

Edward E. Wallach, M.D.
Associate Editor

Female sexual dysfunction: classification, pathophysiology, and management

Rupesh Raina, M.D.,^{a,b} Geetu Pahlajani, M.D.,^a Shazia Khan, M.D.,^b Sajal Gupta, M.D.,^a Ashok Agarwal, Ph.D.,^a and Craig D. Zippe, M.D.^a

^a Glickman Urological Institute and Department of Obstetrics and Gynecology, Cleveland Clinic Foundation; and ^b Department of Internal Medicine and Pediatrics, Case Western Reserve University (MetroHealth Medical Center), Cleveland, Ohio

Female sexual dysfunction is a prevalent problem in the general community; however, it has not been studied as extensively as male sexual dysfunction. Female sexual dysfunction is a common complication after most pelvic surgeries. With the introduction of screening programs, most pelvic malignancies are detected at earlier stages and in younger patients. Sexual dysfunction is a major quality-of-life issue in these young women. Hysterectomy (simple or radical) is the most common type of pelvic surgery in women and is one of the most important causes of female sexual dysfunction. Additionally, female sexual dysfunction is an important issue after urologic (radical cystectomy) and colorectal surgeries (simple and radical proctocolectomy). Sexual dysfunction is a common problem among postmenopausal women. Modifications in the surgical technique (nerve sparing) are rapidly evolving in the field of urology and colorectal surgery, which will be soon followed by modifications in the field of gynecologic surgery. In this article we summarize the pathophysiology and classification of female sexual dysfunction, with special emphasis on the relationship between female sexual dysfunction and pelvic surgeries. (Fertil Steril® 2007;88:1273–84. ©2007 by American Society for Reproductive Medicine.)

Key Words: Female sexual dysfunction, management of female sexual dysfunction, treatment of female sexual dysfunction, nerve-sparing hysterectomy

Female sexual dysfunction (FSD) is a highly prevalent and often underestimated problem in the general community. Improved knowledge about the female pelvic anatomy and recent advances in female sexual physiology have helped to classify FSD. Female sexual dysfunction is defined as a disorder of sexual desire, orgasm, arousal, and sexual pain that results in significant personal distress. It is a multifactorial, age-related, progressive problem (1).

The National Health Survey revealed that 43% of 1,749 women aged <60 years had some form of sexual dysfunction. Female sexual dysfunction is certainly not a problem limited to young women. In fact, population census data from the United States show that approximately 10 million American women, approximately 3% of the total population, aged 50–74 years self-reported some form of sexual dysfunction (2). A recently conducted international survey including 4,507 women aged 18–59 years revealed that 34% of the participants had decreased sexual interest, and 19% did not consider sexual intercourse to be pleasurable (3).

Until recently FSD was considered to be psychological in nature. However, it is now recognized that FSD is multifactorial

in etiology and is associated with numerous medical and surgical diseases. It is a common complication of many pelvic surgeries (gynecologic, urologic, and colorectal). Pelvic surgeries are important and often underestimated causes of sexual dysfunction. Recently FSD has emerged as a major quality-of-life issue in patients undergoing pelvic surgery, especially after simple and radical hysterectomies for gynecologic malignancies and radical cystectomies for bladder cancer. The significant impact of FSD has led to modifications in surgical technique. These modifications are rapidly evolving in the fields of urologic and colorectal surgeries and soon will be followed in gynecologic practice as well. No matter what the cause, FSD can negatively affect a woman's quality of life.

In this article we discuss the classification and pathophysiology of FSD, with a special emphasis on the impact of pelvic surgeries and recent surgical technique modifications. We also outline the current status of medication in the treatment of FSD.

DEFINITION AND CLASSIFICATION

In 1966 Masters and Johnson reported that the normal female sexual response cycle consists of four successive phases: excitement, plateau, orgasm, and resolution. In 1979 Kaplan modified this hypothesis by further dividing the excitement phase into desire and arousal and eliminated the plateau

Received September 10, 2007; accepted September 10, 2007.
Reprints requests: Rupesh Raina, M.D., Department of Internal Medicine and Pediatrics, Case Western Reserve University (MHMC), Cleveland, Ohio 44109 (FAX: 216-778-1385; E-mail: rraina@metrohealth.org).

phase. This three-dimensional model consisting of desire, arousal, and orgasm formed the basis for the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) definitions of sexual dysfunction. Sexual arousal is a state with specific feelings and physiologic changes, usually associated with sexual activity involving the genitals (4). Basson et al. (5) later proposed a five-phase model focused on intimacy. Intimacy and desire are essential for women to participate in sexual activity. Once intimacy and sexual stimuli lead women to arouse emotionally, sexual arousal and desire occur and culminate in emotional and physical satisfaction.

The Sexual Function Health Council of the American Foundation for Urologic Disease (AFUD) convened an interdisciplinary consensus conference panel in 1998 that consisted of 19 experts in FSD selected from five countries. The former DSM-IV classification was expanded by the panel and now includes psychogenic and organic causes of desire, arousal, orgasm, and sexual pain disorders. An essential element of this new diagnostic system is the personal distress criterion, meaning that a condition is considered a disorder only if it creates distress for the woman experiencing the condition (1).

Clear definitions of sexual complaint, sexual dysfunction, and sexual disorders are needed to estimate the prevalence of FSD, evaluate the etiology, and assess the potential interventions, including therapy and pharmacologic treatments. Future insight into the physiology of the sexual cycle might result in modification of these definitions and classifications. As such, the following definitions provide a basis for the remaining discussion in this article. *Sexual complaint* is the expression of discontent or pain associated with sexual functioning. *Sexual dysfunction* is a disturbance in sexual functioning involving one or multiple phases of the sexual response cycle or pain associated with sexual activity. *Sexual disorder* is sexual dysfunction that meets DSM-IV criteria for a sexual disorder and includes dysfunction and marked distress.

Further defining sexual disorders, the 1999 AFUD Consensus Panel Classification System (1) is as follows.

Sexual Desire Disorders

Hypoactive sexual desire disorder Hypoactive sexual desire disorder (HSDD) is a spectrum of diseases that cause personal distress owing to persistent or recurring deficiency (or absence) of sexual fantasies and thoughts and a lack of receptivity to sexual activity (1). Medically induced menopause, depression and its treatments, and endocrine disorders are the most common causes that can disrupt the normal female hormonal milieu, resulting in HSDD (6, 7). Long-term conflicting relationships have also been shown to adversely affect sexual desire (8).

Sexual aversion disorder In this disorder women have a persistent or recurrent phobic aversion, leading to avoidance of sexual contact and precipitating personal distress (1). It is generally a psychological or emotionally based problem. It

can occur for a variety of reasons, including physical or sexual abuse and childhood trauma.

Sexual Arousal Disorder

Sexual arousal disorder is a persistent or recurring inability to attain or maintain adequate sexual excitement, which leads to personal distress (1). Sexual arousal disorder may be experienced as a lack of subjective excitement, somatic responses, or genital lubrication/swelling. Decreased labial and clitoral sensation and engorgement and lack of vaginal smooth muscle relaxation can also cause sexual arousal disorder. This phenomenon is particularly important in patients who have undergone pelvic surgeries. This may cause iatrogenic damage to the pelvic nerves, leading to decreased arousal. Psychological factors are among the other important causes of sexual arousal disorder (9).

