JBUON 2013; 18(4): 818-823
ISSN: 1107-0625, online ISSN: 2241-6293 • www.jbuon.com
E-mail: editorial_office@jbuon.com

REVIEW ARTICLE

Sexual dysfunction in cancer patients: a review

B. Cakar, B. Karaca, R. Uslu

Ege University Schhol of Medicine, Tulay Aktas Oncology Hospital, Bornova, Izmir, Turkey

Summary

Cancer is a life-threatening disease despite the advanced therapeutic strategies now available. A common problem is that physicians and patients tend to concentrate on intensive medical treatment options and underestimate the treatment-related adverse effects. In this review, we summarize one of these adverse effects in cancer patients; sexual dysfunction (SD). In addition, current therapeutic choices with optimal doses and patient selection strategies are defined. All patients should be informed about problems associated with therapy-related SD and must be guided toward the most appropriate therapeutic options before starting treatment.

Key words: *cancer, chemotherapy, radiotherapy, sexual dysfunction, surgery*

Introduction

Various biological and physiological factors affect sexual perception in cancer patients. Alterations in body image due to cancer surgery, chemotherapy-related menopause, and hair loss along with the emotional stress due to struggling with a serious illness make the patients more vulnerable to sexual problems.

Diagnosis of life-threatening cancer leads to intensification in medical treatment options on the part of both physicians and patients, and social and sexual problems are frequently underestimated [1]. Chemotherapy- and radiotherapy-related SD generally ends after the completion of therapeutic manipulations, whereas anatomical defects due to surgery might have a long-lasting effect on the patients' sexuality.

In this review, we discuss separately the various types of SD from breast and gynecological cancers for women and prostate cancer for men and provide medical advice from the point of view of medical oncologists in order to help patients cope with these problems.

Sexual dysfunction in female cancer survivors

A. Possible types of dysfunction according to treatment options

1. Dysfunction resulting from surgery

With the introduction of new therapeutic modalities, cancer has become a chronic form of disease in recent years. Nevertheless, surgery is still the primary treatment option for cancer, especially for the early stages, but surgery may be associated with some disadvantages; for example, gynecological cancers that require the resection of reproductive organs can cause physiological difficulties in female patients attempting to have sexual intercourse. In cervix cancers, a classical radical hysterectomy generally includes an upper vaginal excision which may cause dyspareunia and some innervational problems [2].

Moreover, vulvar and vaginal cancer surgery with large excisional procedures can lead to difficulties in penile-vaginal intercourse. Anatomically, the thoracic and sacral plexus innervate the pelvic organs, and some types of procedures related to cancer may lead to these nerves being cut or damaged during surgery. When a radical hysterectomy is performed, paraaortic lymph node and uterosacral ligament excision can result in superior hypogastric plexus and hypogastric

Correspondence to: Burcu Cakar, MD. Ege University School of Medicine, Tulay Aktas Oncology Hospital, 35100 Bornova, Izmir, Turkey. Tel: + 90 232 390 43 87, Fax: + 90 232 374 73 21, E-mail:burcu.cakar@gmail.com
Received: 21/11/2012; Accepted: 30/12/2012

nerve damage, respectively [3]. Thus, nerve injuries can hinder sexual arousal and cause orgasmic disorders.

In addition, an oophorectomy will result in iatrogenic menopause in premenopausal patients, a serious problem in and of itself, by means of early hormonal withdrawal in young patients. Postmenopausal patients may also suffer from sexual arousal problems due to ovarian testosterone loss.

2. Dysfunction resulting from radiotherapy

Radiotherapy is one of the main therapeutic modalities in cancer treatment. In gynecological cancers, this is the primary therapeutic option for early stage cervix and endometrial cancer. During radiotherapy, nerve damage, vaginal atrophy, and fibrosis can occur in the genital area which was exposed to radiation. In the literature, some local methods have been advised to prevent these complications, and these will be discussed later in the treatment section of the article.

