity statistics not reported
Vanderbilt Cystectomy Index (VCI)	42	General FACT domains (physical well-being, social/family well-being, emotional well-being, functional well-being) + additional 15 items covering urinary, sexual and bowel function, and body image	IC 0.85 T-RT 0.89

Table 2
Summary of Published QOL and Sexual Function Assessments Following Cystectomy and Urinary Diversion

Author	HRQOL Survey	Population	Findings
Mansson et al ¹³	FACT-BI	35 continent diversion patients 29 neobladder patients	No differences between patients with continent diversion and those with orthotopic substitution. One ileal conduit patient could achieve erections, 6 neobladder patients achieved erections. Interest in sexual activity was equal among both groups.
Allaready et al ²¹	FACT-BI	82 cystectomy patients 177 bladder intact patients	General QOL does not vary among long-term bladder cancer survivors regardless of treatment, but sexual functioning can be adversely affected in those undergoing cystectomy. Patients experienced worse sexual function scores after cystectomy than controls who did not undergo cystectomy. Cystectomy patients also more likely to lack interest in sex.
Yuh et al ⁶⁰	FACT-BI	34 robot assisted cystectomy patients	QoL appears to return promptly to, or exceed, baseline levels by 6 months after RARC.
Mansson et al ²²	FACT-BI	29 Swedish men and 32 Egyptian men evaluated after cystectomy	Patient-assessed outcomes differ in patients from different sociocultural backgrounds. Ability to maintain an erection declined equally in both groups of men.
Karvinen et al ²³	FACT-BI	525 bladder cancer survivors	Exercise is positively associated with QoL in bladder cancer survivors including sexual function. Significant erectile dysfunction noted among all patients after cystectomy.
Kikuchi et al ²⁴	FACT-BI	49 radical cystectomy patients	The type of urinary diversion does not appear to be associated with a different QOL. Urinary function and body image are affected by type of reconstruction. Interest in sexual activity extremely low in all patients, and only 5/39 (12.8%) male patients were capable of maintaining an erection.
Matsuda et al ⁶	FACT-BI	95 patient with bladder cancer (20 underwent cystectomy)	Overall negative long term effect of cystectomy on HRQOL. Sexuality, erectile function and interest in sex were impaired by cystectomy.
Gilbert et al ¹⁶	BCI	315 bladder cancer patients	QOL and sexual function were lower among patients treated with cystectomy compared to native bladder (non- cystectomy) bladder cancer patients.
Hedgepeth et al ²⁵	BCI	336 bladder cancer patients	No difference in body image between patient with neobladders and those with ileal conduits; however, sexual function scores appeared lower (not statistically significant) over time compared to neobladder patients.
Cookson et al ¹⁴	VCI	40 patient (23 neobladders, 17 ileal conduits)	Men were interested in sex after surgery, but struggled to maintain erections.
Vakalopoulos et al ²⁶	VCI	25 ileal neobladder and 14 cutaneous diversion patients	Equal quality of life following cutaneous or ileal neobladder diversion.

Author	HRQOL Survey	Population	Findings
Severin et al ²⁷	EORTC QLQ-BLM30	36 patients with conduit and 20 with continent urinary diversion	No clear differences based on technique of urinary diversion on HRQOL.
Mansson et al ⁶¹	EORTC QLQ-BLM30	119 patients treated with either continent cutaneous diversion or neobladder	Post-operative sexual function decreased equally among both groups. QOL scores differed based on surgeon vs third party assessment.
Erber et al ¹⁸	EORTC QLQ-BLM30	146 with an ileal conduit and 115 with an ileal neobladder	Ileal neobladders favored urinary diversion of choice.