Orgasmic Disorders

Orgasmic disorder is either complete absence or recurrent difficulty in attaining orgasm after sufficient sexual stimulation (1). Orgasmic disorders can be primary (a woman never has achieved orgasm) or secondary (a woman was able to achieve orgasm previously but is no longer able to do so). It is a prevalent problem among women who present to sex therapy clinics. Anorgasmia is noticed in 24%–37% of women presenting to sex therapy clinics for various reasons (10). Primary orgasmic disorder is usually due to emotional trauma or sexual abuse. Hormonal deficiency, surgical trauma, or medications are the common causes for secondary orgasmic disorder. Anorgasmia is also a common complaint in women taking selective serotonin reuptake inhibitors. Depending upon the dose and type of the drug, up to 50% of women have been shown to suffer from a lack of orgasm (11).

Sexual Pain Disorders

There are two types of sexual pain disorders: vaginismus and dyspareunia (1). *Vaginismus* is defined as recurrent or persistent involuntary spasm of vaginal musculature that interferes with vaginal penetration. *Dyspareunia* is defined as recurrent or persistent genital pain associated with sexual intercourse. Dyspareunia rates reported in the literature range from 14% to 18% (12). Pain may also be induced by noncoital stimulation in certain disorders like genital herpes, endometriosis, and vestibulitis. Psychological factors, such as fear, anxiety, and interpersonal conflict, are the cause of dyspareunia in one third of cases (13). Disorders of the pelvic floor and postmenopausal decreased vaginal lubrication can also cause pain with sexual activity (14, 15). Dyspareunia is also seen in women with decreased vaginal lubrication. This is usually seen in women with damage to the pelvic nerves as a complication of pelvic surgeries. Multiparous women are at increased risk of pelvic floor disorders because of the muscular and vascular changes that occur during childbirth. Sexual dysfunction due to problems with vaginal lubrication and sexual intercourse are commonly seen in older women.

PHYSIOLOGY AND PATHOPHYSIOLOGY OF FSD

Female sexual dysfunction is a complex neurovascular phenomenon that is under the control of psychological, neurovascular, and hormonal factors. During sexual arousal, blood flow to the clitoris and the labia minora increases, leading to engorgement of these organs, which in turn results in protrusion of the glans clitoris and eversion and engorgement of the labia minora. This increase in blood flow to the vagina and uterus leads to increased secretion from the uterus and Bartholin's glands, which lubricates the vagina. Additional lubrication comes from the transudation of plasma from engorged vessels in the vaginal wall. Sexual dysfunction after pelvic surgeries may be due to interruption of the vascular supply and neurologic innervation. Contraction of the pelvic floor muscles (the pelvic diaphragm in particular) intensifies the orgasm. However, a non-voluntary contraction commonly leads to vaginismus. A complete understanding of the physiologic and pathologic aspects of FSD is essential to develop any therapeutic strategies. Therefore, we will briefly review the hormonal, neurologic, and vascular aspects of FSD.

Hormonal Influences on FSD

Estrogen Estradiol is a predominant female sex hormone in women that helps maintain the integrity of vaginal mucosal epithelium and promotes lubrication. Estrogen plays a major role in regulating sexual function and nitric oxide synthesis in the vagina and clitoris. It also has vasoprotective and vasodilator effects on the vagina. After menopause, vaginal lubrication and sexual desire and frequency decrease, which may result in vaginismus (16). Estrogen replacement therapy in postmenopausal women has been shown to improve vaginal lubrication and sexual desire (17).

Testosterone Testosterone is the predominant androgen in women. The adrenal glands and ovaries are the major source for T synthesis. Circulating androstenedione, which is also a major source of T, is derived from the ovaries and adrenal glands. Testosterone levels tend to decrease with age. The levels of T and DHEAS levels decline considerably in women who undergo bilateral oophorectomy (18).

Low levels of T are associated with decreased sexual arousal, libido, sexual response, genital sensation, and orgasm (19). Testosterone acts on the central nervous system and affects sexual behavior. Martin et al. (20) reported that T might enhance nitric oxide synthase activity, which produces vascular smooth muscle relaxation. Testosterone has also been shown to improve sexual desire in women who are postmenopausal secondary to oophorectomy. However, androgen replacement is associated with virilization, acne, and hirsutism.

Neurogenic Influences on FSD

Neurologic disorders constitute important causes of sexual dysfunction in both men and women. Various types of neurologic disorders can lead to FSD, including diseases of the central or peripheral nervous system and spinal cord injury (SCI). The sacral reflex arc and upper motor neurons must

be intact for a woman to achieve orgasm and feel sexual desire. The influence of SCI is strictly dependent on the degree and location of the injury (21). Complete upper motor neuron lesions that affect the sacral segments will have a negative impact on psychogenic lubrication, whereas incomplete upper motor neuron lesions involving the sacral segments will allow both psychogenic and reflex vaginal lubrication (22, 23). It has been reported that women with SCI were less likely to achieve orgasm than women without such an injury (21, 24). Sipski et al. (21) also reported that women with lower motor neuron lesions are less likely to achieve orgasm than women with such lesions in any other area. Women with SCI have been shown to take longer to achieve orgasm (21). Studies also have revealed that women's sexual desire after an SCI falls significantly and that these patients are at an increased risk for hypoactive sexual desire after the injury (25, 26). These findings are further supported by studies reporting on women with multiple sclerosis. They reported a decrease in vaginal sensation, orgasmic capacity, and sexual desire (27, 28).

Vasculogenic Influences on FSD

Men and women can experience sexual dysfunction secondary to chronic medical diseases (29). Medical disorders such as diabetes, hypertension, and hyperlipidemia are the most important risk factors for atherosclerosis. Atherosclerosis involving the pelvic vasculature predisposes men and women to vasculogenic impotence. In women, atherosclerosis affecting the hypogastric/pudendal arterial bed decreases the blood flow to the clitoris and vagina; this is known as clitoral vascular insufficiency syndrome (30). Decreased blood flow can result in the loss of corporal smooth muscle in the vagina and clitoris, followed by fibrosis (31). In addition, blunt trauma, radiation, and pelvic fractures can diminish vaginal and clitoral blood flow, which contributes to sexual dysfunction.

Generally, it is not possible to delineate a single possible cause for FSD after pelvic surgeries. Usually the etiology is mixed, involving vascular and neurogenic causes. In the following section we discuss FSD after major pelvic surgeries, including gynecologic, urologic, and colorectal operations performed for various pelvic malignancies and benign conditions.

FSD AFTER PELVIC SURGERIES

The pelvic autonomic nerves are essential for the normal function of various pelvic organs. The sympathetic fibers are derived from hypogastric plexus over the sacral promontory. The parasympathetic fibers (pelvic nerves) originate from sacral roots of S2–S4. Hypogastric nerves join pelvic nerves to form major autonomic supply to the pelvic organs.

Hysterectomy (simple and radical), cystectomy (simple and radical), and rectal excisions are the most important pelvic surgeries performed in women for various pelvic diseases. Genitourinary dysfunction after pelvic surgeries is most commonly related to injury of the autonomic pelvic

nerves (Table 1). Hysterectomy (radical or simple) has been the most commonly performed pelvic surgery in women of all ages, with more than half a million performed every year in the United States (32).

Sexual Dysfunction After Simple and Radical Hysterectomy

FSD after simple hysterectomy Although simple hysterectomy is the most common gynecologic surgery, sexual dysfunction after this surgery has not been widely reported in prospective studies. Most of the data come from retrospective studies. The paucity of literature is a major limitation. Of the half million women who undergo hysterectomy each year, the majority are not evaluated for sexual activity after hysterectomy. The limited studies of women's sexual function after hysterectomy show that 15%–37% of women report a considerable decrease in their sex life after surgery (33, 34). The reasons for this decline in sexual activity include lack of vaginal lubrication and loss of libido and the presence of various preoperative conditions, such as dyspareunia and dysmenorrhea. Conversely, several studies have reported that sexual function improves after simple hysterectomy in 30%–50% of patients (35, 36).