3. Dysfunction resulting from hormonotherapy

In hormone receptor positive breast cancer patients, selective estrogen receptor modulators (SERMs), such as tamoxifen and aromatase inhibitors (AIs) that decrease the exposure of breast tissue to estrogen are widely being used for the prevention of local and distant recurrences. Tamoxifen has a partial agonistic effect on the female genital tract, but during the estrogen blockage on the breast tissue, it has a minimal estrogenic effect on the vaginal mucosa. Furthermore, AIs have a stronger effect on hormone depletion in breast tissue and a pure antagonistic effect on the genital tract. Vaginal dryness, pruritus, and dyspareunia are seen more frequently in this group of patients [4]. The quality of life evaluation of the Anastrozole, Tamoxifen, Alone or in Combination (ATAC) trial showed that the incidence of vaginal dryness and dyspareunia along with a decrease in sexual desire was more prevalent in the AI group, whereas the Intergroup Exemestane Study (IES) showed no difference between the exemestane and tamoxifen group regarding SD [5,6]. Although AIs are more frequently related to vulvar and vaginal symptoms, they are the first hormonal treatment option, particularly for postmenopausal women.

4. Dysfunction resulting from chemotherapy

Chemotherapy can cause ovarian dysfunction due to the age of the patient, type of the agent used, and treatment duration. Various agents are related to ovarian failure, the most well-known being alkylating agents and taxanes. Amenorrhea can be permanent or transient as a result of therapy. Women who became postmenopausal after chemotherapy develop more sexual problems [7]. Since chemotherapy inhibits the maturation of the primordial follicles in a dose- and drug-dependent manner, younger patients who have more follicles have a better chance of regaining their ovarian functions after chemotherapy [8]. Besides these permanent repercussions, the chemotherapeutic agents can also lead to temporary adverse reactions such as nausea/vomiting, hair loss, and disturbances in body perception that might decrease the patients' sexual desire.

B. Medical advice to overcome treatment-related sexual dysfunction in female cancer survivors

Diseases related to social and physiological issues as well as sexual problems are often underestimated by physicians during cancer chemotherapy. Nevertheless, for any disease, therapeutic choices that do not seriously restrict the quality of life of the patients but help them adapt to the therapy are much better. By managing therapy-related complications properly, doctors can provide more comfortable treatment duration for the patients.

1. Vaginal atrophy treatment

Vaginal dryness and dyspareunia are important predictors of SD in women with cancer [9,10]. Regular usages of vaginal moisturizers can relieve the symptoms. These moisturizers, frequently consisting of ingredients such as purified water, glycerin, and mineral oil, adhere to the vaginal epithelium and form a thin layer on the vaginal tissue. It is recommended that patients use these moisturizers regularly every two to three days. Vaginal lubricants, not to be confused with vaginal moisturizers, should be used before sexual intercourse. These are generally inserted into the vagina by applicators and should be used at least 15 minutes before intercourse.

Vaginal moisturizers and lubricants only provide relief from symptoms, but vaginal estrogen preparations have therapeutic effects on vaginal atrophy. Both systemic and local estrogens are efficacious, but local forms are preferable since they have a minimal effect on systemic estrogen exposure. Although some authors claim that more systemic estrogen absorption occurs in the atrophic epithelium, this hypothesis has not yet been proven [11]. Vaginal estrogen comes in cream, tablet, or ring form. The efficacy is similar for each group. Vaginal rings contain estradi-

ol and release 6-9 mcg daily over a three-month period. This level of estradiol is similar to that of a postmenopausal woman receiving hormone therapy. The rings are generally well tolerated. They are replaced every three months and do not cause discomfort during sexual intercourse. Vaginal tablets also contain estradiol or estriol and are used once daily for the first two weeks and twice a week afterwards as maintenance dose. The tablets are inserted by applicators. Vaginal creams also can be used daily for the first three weeks and twice a week afterwards for maintenance. Although vaginal estrogen has dominant local effects, studies have shown minimal systemic effects. In one study conducted with low dose local estrogen therapy, the decline in bone resorption raised the probability of systemic absorption [12]. In another study, breast cancer patients being treated with AIs in combination with these vaginal preparations demonstrated increased serum estrogen levels in the early stages of therapy [13]. Therefore, based on these results, forms of vaginal estrogen do not seem to be safe in hormone responsive malignancies. If they have to be used because of severe symptoms, then using vaginal preparations containing estriol is preferable to estradiol since estriol can not be turned into estradiol at the steroid pathway.