In a prospective, randomized, controlled study, Alexander et al. (37) evaluated the impact of hysterectomy and hysteroscopic endometrial ablation in patients with dysfunctional uterine bleeding. They found that 27% of women reported loss of sexual interest and 25% reported increase in sexual activity. Sexual activity may have increased as a result of postoperative relief of dyspareunia and dysmenorrhea.

The Maryland Women's Health Study revealed that after simple hysterectomy, overall sexual functioning improved without a change in the frequency of orgasm (38). Dragisic and Milad (39) reported no change in sexual desire, orgasm frequency, or orgasm after simple hysterectomy. Questions have been raised regarding the impact of the type of hysterectomy (vaginal vs. abdominal) on sexual function. However, in 2004 El-Toukhy et al. (40) reported no significant difference in sexual function after abdominal or vaginal simple hysterectomy. Similarly, Roovers et al. (41) reported that persistence and development of bothersome problems during sexual activity seems to be similar in all three types of hysterectomies (vaginal, subtotal, and abdominal). Alexander et al. (37) also reported no difference in sexual function between their two study groups (hysterectomy and hysteroscopic endometrial ablation).

TABLE 1

Sexual dysfunction after pelvic cancer surgeries.

First author/year (reference)	Study design	Total cases (n)	Type of surgery	F/U (mo)	Sexual function (%)	Definition
Radical cystectomy						
Bjerre/1997 (58)	Retrospective	N/A	NSRC	54	18	Sexually active (maintained coital frequency)
			Ileal conduit NSRC + neobladder	8	44	
Horenblas/2001 (97)	Retrospective	3	Neobladder	42	100	Normal vaginal lubrication
Zippe/2004 (59)	Retrospective	28	RC	24	48	Sexually active, IFSI questionnaire
Rectal excision						
Havenga/1996 (98)	Retrospective	54	TME	N/A	91	Achieve orgasm
Chatwin/2002 (99)	Retrospective	11	LAR	N/A	82	Sexually active
Pocard/2002 (66)	Prospective	7	TME	N/A	69	Sexually active
Hysterectomy (carcinoma of cervix, vagina, and ovary)						
Dennerstein/1997 (34)	Retrospective	89	Hysterectomy/oophorectomy	N/A	37	Loss of desire
Stewart/2001 (50)	Retrospective	139	Hysterectomy/oophorectomy	7.29 ± 4.9 y	57	Decreased sexual function

Note: F/U = follow-up; NSRC = nerve-sparing radical cystectomy; RC = radical cystectomy; IFSI = Index of Female Sexual Function; TME = total mesorectal excision; LAR = low anterior resection.

Raina. Female sexual dysfunction. *Fertil Steril* 2007.

There is a growing interest among gynecologists regarding the innervation of the cervix and upper vagina. This autonomic innervation seems to play an essential role in orgasm. If the uterovaginal plexus are damaged during surgical removal of the cervix, it may interfere with lubrication and orgasm. This hypothesis was supported by a report from Kilku (42), who found that the frequency of orgasm was significantly lower in women who underwent total hysterectomy than in women who had a subtotal hysterectomy. However, further randomized controlled trials failed to support this theory (43). Further prospective research using validated questionnaires in women undergoing hysterectomy needs to be carried out regarding this question.

It seems that simple hysterectomy does not adversely affect sexual function (44). This assumption needs to be confirmed in studies that feature validated questionnaires that can stratify the different domains of sexual function, which include orgasm, desire and arousal, pain during intercourse, lubrication, and satisfaction.

FSD after treatment of cervical cancer Quality-of-life issues are becoming significant endpoints in gynecologic surgery patients. These issues have not been reported adequately in the literature. The introduction of cervical screening programs (annual Papanicolaou smear evaluation) has led to early detection of cervical cancer at a younger age. This age migration can potentially make sexual function a major postoperative issue in gynecologic surgery. Although reports of sexual function after gynecologic surgeries date back to the 1980s, these studies did not use standard questionnaires and definitions, which produced wide variations in the reports. Surgical treatment of cervical cancer can lead to lack of vaginal lubrication and loss of libido. Both of these complications can be further aggravated by bilateral oophorectomy, especially after radical hysterectomy. Vaginal dryness and short vaginal vault are the two most important causes of postoperative dyspareunia.

In a population-based epidemiologic study in Sweden, Bergmark et al. (45) reported that reduced sexual satisfaction and dyspareunia were the primary source of symptom-induced distress after treatment of cervical cancer. Recent studies by Jensen et al. (46) demonstrated that patients treated with radical hysterectomy and radiotherapy had short-term sexual difficulties, such as dyspareunia and vaginal dryness, leading to decreased sexual satisfaction. However, some of these postoperative problems subsided 6 months after surgery.

Sexual dysfunction is further aggravated by the use of adjuvant radiotherapy. Multimodality treatments have been more commonly used for cervical cancers (47). Radiotherapy as primary treatment or combined with surgery will more commonly predispose women to sexual dysfunction than hysterectomy alone (47). A considerable percentage of patients who received intracavitary brachytherapy either failed to resume sexual activity within 1 year or stopped all sexual activity (48). Irrespective of the type of treatment, it is evi-

dent from the literature that sexual dysfunction is an important and highly prevalent concern after cervical cancer treatment, which should be an essential part of pretreatment informed consent.

FSD after treatment of other gynecologic malignancies Sexual dysfunction is a common complication after ovarian cancer management. Multimodality treatments include hysterectomy, oophorectomy, and adjuvant chemotherapy and are commonly used in ovarian cancer management. The reported incidence rates are similar to those associated with cervical cancer management (49). In 2001 Stewart et al. (50) reported that 57% women who underwent ovarian cancer treatments experienced a decrease in sexual function. Recently Carmack Taylor et al. (49) reported that of 232 ovarian cancer patients, only 50% were sexually active after treatment. Of these 50% patients, 47% reported no or little desire, 80% reported problems with vaginal dryness, and 62% reported pain or discomfort during penetration. The reasons for sexual inactivity included lack of partner (44.1%), lack of interest (38.7%), physical problems that made sex difficult (23.4%), and fatigue (10.8%). It is obvious from these studies that sexual dysfunction is a significant complication after ovarian cancer management. Sexual rehabilitation should be addressed in these patients and their partners. The published data on sexual dysfunction rates after treatment of endometrial and vulval cancer are limited.

There is a definitive increase in the awareness about the impact of gynecologic cancer surgeries on FSD. The assessment and treatment of sexual function should become an important part of the standard care of women diagnosed and treated for gynecologic cancers.

The growing awareness about sexual dysfunction after pelvic surgery will lead to the development of better surgical techniques and better information on postoperative sexual dysfunction. The risk and benefits of any pelvic surgery in terms of sexual dysfunction should be included in an accurate consent process. In the future, sexual function will become a routine part of the informed consent process for gynecologic surgery.

Nerve-sparing hysterectomy: an evolving new concept Recently there has been growing interest among gynecologists regarding the role of nerve-sparing radical hysterectomy for carcinoma of the cervix. Several cadaver studies outlined the detailed female pelvic anatomy and led to the modification of the hysterectomy procedure. In 1998 Hockel et al. (51) reported a detailed anatomic approach to nerve-sparing hysterectomy in a cadaveric model using liposuction-assisted, nerve-sparing, extended radical hysterectomy. They applied a similar technique in women with vaginal and cervical cancer and demonstrated that liposuction-assisted, nerve-sparing hysterectomy is feasible and safe. This nerve-sparing technique later underwent several modifications (52). The oncologic safety of this surgery has yet to be proven in long-term studies. However, initial results showed a definite improvement in voiding dysfunction

related to conventional radical hysterectomy (52). None of these trials evaluated the aspect of FSD using validated questionnaires. The effect of nerve-sparing hysterectomy on FSD needs to be further evaluated in prospective long-term trials.

FSD After Radical Cystectomy

Radical cystectomy or anterior exenteration has been the standard for treatment of aggressive superficial bladder cancer or invasive carcinoma (53). Sexual dysfunction is a major concern of many younger female patients undergoing radical cystectomy (54, 55). During radical cystectomy the neurovascular bundles (located on the lateral walls of the vagina) are usually removed or damaged during removal of the bladder, urethra, and anterior vaginal wall (55–57). In addition, significant devascularization of the clitoris often occurs with removal of the distal urethra, affecting subsequent sexual arousal and desire (55–57). The urinary diversion technique (orthotopic vs. non-orthotopic) has been implicated hypothetically to influence sexual function after radical cystectomy. In the initial reported series by Nordstrom et al. (54), 5 of 6 patients reported sexual dysfunction after radical cystectomy with ileal conduit. The most important reasons for the dysfunction were loss of sexual desire, vaginal dryness, and dyspareunia. However, later studies by Bjerre et al. (58) and Zippe et al. (59) did not reveal any significant difference between the types of urinary diversion and sexual dysfunction. The studies by Nordstrom et al. (54), Bjerre et al. (58) and Zippe et al. (59) lacked a validated questionnaire and consisted of small numbers of patients in each group, which may be important reasons why the investigators failed to observe significant differences between the types of diversion (Table 1).

We evaluated sexual function in 34 women after radical cystectomy from 1997 to 2002 (59). The most common symptoms reported by the patients included diminished ability or inability to achieve orgasm ($n = 12$; 45%), decreased lubrication ($n = 11$; 41%), decreased sexual desire ($n = 10$; 37%), and dyspareunia ($n = 6$; 22%). Only 13 of the 27 patients (48%) were able to have successful vaginal intercourse, with 14 (52%) reporting decreased satisfaction in overall sexual life after radical cystectomy. Our study revealed that sexual dysfunction is a prevalent problem after radical cystectomy. All domains of sexual function were affected (decreased orgasm, decreased lubrication, lack of sexual desire, and dyspareunia). Our results also revealed that the type of urinary diversion did not affect sexual dysfunction.

Various reports on the magnitude of sexual dysfunction after cystectomy have prompted modifications of the surgical technique in female radical cystectomy. Resection of the distal urethra has been reported to produce significant devascularization of the clitoris and reduced sexual arousal (57). Moreover, preservation of the urethra was not associated with increased risk of local recurrence (57). Later studies also reported that complete resection of the cranial two-thirds of the vagina results in dissection of most of the autonomic nerves to the urethra and vagina in women. However, if the

lateral vaginal walls are left intact, the majority of plexus fibers to the urethra may be preserved, which seems to increase sexual function (60, 61). These observations from various investigators led urologists to modify the surgical technique. Schoenberg et al. (62) reported that in women treated with anterior exenteration the sacrifice of the vagina and urethra is usually not necessary, and this helps preserve sexual function. Their technique enables maximum preservation of vagina and urethra in women undergoing anterior exenteration.

Sexual Dysfunction After Rectal Cancer Surgeries

Rectal cancers are one of the most important pelvic cancers in women. Sexual dysfunction rates after low anterior resection and abdominoperineal resection vary from 10% to 60% (63). These high rates of sexual dysfunction have led oncologists to modify their technique. Most surgeons today perform total mesorectal excision (TME) with preservation of the neurovascular bundle, which has been shown to reduce rates of sexual dysfunction (64). Enker et al. (65) reported that 57% of patients undergoing abdominoperineal resection and 85% of patients undergoing sphincter-preservation surgeries were able to maintain their sexual function when these surgeries were performed according to the principles of TME. In a study by Pocard et al. (66), 4 of 7 women were able to achieve orgasm similar to their preoperative state with TME and autonomic nerve preservation.

Laparoscopically assisted mesorectal excision is increasingly being performed. Quah et al. (67) reported that the sexual dysfunction rate in women who underwent laparoscopic surgery was similar to that of women who underwent open surgery. Rectal cancers are commonly treated with multimodality treatments, which include neoadjuvant and adjuvant radiation therapy (67). Mannaerts et al. reported that the preoperative ability to have an orgasm disappeared in 50% of female patients who underwent multimodality treatment.

The literature demonstrates that sexual dysfunction is a significant problem after radical rectal surgeries and is often underreported, especially in women. Standard treatment options for rectal cancer are associated with high rates of sexual dysfunction. Total mesorectal excision has shown some promise in reducing sexual dysfunction. When feasible, TME with autonomic nerve preservation can be performed to preserve sexual function. This recommendation is particularly important given that the majority of pelvic malignancies affect women after the age of 50 years, when the prevalence of sexual dysfunction increases.

SEXUAL DYSFUNCTION WITH AGING

Sexual dysfunction is an age-related problem and is highly prevalent in older women. Various physiologic and psychological changes that occur with aging can significantly affect a woman's sexual life. A unique approach is needed to evaluate sexual function in older women. Bretshneider and McCoy (68) reported that the frequency of touching and caressing and other sexual activities that are important for sex tend to

decrease with age. Analysis of data from a national survey did not find any differences in the frequency of sexual activities between men and women who were older than 60 years (69).

Many women experience a change in their sexual function during the years immediately before and after menopause. This is primarily a result of a decrease in estrogen (E) and T levels. As women age, they also experience decreased blood flow to their genitals. Common complaints include a loss of desire, diminished responsiveness, and low sexual arousal. Vaginal atrophy, which involves thinning, drying, and irritation of the vaginal lining, causes significant distress for the menopausal woman. In addition, the interplay of psychological, cultural, and interpersonal factors all contributes to the aging woman's sexual experience.

It is well known that sexual function decreases with age. It may be due to decrease in the libido because of decrease in the E levels, increasing vaginal dryness, and decreased vascularity in the genital area. Evaluation of the exact cause of dysfunction is difficult because the dysfunction is usually multifactorial.

SEXUAL DYSFUNCTION IN THE POSTPARTUM PERIOD

The incidence of short-term postpartum sexual dysfunction varies from 22% to 86% (70). Even so, there are only a few reports in the literature that were based on large, prospective trials. Approximately 4 million women give birth each year in the United States. Irrespective of the type of delivery, short-term postpartum sexual changes, such as dyspareunia and loss of desire, are highly prevalent in postpartum women. These problems are further compounded by increased family burden and emotional problems. Glazener (71) reported that 53% of women have problems with sexual intercourse in the first 8 weeks after delivery. This study outlined the importance of health education regarding sexual dysfunction in the antenatal period. Johanson et al. (72) reported a significant increase in dyspareunia after assisted vaginal delivery (forceps or vacuum) vs. spontaneous vaginal delivery or cesarean section. There is a general consensus within the literature that assisted vaginal delivery is associated with increased risk of sexual dysfunction in the postpartum period. However, there is a major gap in the information regarding sexual function after cesarean section. Most of the studies that have been performed on this topic are retrospective in nature, did not use a validated questionnaire, and did not evaluate the various domains of sexual function. A recent large study utilizing a detailed questionnaire reported that persistence of dyspareunia for longer than 6 months occurred at a rate of 3.4% for the spontaneous-without-injuries and cesarean section group, 10% for the episiotomy/leisure group, and 14% for the operative vaginal deliveries group (73).