2. Testosterone for sexual desire

In women, half of the circulating testosterone is produced from the ovaries. Even in postmenopausal women, a bilateral oophorectomy can cause sexual desire disorder due to the decrease in serum testosterone levels [14]. To our knowledge, concomitant testosterone patches and estrogen usage augment the sexual desire. Since some studies have shown a relationship between increased estrogen and androgen levels and breast cancer development in postmenopausal women, the role of testosterone in carcinogenesis has not been elucidated clearly [15,16]. Thus, the use of testosterone remains controversial.

3. Sildenafil

Sildenafil didn't demonstrate any benefit in a study in female patients and standard usage in women is not yet recommended [17].

4. Vaginal dilators to prevent vaginal fibrosis

Pelvic radiotherapy may cause vaginal fibrosis. Some studies have suggested that having sexual intercourse three to four times a week for sexually active patients and using vaginal dilators three times a week for at least 10 minutes for sexually inactive patients might prevent vaginal fibrosis due to radiotherapy. Although vaginal dilators have become an established practice in the United Kingdom, they pose a small but serious risk for vaginal rupture. A recent Cochrane review concluded that there was insufficient data to confer benefit and did not recommend routine regular use of vaginal dilators [18].

In conclusion, some women become postmenopausal during chemotherapy and never recover ovarian function. When patients experience postmenopausal symptoms, vaginal atrophy and dyspareunia can be coped with local vaginal treatment procedures. Our experience has shown that systemic estrogen and testosterone treatment are not options for hormone-responsive tumors. Breast cancer patients who will receive adjuvant hormonotherapy, especially AIs, should be carefully instructed regarding the possible adverse effects which may occur and should be given advice on how to cope with them.

Sexual dysfunction in male cancer survivors

Sexual function contributes to quality of life. Cancer-related surgery and androgen deprivation therapy (ADT) for prostate cancer can lead to SD in men. Radical prostatectomy, genitourinary cancer, and rectal cancer operations are some of the primary causes. Preoperative erectile function (EF) and nerve- sparing status are critical predictors of erectile dysfunction (ED) [19]. The main causes and therapeutic alternatives for SD are discussed below.

A. Possible types of the dysfunction according to treatment options

1. Dysfunction resulting from surgery

Male genitourinary cancer can result in ED and orgasmic problems. Prostate cancer is the most common type encountered in men, and prostatectomy is one of the main treatment options in the early stages. Prostate operations, even if nerve-sparing procedures are performed, can result in ED [20]. The cavernous bodies of the penis are innervated from the cavernosal nerves that originate from the pelvic plexus. This plexus is localized at the upper part of the seminal vesicles and anterolateral wall of the rectum. As a consequence of this anatomic closeness, besides prostate surgery, low anterior resection of rectal tumors and bladder cancer surgery can also cause ED. Even if nerve-sparing techniques are used,

the traction or thermal injury of these nerves perioperatively can result in the same problems, and recovery takes between 18 and 24 months. The source of the blood supply for the penis is the internal pudendal artery. This artery, along with its accessory branches, is believed to be the dominant artery in some patients. If this artery is damaged during surgery, erectile tissue oxygenation will be broken down [21]. Finally, surgical complications may result in enervation and/or ischemia which, combined with the chronic inflammatory response to cavernosal hypoxia, can lead to progressive fibrosis and chronic ED [19].

2. Dysfunction resulting from androgen deprivation therapy

Gonadal testosterone is the main source of androgen. In the prostate, testosterone is converted by the 5α-reductase to dihydrotestosterone, which has a more potent androgenic activity. The goal of ADT is to lower the testosterone levels by either medical luteinizing hormone-release hormone (LHRH) agonists or surgical procedures (bilateral orchiectomy) in order to treat the prostate cancer. There is no difference in the efficacy with regard to testosterone levels in either of these methods, and combining them has shown no proven benefits [22]. Although ADT appears to have advantages for locally advanced and metastatic prostate cancer, its impact on quality of life remains controversial. Hormone deprivation may result in a decrease in the size of the penis and testicles, loss of libido, and a decrease in intrapenile nitric oxide synthase levels, which are essential for having an erection [23]. Although some patients might not experience loss of EF or arousal despite the testosterone deprivation, these problems are not rare. Before being treated, the adverse effects of ADT should be discussed, and during follow-up, the patients who develop ED should be warned that after the cessation of ADT, some time may pass before they recover EFs.