Perineal trauma and operative vaginal delivery are associated with increasing severity and incidence of dyspareunia (74). The higher rates of persistent dyspareunia with operative vaginal delivery should be part of the antenatal counseling process of patients. Further studies need to be conducted

using validated sexual health questionnaires and evaluating all the components of female sexual dysfunction, as they are affected by different modes of delivery.

EVALUATION OF FSD

Most women with FSD will present to a gynecologist for evaluation, so it is essential for gynecologists to have a comprehensive knowledge regarding the methodology of a complete and systematic evaluation. A thorough clinical evaluation should be the cornerstone of this process, and it should be followed by essential laboratory testing. Clinical evaluation of FSD includes history (including medical disorders, medications, and psychosexual assessment) and physical examination (local examination for potential causes for pain, including infectious diseases, tumors, polyps, and diseases such as endometriosis and pelvic inflammatory disorders). Basic laboratory testing should be performed (serum chemistry, complete blood count, and lipid profiles) to identify vascular risk factors such as hypercholesterolemia, diabetes, and renal failure. Thyroid function tests are used to exclude hypothyroidism. Follicle-stimulating hormone, LH, T, and E should be measured to gauge the functional integrity of the hypothalamic-pituitary-gonadal axis.

Medications such as antihypertensive agents (α -blockers, β -blockers, calcium channel blockers, and diuretics), chemotherapeutic agents, drugs that act on the central nervous system (antidepressants, anticonvulsants, antipsychotics, and anticholinergics), and antiandrogens commonly cause FSD.

Several self-reported questionnaires are available to assess sexual dysfunction. However, most of them are not validated and do not assess all of the domains of female sexual function (e.g., arousal, desire, orgasm, and satisfaction). The Female Sexual Function Index is the most commonly used validated questionnaire. It is a 19-item questionnaire that assesses female sexual function domains (75). There are two other validated questionnaires that are available: the 22-item Brief Sexual Function Index and the 31-item Sexual Function Questionnaire (76).

It is not known whether advanced diagnostic investigations such as vaginal plethysmography (which measures physical changes in vaginal engorgement with each heart beat and provides quantitative data on the extent of vaginal congestion) and duplex ultrasonography increase physician and patient understanding of the problem and the cost-effectiveness of the investigation.

TREATMENT OPTIONS FOR FSD

Numerous medications are available for the treatment of FSD, including hormones and various drugs. However, no single treatment has been established as a gold standard. Before starting treatment, the patient should be evaluated thoroughly for all medical illnesses and drug history that may produce sexual dysfunction. Estrogens, androgens, dopaminergic agonists, nitric oxide donors, prostaglandins, and

α -melanocyte-stimulating hormones are commonly used to treat FSD. Women with a lack of sexual desire are probably more responsive to androgens, estrogens, and dopamine receptor antagonists, whereas those with sexual arousal disorder may be more responsive to phosphodiesterase (PDE) inhibitors and prostaglandins (77).

Estrogens

Estrogens have been the mainstay of treatment of FSD for many years (78). Studies in peri- and postmenopausal women revealed a strong correlation between decreasing E levels and sexual function (79). Estrogens are available as oral tablets, dermal patches, vaginal pessaries, vaginal E tablets, E creams, and jellies. A meta-analysis conducted by Cardozo et al. (79) comparing E with placebo revealed that irrespective of the route of administration, E significantly improved dyspareunia and vaginal pH. Estrogens are reported to improve mood and sexual desire, frequency, and orgasm. Hormone replacement therapy in postmenopausal women improves clitoral and vaginal sensitivity, lubrication, and sexual desire (80). Currently, estrogens are the most commonly used medications for the treatment of FSD, especially in peri- and postmenopausal women.

Androgens

Androgens have been used in the treatment of FSD because of the assumption that FSD is an androgen deficiency-related

disease (81). Testosterone is the most commonly used androgen in clinical practice, followed by DHEA and androstenedione. In several studies, T treatment improved well-being in patients experiencing both natural and surgical menopausal symptoms (82, 83). Testosterone is available as oral tablets and in sublingual and topical forms. Testosterone increases clitoral sensitivity and sexual arousal. Side effects like weight gain, clitoromegaly, and increased facial hair should be monitored.

Combined treatment with estrogens and T is useful in relieving dyspareunia and lack of vaginal lubrication (Table 2). No randomized controlled trial has compared the efficacy of either T alone or in combination with E as a treatment for FSD.

Vasoactive Medications

PDE Inhibitors The introduction of oral PDE-5 inhibitors has revolutionized the treatment of erectile dysfunction in men. Phosphodiesterase-5 inhibitors increase the cyclic guanosine monophosphate in the smooth muscle and produce smooth muscle relaxation. These agents also supposedly enhance vaginal lubrication and engorgement. In 1999 Kaplan et al. (84) reported no overall improvement in sexual function after sildenafil treatment in postmenopausal women. However, vaginal lubrication and clitoral sensitivity did increase. In 2002 Basson et al. (9) conducted a large, randomized, controlled trial in women with female sexual arousal disorders and concluded that sildenafil did not improve sexual

TABLE 2

Results and outcomes of different treatment options for female sexual dysfunction.

Author/year (reference)	Study design	Treatment	Results and outcomes
Sherwin/1985 (19)	Prospective, double-blind, crossover	Estrogen + androgen vs. estrogen vs. placebo	Energy level, appetite, and well-being were increased in combination of androgen compared with estrogen alone or placebo
Sarrel/1998 (16)	Prospective, randomized, parallel study	Estrogen vs. estrogen + androgen on blood flow	Similar vasodilator effect in each group
Lobo/2003 (100)	Double-blind, randomized, controlled	Estrogen vs. estrogen + testosterone	Interest, desire, and frequency increase greater in combination group than with estrogen alone
Rioux/2000 (101)	Open-label, randomized, multicenter	Estrogen vaginal tablets vs. estrogen cream	Dryness, soreness, and irritation were relieved in both groups. Estrogen tablets have lesser discontinuation rates than cream
Ayton/1996 (102)	Open-label, parallel, comparative, multicenter	Estrogen cream vs. ring	Vaginal rings are more acceptable than vaginal cream

Raina. Female sexual dysfunction. *Fertil Steril* 2007.

response. Several investigators assessed the role of PDE-5 inhibitors in women taking antidepressant medications and in women with SCI. Sildenafil has been reported to increase sexual function in patients taking selective serotonin reuptake inhibitors and patients with SCI (85, 86). Although initial reports have failed to find any significant improvement in sexual arousal disorders, several investigators demonstrated its usefulness in certain subsets of the population. The role of sildenafil has yet to be confirmed in the general population presenting with FSD.

Vardenafil is another PDE-5 inhibitor. The U.S. Food and Drug Administration (FDA) approved it in 2003 for the treatment of erectile dysfunction in men. Tadalafil is another PDE-5 inhibitor; phase II trials are currently under way to evaluate its efficacy in FSD. Both vardenafil and tadalafil are approved for the treatment of erectile dysfunction in men. However, their role in FSD has not been studied. None of the oral PDE-5 inhibitors are approved by the FDA for treatment of FSD.

Adrenoceptor antagonists Phentolamine and yohimbine are the two vasodilators (α -adrenoceptor antagonists) used to treat FSD. They produce vasodilatation by relaxing smooth muscle. Phentolamine has been shown to increase self-reported lubrication and sexual arousal (87). Yohimbine failed to show any improvement in placebo-controlled trials including patients with FSD induced by selective serotonin reuptake inhibitors (88).

Other Medications

Various other medications, such as dopamine receptor agonists (apomorphine), α -melanocyte-stimulating hormone, serotonin receptor antagonists (finasteride), selective E receptor modulators, and selective androgen receptor modulators are in phase II trials (89).

Tibolone is a synthetic steroid that has progestogenic and androgenic properties, as well as estrogenic effects. It has been approved for treatment of FSD in Europe and Asia. Tibolone increased sexual desire in women with FSD better than placebo (89).

Medical Devices

The Eros Clitoral Therapy Device is a handheld medical device approved by the FDA for sexual arousal and orgasmic disorders in women. It seems to be beneficial in women with sexual arousal disorder (90).

InterStim therapy, which involves mild neurostimulation of the sacral nerve, was originally designed for urinary incontinence and is currently under investigation for sexual arousal disorder (88).

Behavioral Therapy

Behavioral, cognitive, medical, and surgical therapeutic approaches have to be combined in an integrated model for

managing women with sexual dysfunction. Female sexual arousal disorders can be effectively managed by psychotherapy. Psychotherapy in this group of women removes inhibitions and enhances interpersonal relations and motivation levels (91). Vaginismus is one of the common female psychosexual problems. Behavioral therapy in women with vaginismus leads to improvements on parameters related to marital harmony and overall sexual functioning of the women (92). Management of the partners with couples therapy helps create changes at the deeper emotional levels and lead to better intimacy levels (93). Behavioral therapy based on Master's and Johnson's theoretical model of communication leads to significant increase in assertiveness and intimacy in sexual relations for the couple (94–96).

SUMMARY

Female sexual dysfunction is a multifactorial and complex problem of the community. Recent advances in anatomic and physiologic details have led to increased insight into female sexual function, which formed the basis for an international consensus classification of FSD. Initial studies underestimated sexual dysfunction because of a lack of general consensus and validated questionnaires that can illustrate different domains of female sexual function. Recently, with the use of validated questionnaires and advances in the evaluation of sexual function in women, a more clear understanding of the problem has emerged.

For years, the endpoints of cancer treatment were mainly concentrated on recurrence and survival. With increasing availability of screening modalities, younger women are diagnosed at earlier stages, making quality of life a major issue. Sexual function has been one of the most important quality-of-life issues after pelvic cancer surgery. Recently, multimodality treatments have become a standard treatment option for many malignancies. These treatments, which include pelvic radiation after radical surgery, have further compounded the problem of FSD.

The management of FSD should include psychological and medical evaluation. The medical management of FSD is one of the rapidly developing fields of medicine. Currently, hormonal supplement options are the mainstay of treatment. The future of this field is interesting and encouraging. Gynecologists will play a major role in the diagnosis and management of FSD, irrespective of etiology. Further studies are essential for formulating effective treatment strategies.

REFERENCES

1. Basson R, Berman J, Burnett A, Derogatis L, Ferguson D, Fourcroy J, et al. Report of the international consensus development conference on female sexual dysfunction: definitions and classifications. *J Urol* 2000;163:888–93.
2. Laumann EO, Paik A, Rosen RC. Sexual dysfunction in the United States: prevalence and predictors. *JAMA* 1999;281:537–44.
3. Salonia A, Munarriz RM, Naspro R, Nappi RE, Briganti A, Chionna R, et al. Women's sexual dysfunction: a pathophysiological review. *BJU Int* 2004;93:1156–64.