3. Dysfunction resulting from radiotherapy

External beam radiation therapy is one of the principle treatment options for localized prostate cancer and has similar progression free survival rates as surgery.[22]. During this therapy, the radiation dose is delivered to the bulb of the penis. Corporal bodies seem to be associated with radiation-induced impotence due to penile strictures [24]. Although some data has claimed that radiotherapy provides more benefits than surgery, it is believed that surgery causes ED more frequently within the first two years, whereas fibrosis after radiotherapy occurs nearly three years after this treatment. Overall, at the five-year follow-up, the results of EF are similar in the surgical and radiation groups [25].

B. Medical advice to overcome treatment-related sexual dysfunction in male cancer survivors

In prostate cancer patients, whether the therapeutic choice is radiation therapy or surgery, the use of erectogenic agents is referred to as penile rehabilitation. This therapy does not only support the patients' ability to achieve erection but also aims to preserve EF for cavernosal oxygenation.

1. Phosphodiesterase-5 inhibitors

Phosphodiesterase-5 (PDE5) inhibitors are the first choice of treatment for male SD. During sexual stimulation, nitric oxide is released from the cavernous bodies of the penis, and this activates the guanylate cyclase enzyme. This results in an increase in cyclic guanosine monophosphate (cGMP) levels. cGMP relaxes the smooth muscle of the cavernous bodies and provides blood flow to the cavernosal tissues. In turn, these perform an erection. The guanylate cyclase enzyme is specific for cGMP degradation. Through the inhibition of PDE5, cGMP degradation is prevented. Since the primary erectile problems after surgery are related to hypoxia due to innervation or ischemia, penile tissue oxygenation might be maintained by sustained erections. Various studies have been conducted to support this hypothesis, and they have shown that spontaneous EF is recovered earlier via the use of PDE5 inhibitors [26,27].

Both routine and on-demand usage seem to be effective in the studies, and past comparisons did not confirm the superiority of one method or the other [28]. There are three forms of PDE5 inhibitors: sildenafil, vardenafil, and tadalafil. The efficacies of these drugs are similar, but the duration effect is nearly four hours for sildenafil and vardenafil but up to 36 hours for tadalafil. The optimal timing for usage is one hour before sexual intercourse. It is important to note that these agents can cause severe hypotension and syncope if used with nitrates. Thus, PDE5 inhibitors are not recommended for patients on nitrate treatment [29]. Sildenafil is recommended at doses of 50 mg; however, if well tolerated, this may be elevated to 100 mg in order to achieve sufficient results. The recommended starting dose for tadalafil is 10 mg, and this should be adapted according to the patient's response. Vardenafil is available in 5,10, and 20 mg forms. It is generally advised to start

with 10 mg and increase the amount if necessary [30]. In the past, these agents were believed to cause myocardial infarction and sudden death; however, study results never confirm this connection. The deaths could have been related directly to the act of sexual intercourse itself [31,32]. To our knowledge, these drugs do not have a negative effect on coronary hemodynamics and can be used by patients who have stable coronary artery disease and are not using nitrate medication.

2. Urethral suppositories and penile self-injection agents

Alprostadil (PGE1) is another medical option for cavernosal nerve damage and is administered to patients so as to increase corporal oxygenation by increasing blood flow. Intracavernosal injections and intraurethral suppository forms (MUSE®) are available. Studies have shown the efficacy of intraurethral alprostadil in postprostatectomy patients [33,34]. These patients should be adequately informed and instructed before performing self-injections as these injections could often result to priapism when compared with intraurethral applications. Studies which compared the effectiveness of PDE5 inhibitors with alprostadil revealed comparable results with a higher dropout rate in the alprostadil group [35]. Although the application of alprostadil causes more discomfort than PDE5 inhibitors, it has no systemic consequences due to localized therapy and might be a satisfactory option for patients to avoid cardiac toxicity .