4. Berman JR, Berman LA, Werbin TJ, Goldstein I. Female sexual dysfunction: anatomy, physiology, evaluation and treatment options. *Curr Opin Urol* 1999;9:563–8.
5. Basson R. Using a different model for female sexual response to address women's problematic low sexual desire. *Sex Marital Ther* 2001;27:395–403.
6. Bachmann GA, Leiblum SR. The impact of hormones on menopausal sexuality: a literature review. *Menopause* 2004;11:120–30.
7. Warnock JK, Bundren JC, Morris DW. Female hypoactive sexual desire disorder due to androgen deficiency: clinical and psychometric issues. *J Sex Marital Ther* 1997;33:761–6.
8. Seagraves RT. Female sexual disorders: psychiatric aspects. *Can J Psychiatry* 2002;47:419–25.
9. Basson R, McInnes R, Smith MD, Hodgson G, Koppiker N. Efficacy and safety of sildenafil citrate in women with sexual dysfunction associated with female sexual arousal disorder. *J Womens Health Gend Based Med* 2002;11:367–77.
10. Rosen RC. Prevalence and risk factors of sexual dysfunction in men and women. *Curr Psychiatry Rep* 2000;2:189–95.
11. Rosen RC, Lane RM, Menza M. Effects of SSRIs on sexual function: a critical review. *J Clin Psychopharmacol* 1999;19:67–85.
12. Spector IP, Carey MP. Incidence and prevalence of the sexual dysfunctions: a critical review of the empirical literature. *Arch Sex Behav* 1990;19:389–408.
13. Fry RP, Crisp AH, Beard RW. Sociopsychological factors in chronic pelvic pain: a review. *J Psychosom Res* 1997;42:1–15.
14. Pauls RN, Berman JR. Impact of pelvic floor disorders and prolapse on female sexual function and response. *Urol Clin North Am* 2002;29:677–83.
15. Salonia A, Zanni G, Nappi RE, Briganti A, Deho F, Fabbri F, et al. Sexual dysfunction is common in women with lower urinary tract symptoms and urinary incontinence: results of a cross-sectional study. *Eur Urol* 2004;45:642–8; discussion 648.
16. Sarrel PM. Ovarian hormones and vaginal blood flow: using laser Doppler velocimetry to measure effects in a clinical trial of post-menopausal women. *Int J Impot Res* 1998;10(Suppl 2):S91–3; discussion S98–101.
17. Berman JR, Goldstein I. Female sexual dysfunction. *Urol Clin North Am* 2001;28:405–16.
18. Davison SL, Davis SR. Androgens in women. *J Steroid Biochem Mol Biol* 2003;85:363–6.
19. Sherwin BB, Gelfand MM. Differential symptom response to parenteral estrogen and/or androgen administration in the surgical menopause. *Am J Obstet Gynecol* 1985;151:153–60.
20. Rako S. Testosterone supplemental therapy after hysterectomy with or without concomitant oophorectomy: estrogen alone is not enough. *J Womens Health Gend Based Med* 2000;9:917–23.
21. Sipski ML, Alexander CJ, Rosen RC. Orgasm in women with spinal cord injuries: a laboratory-based assessment. *Arch Phys Med Rehabil* 1995;76:1097–102.
22. Sipski ML, Alexander CJ, Rosen RC. Physiological parameters associated with psychogenic sexual arousal in women with complete spinal cord injuries. *Arch Phys Med Rehabil* 1995;76:811–8.
23. Berard EJ. The sexuality of spinal cord injured women: physiology and pathophysiology. A review. *Paraplegia* 1989;27:99–112.
24. Sipski ML, Alexander CJ, Rosen R. Sexual arousal and orgasm in women: effects of spinal cord injury. *Ann Neurol* 2001;49:35–44.
25. Charlifue SW, Gerhart KA, Menter RR, Whiteneck GG, Manley MS. Sexual issues of women with spinal cord injuries. *Paraplegia* 1992;30:192–9.
26. Whipple B, Komisaruk BR. Sexuality and women with complete spinal cord injury. *Spinal Cord* 1997;35:136–8.
27. Litwiller SE, Frohman EM, Zimmern PE. Multiple sclerosis and the urologist. *J Urol* 1999;161:743–57.
28. Zorzon M, Zivadinov R, Bosco A, Bragadin LM, Moretti R, Bonfigli L, et al. Sexual dysfunction in multiple sclerosis: a case-control study. I. Frequency and comparison of groups. *Mult Scler* 1999;5:418–27.
29. Benet AE, Melman A. The epidemiology of erectile dysfunction. *Urol Clin North Am* 1995;22:699–709.
30. Goldstein I, Berman JR. Vasculogenic female sexual dysfunction: vaginal engorgement and clitoral erectile insufficiency syndromes. *Int J Impot Res* 1998;10(Suppl 2):S84–90. discussion S98–101.
31. Park K, Goldstein I, Andry C, Siroky MB, Krane RJ, Azadzi KM. Vasculogenic female sexual dysfunction: the hemodynamic basis for vaginal engorgement insufficiency and clitoral erectile insufficiency. *Int J Impot Res* 1997;9:27–37.
32. Lepine LA, Hillis SD, Marchbanks PA, Koonin LM, Morrow B, Kieke BA, et al. Hysterectomy surveillance—United States, 1980–1993. *MMWR CDC Surveill Summ* 1997;46:1–15.
33. Dennerstein L, Wood C, Burrows GD. Sexual response following hysterectomy and oophorectomy. *Obstet Gynecol* 1977;49:92–6.
34. Dennerstein L, Wood G, Burrows GD. Sexual dysfunction following hysterectomy. *Sexual dysfunction following hysterectomy Aust Fam Physician* 1977;6:535–43.
35. Helstrom L. Sexuality after hysterectomy: a model based on quantitative and qualitative analysis of 104 women before and after subtotal hysterectomy. *J Psychosom Obstet Gynaecol* 1994;15:219–29.
36. Dodds DT, Potgieter CR, Turner PJ, Scheepers GP. The physical and emotional results of hysterectomy: a review of 162 cases. *S Afr Med J* 1961;35:53–4.
37. Alexander DA, Naji AA, Pinion SB, Mollison J, Kitchener HC, Parkin DE, et al. Randomised trial comparing hysterectomy with endometrial ablation for dysfunctional uterine bleeding: psychiatric and psychosocial aspects. *BMJ* 1996;312:280–4.
38. Rhodes JC, Kjerulff KH, Langenberg PW, Guzinski GM. Hysterectomy and sexual functioning. *JAMA* 1999;282:1934–41.
39. Dragisic KG, Milad MP. Sexual functioning and patient expectations of sexual functioning after hysterectomy. *Am J Obstet Gynecol* 2004;190:1416–8.
40. El-Toukhy TA, Hefni M, Davies A, Mahadevan S. The effect of different types of hysterectomy on urinary and sexual functions: a prospective study. *J Obstet Gynaecol* 2004;24:420–5.
41. Roovers JP, van der Bom JG, van der Vaart CH, Heintz AP. Hysterectomy and sexual wellbeing: prospective observational study of vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy. *BMJ* 2003;327:774–8.
42. Kilkku P. Supravaginal uterine amputation versus hysterectomy with reference to subjective bladder symptoms and incontinence. *Acta Obstet Gynecol Scand* 1985;64:375–9.
43. Thakar R, Ayers S, Clarkson P, Stanton S, Manyonda I. Outcomes after total versus subtotal abdominal hysterectomy. *N Engl J Med* 2002;347:1318–25.
44. Learman LA, Summitt RL Jr, Varner RE, McNeely SG, Goodman-Gruen D, Richter HE, et al. A randomized comparison of total or supra-cervical hysterectomy: surgical complications and clinical outcomes. *Obstet Gynecol* 2003;102:453–62.
45. Bergmark K, Avall-Lundqvist E, Dickman PW, Henningsohn L, Steineck G. Patient-rating of distressful symptoms after treatment for early cervical cancer. *Acta Obstet Gynecol Scand* 2002;81:443–50.
46. Jensen PT, Groenvold M, Klee MC, Thranov I, Petersen MA, Machin D. Early-stage cervical carcinoma, radical hysterectomy, and sexual function. A longitudinal study. *Cancer* 2004;100:97–106.
47. Auchincloss SS. After treatment. Psychosocial issues in gynecologic cancer survivorship. *Cancer* 1995;76:2117–24.
48. Andersen BL. Quality of life for women with gynecologic cancer. *Curr Opin Obstet Gynecol* 1995;7:69–76.
49. Carmack Taylor CL, Basen-Engquist K, Shinn EH, Bodurka DC. Predictors of sexual functioning in ovarian cancer patients. *J Clin Oncol* 2004;22:881–9.
50. Stewart DE, Wong F, Duff S, Melancon CH, Cheung AM. “What doesn't kill you makes you stronger”: an ovarian cancer survivor survey. *Gynecol Oncol* 2001;83:537–42.
51. Hockel M, Konerding MA, Heussel CP. Liposuction-assisted nerve-sparing extended radical hysterectomy: oncologic rationale, surgical anatomy, and feasibility study. *Am J Obstet Gynecol* 1998;178:971–6.

52. Hoffman MS. Extent of radical hysterectomy: evolving emphasis. *Gynecol Oncol* 2004;94:1–9.
53. Stein JP, Skinner DG. Results with radical cystectomy for treating bladder cancer: a 'reference standard' for high-grade, invasive bladder cancer. *BJU Int* 2003;92:12–7.
54. Nordstrom GM, Nyman CR. Male and female sexual function and activity following ileal conduit urinary diversion. *Br J Urol* 1992;70:33–9.
55. Berman L, Berman J, Felder S, Pollets D, Chhabra S, Miles M, et al. Seeking help for sexual function complaints: what gynecologists need to know about the female patient's experience. *Fertil Steril* 2003;79:572–6.
56. Stenzl A, Colleselli K, Poisel S, Feichtinger H, Pontasch H, Bartsch G. Rationale and technique of nerve sparing radical cystectomy before an orthotopic neobladder procedure in women. *J Urol* 1995;154:2044–9.
57. Stenzl A, Colleselli K, Poisel S, Feichtinger H, Bartsch G. Anterior exenteration with subsequent ureteroileal urethrostomy in females. Anatomy, risk of urethral recurrence, surgical technique, and results. *Eur Urol* 1998;33(Suppl 4):18–20.
58. Bjerre BD, Johansen C, Steven K. A questionnaire study of sexual problems following urinary diversion in the female patient. *Scand J Urol Nephrol* 1997;31:155–60.
59. Zippe CD, Raina R, Shah AD, Massanyi EZ, Agarwal A, Ulchaker J, et al. Female sexual dysfunction after radical cystectomy: a new outcome measure. *Urology* 2004;63:1153–7.
60. Burkhard FC, Studer UE. Orthotopic bladder substitution. *Curr Opin Urol* 2000;10:343–9.
61. Kessler TM, Burkhard FC, Perimenis P, Danuser H, Thalmann GN, Hochreiter WW, et al. Attempted nerve sparing surgery and age have a significant effect on urinary continence and erectile function after radical cystoprostatectomy and ileal orthotopic bladder substitution. *J Urol* 2004;172:1323–7.
62. Schoenberg M, Hortopan S, Schlossberg L, Marshall FF. Anatomical anterior exenteration with urethral and vaginal preservation: illustrated surgical method. *J Urol* 1999;161:569–72.
63. Banerjee AK. Sexual dysfunction after surgery for rectal cancer. *Lancet* 1999;353:1900–2.
64. Enker WE. Total mesorectal excision—the new golden standard of surgery for rectal cancer. *Ann Med* 1997;29:127–33.
65. Enker WE, Havenga K, Polyak T, Thaler H, Cranor M. Abdominoperineal resection via total mesorectal excision and autonomic nerve preservation for low rectal cancer. *World J Surg* 1997;21:715–20.
66. Pocard M, Zinzindohoue F, Haab F, Caplin S, Parc R, Turet E. A prospective study of sexual and urinary function before and after total mesorectal excision with autonomic nerve preservation for rectal cancer. *Surgery* 2002;131:368–72.
67. Quah HM, Jayne DG, Eu KW, Seow-Choen F. Bladder and sexual dysfunction following laparoscopically assisted and conventional open mesorectal resection for cancer. *Br J Surg* 2002;89:1551–6.
68. Bretschneider JG, McCoy NL. Sexual interest and behavior in healthy 80- to 102-year-olds. *Arch Sex Behav* 1988;17:109–29.
69. Marsiglio W, Donnelly D. Sexual relations in later life: a national study of married persons. *J Gerontol* 1991;46:S338–44.
70. Hicks TL, Goodall SF, Quattrone EM, Lydon-Rochelle MT. Postpartum sexual functioning and method of delivery: summary of the evidence. *J Midwifery Womens Health* 2004;49:430–6.
71. Glazener CM. Sexual function after childbirth: women's experiences, persistent morbidity and lack of professional recognition. *Br J Obstet Gynaecol* 1997;104:330–5.
72. Johanson R, Wilkinson P, Bastible A, Ryan S, Murphy H, O'Brien S. Health after childbirth: a comparison of normal and assisted vaginal delivery. *Midwifery* 1993;9:161–8.
73. Buhling KJ, Schmidt S, Robinson JN, Klapp C, Siebert G, Dudenhausen JW. Rate of dyspareunia after delivery in primiparae according to mode of delivery. *Eur J Obstet Gynecol Reprod Biol* 2006;124:42–6.
74. Signorello LB, Harlow BL, Chekos AK, Repke JT. Postpartum sexual functioning and its relationship to perineal trauma: a retrospective cohort study of primiparous women. *Am J Obstet Gynecol* 2001;184:881–8; discussion 888–90.
75. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, et al. The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. *J Sex Marital Ther* 2000;26:191–208.
76. Mazer NA, Leiblum SR, Rosen RC. The brief index of sexual functioning for women (BISF-W): a new scoring algorithm and comparison of normative and surgically menopausal populations. *Menopause* 2000;7:350–63.
77. Fourcroy JL. Female sexual dysfunction: potential for pharmacotherapy. *Drugs* 2003;63:1445–57.
78. Burkman RT, Collins JA, Greene RA. Current perspectives on benefits and risks of hormone replacement therapy. *Am J Obstet Gynecol* 2001;185:S13–23.
79. Cardozo L, Bachmann G, McClish D, Fonda D, Birgerson L. Meta-analysis of estrogen therapy in the management of urogenital atrophy in postmenopausal women: second report of the Hormones and Urogenital Therapy Committee. *Obstet Gynecol* 1998;92:722–7.
80. Collins A, Landgren BM. Reproductive health, use of estrogen and experience of symptoms in perimenopausal women: a population-based study. *Maturitas* 1994;20:101–11.
81. Basson R. Female sexual response: the role of drugs in the management of sexual dysfunction. *Obstet Gynecol* 2001;98:350–3.
82. Montgomery JC, Appleby L, Brincat M, Versi E, Tapp A, Fenwick PB, et al. Effect of oestrogen and testosterone implants on psychological disorders in the climacteric. *Lancet* 1987;1:297–9.
83. Robinson D, Cardozo LD. The role of estrogens in female lower urinary tract dysfunction. *Urology* 2003;62:45–51.
84. Kaplan SA, Reis RB, Kohn II, Ikeguchi EF, Laor E, Te AE, et al. Safety and efficacy of sildenafil in postmenopausal women with sexual dysfunction. *Urology* 1999;53:481–6.
85. Berman JR, Berman LA, Lin H, Flaherty E, Lahey N, Goldstein I, et al. Effect of sildenafil on subjective and physiologic parameters of the female sexual response in women with sexual arousal disorder. *J Sex Marital Ther* 2001;27:411–20.
86. Sipski ML, Rosen RC, Alexander CJ, Hamer RM. Sildenafil effects on sexual and cardiovascular responses in women with spinal cord injury. *Urology* 2000;55:812–5.
87. Rosen RC, Phillips NA, Gendrano NC 3rd, Ferguson DM. Oral phentolamine and female sexual arousal disorder: a pilot study. *J Sex Marital Ther* 1999;25:137–44.
88. Michelson D, Kociban K, Tamura R, Morrison MF. Mirtazapine, yohimbine or olanzapine augmentation therapy for serotonin reuptake-associated female sexual dysfunction: a randomized, placebo controlled trial. *J Psychiatr Res* 2002;36:147–52.
89. Walsh KE, Berman JR. Sexual dysfunction in the older woman: an overview of the current understanding and management. *Drugs Aging* 2004;21:655–75.
90. Wilson SK, Delk JR 2nd, Billups KL. Treating symptoms of female sexual arousal disorder with the Eros-Clitoral Therapy Device. *J Gend Specif Med* 2001;4:54–8.
91. Leiblum S, Brown C, Wan J, Rawlinson L. Persistent sexual arousal syndrome: a descriptive study. *J Sex Med* 2005;2:331–7.
92. Kabacki E, Batur S. Who benefits from cognitive behavioral therapy for vaginismus? *J Sex Marital Ther* 2003;29:277–88.
93. Gehring D. Couple therapy for low sexual desire: a systemic approach. *J Sex Marital Ther* 2003;29:25–38.
94. Marks IM. Review of behavioral psychotherapy, II: sexual disorders. *Am J Psychiatry* 1981;138:750–6.
95. Tullman GM, Gilner FH, Kolodny RC, Dornbush RL, Tullman GD. The pre- and post-therapy measurement of communication skills of couples undergoing sex therapy at the Masters & Johnson Institute. *Arch Sex Behav* 1981;10:95–109.
96. Master WH, Johnson VE. Principles of the new sex therapy. *Am J Psychiatry* 1976;133:548–54.
97. Horenblas S, Meinhardt W, Ijzerman W, Moonen LF. Sexuality preserving cystectomy and neobladder: initial results. *J Urol* 2001;166:837–40.

98. Havenga K, Enker WE, McDermott K, Cohen AM, Minsky BD, Guillem J. Male and female sexual and urinary function after total mesorectal excision with autonomic nerve preservation for carcinoma of the rectum. *J Am Coll Surg* 1996;182:495–502.
99. Chatwin NA, Ribordy M, Givel JC. Clinical outcomes and quality of life after low anterior resection for rectal cancer. *Eur J Surg* 2002;168:297–301.
100. Lobo RA, Rosen RC, Yang HM, Block B, Van Der Hoop RG. Comparative effects of oral esterified estrogens with and without methyltestosterone on endocrine profiles and dimensions of sexual function in postmenopausal women with hypoactive sexual desire. *Fertil Steril* 2003;79:1341–52.
101. Rioux JE, Devlin C, Gelfand MM, Steinberg WM, Hepburn DS. 17beta-estradiol vaginal tablet versus conjugated equine estrogen vaginal cream to relieve menopausal atrophic vaginitis. *Menopause* 2000;7:156–61.
102. Ayton RA, Darling GM, Murkies AL, Farrell EA, Weisberg E, Selinus I, et al. A comparative study of safety and efficacy of continuous low dose oestradiol released from a vaginal ring compared with conjugated equine oestrogen vaginal cream in the treatment of postmenopausal urogenital atrophy. *Br J Obstet Gynaecol* 1996;103:351–8.