3. Vacuum constriction devices

Vacuum constriction devices (VCDs) have a partial vacuum effect on the penis via an elastic ring that is located at the base of the penis to maintain the erection. The ring should be removed within 30 minutes to avoid hypoxic injury of the penis. However, VCDs can also result in an ejaculation due to urethral constriction. The complication rate is low, and there is no clear contraindication except for bleeding disorders. Recent studies have shown positive results regarding the early use of VCDs for penile rehabilitation; thus they are becoming recognized as an acceptable option for cancer patients experiencing SD [36,37]. In the early postprostatectomy period, for some patients with severe neural or hypoxic injuries, initiating erections might be impossible. We believe that this group of patients could benefit from the use of VCDs.

These three treatment options mentioned above have proven to be effective for male cancer survivors suffering from SD. Most clinicians prefer to begin treatment with PDE5 inhibitors and then move to alprostadil and VCDs for patients who are not suitable for PDE5 inhibitor. Combinations of VCDs and PDE5 inhibitors can be used for selected populations to achieve a rapid return of sexual function [38,39]. Patients who do not respond to these medical options should be referred to an experienced urologist for a penile prosthesis to maintain sexual function.

Conclusions

Cancer treatment has multiple and variable adverse effects. Sexual dysfunction from various surgical and medical approaches is often underestimated by physicians and may lower the quality of life and break down the main treatment unison. All patients should be informed in detail about treatment-related adverse effects and must be guided through the therapeutic options in order to choose the best mode of action.

References

1. Anllo LM. Sexual life after breast cancer. J Sex Marital Ther 2000;26:241–248.
2. 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.
3. Dursun P, Ayhan A, Kuscu E. Nerve-sparing radical hysterectomy for cervical carcinoma. Crit Rev Oncol Hematol 2009;70:195–205.
4. Derzko C,Elliot S, Lam W. Management of sexual dysfunction in postmenopausal breast cancer patients taking adjuvant aromatase inhibitor therapy. Curr Oncol 2007;14:20–40.
5. Cella D, Fallowfield L, Barker P et al. Quality of life of postmenopausal women in the ATAC (Arimidex, tamoxifen, alone or in combination) trial after completion of 5 years' adjuvant treatment for early breast cancer. Breast Cancer Res Treat 2006;100:273–284.
6. Fallowfield LJ, Bliss JM, Porter LS et al. Quality of life in the intergroup exemestane study:a randomised trial of exemestane versus continued tamoxifen after 2 to 3 years of tamoxifen in postmenopausal women with primary breast cancer. J Clin Oncol 2006;24:910–917.
7. Burwell SR, Case LD, Kaelin C, Avis NE. Sexual problems in younger women after breast cancer surgery. J Clin Oncol 2006;24:2815-2821.

8. Okanami Y, Ito Y, Watanabe C et al. Incidence of chemotherapy-induced amenorrhea in premenopausal patients with breast cancer following adjuvant antracycline and taxane. Breast Cancer 2011;18:182-188.
9. Ganz PA, Desmond KA, Leedham B et al. Quality of life in long-term, disease free survivors of breast cancer:a follow-up study. J Natl Cancer Inst 2002;94:39-49.
10. Broeckel JA,Thors CL, Jacobsen PB, Small M, Cox CE. Sexual functioning in long-term breast cancer survivors treated with adjuvant chemotherapy. Breast Cancer Res Treat 2002;75:241-248.
11. Santen RJ, Pinkerton JV, Conaway M et al. Treatment of urogenital atrophy with low-dose estradiol:preliminary results. Menopause 2002;9:179-187.
12. Naessen T, Berglund L, Ulmsten U. Bone loss in elderly women prevented by ultra low doses of parenteral 17beta-estradiol. Am J Obstet Gynecol 1997;177:115-119.
13. Kendall A, Dowsett M, Folkerd E, Smith I. Caution:Vaginal estradiol appears to be contraindicated in postmenopausal women on adjuvant aromatase inhibitors. Ann Oncol 2006;17:584-587.
14. Melisko ME, Goldman M, Rugo HS. Amelioration of sexual adverse effects in the early breast cancer patient. J Cancer Surviv 2010;4:247–255.
15. Berrino F, Muti P, Micheli A et al. Serum sex hormone levels after menopause and subsequent breast cancer. J Natl Cancer Inst 1996;88:291–296.
16. Yu H, Shu XO, Shi R et al. Plasma sex steroid hormones and breast cancer risk in Chinese women. Int J Cancer 2003;105:92-97.
17. 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. Women Health Gend Based Med 2002;11:367-377.
18. Miles T, Johnson N. Vaginal dilator therapy for women receiving pelvic radiotherapy. Cochrane Database Syst Rev 2010;9:CD007291.
19. Moskovic DJ, Miles BJ, Lipshultz LI, Khera M. Emerging concepts in erectile preservation following radical prostatectomy:a guide for clinicians. Int J Impot Res 2011;23:181-192.
20. Messaoudi R, Menard J, Ripert T, Parquet H, Staerman F. Erectile dysfunction and sexual health after radical prostatectomy:impact of sexual motivation. Int J Impot Res 2011;23;81–86.
21. Mulhall JP, Secin FP, Guillonneau B. Artery sparing radical prostatectomy-myth or reality? J Urol 2008;179:827–831.
22. http://www.nccn.org/professionals/physician_gls/pdf/prostate.pdf (Access date:05/01/2012).
23. Schwandt A, Garcia JA. Complications of androgen deprivation therapy in prostate cancer. Curr Opin Urol 2009;19:322–336.
24. Roach M, Winter K, Michalski JM et al. Penile bulb dose and impotence after three-dimensional conformal radiotherapy for prostate cancer on RTOG 9406: findings from a prospective, multi-institutional, phase I/II dose-escalation study. Int J Radiat Oncol Biol Phys 2004;60:1351–1356.
25. Potosky AL, Davis WW, Hoffman RM et al. Five-year outcomes after prostatectomy or radiotherapy for prostate cancer:the prostate cancer outcomes study. J Natl Cancer Inst 2004;96:1358–1367.
26. Padma-Nathan H, McCullough AR, Levine LA et al. Randomized, double-blind, placebo-controlled study of postoperative nightly sildenafil citrate for the prevention of erectile dysfunction after bilateral nerve-sparing radical prostatectomy. Int J Impot Res 2008;20:479-486.
27. Montorsi F, McCullough A. Efficacy of sildenafil citrate in men with erectile dysfunction following radical prostatectomy:a systematic review of clinical data. J Sex Med 2005;2:658-667.
28. Montorsi F, Brock G, Lee J et al. Effect of nightly versus on-demand vardenafil on recovery of erectile function in men following bilateral nerve-sparing radical prostatectomy. Eur Urol 2008;54:924-931.
29. Corona G, Razzoli E, Forti G, Maggi M. The use of phosphodiesterase 5 inhibitors with concomitant medications. J Endocrinol Invest 2008;31:799-808.
30. Hatzimouratidis K, Amar E, Eardley I et al. Guidelines on male sexual dysfunction:erectile dysfunction and premature ejaculation. Eur Urol 2010;57:804-814.
31. Weinmann W, Bohnert M, Wiedemann A, Renz M, Lehmann N, Pollak S. Post-mortem detection and identification of sildenafil (Viagra) and its metabolites by LC/MS and LC/MS/MS. Int J Legal Med 2001;114:252–258.
32. Dumestre-Toulet V, Cirimele V, Gromb S et al. Last performance with VIAGRA:post-mortem identification of sildenafil and its metabolites in biological specimens including hair sample. Forensic Sci Int 2002;126:71–76.
33. Costabile RA, Spevak M, Fishman IJ et al. Efficacy and safety of transurethral alprostadil in patients with erectile dysfunction following radical prostatectomy. J Urol 1998;160:1325–1328.
34. Montorsi F, Guazzoni G, Strambi LF et al. Recovery of spontaneous erectile function after nerve-sparing radical retropubic prostatectomy with and without early intracavernous injections of alprostadil:results of a prospective, randomised trial. J Urol 1997;158:1408-1410.
35. McCullough AR, Hellstrom WG, Wang R, Lepor H, Wagner KR, Engel JD. Recovery of erectile function after nerve sparing radical prostatectomy and penile rehabilitation with nightly intraurethral alprostadil versus sildenafil citrate. J Urol 2010;183:2451-2456.
36. Raina R, Pahlajani G, Agarwal A, Jones S, Zippe C. Long-term potency after early use of a vacuum erection device following radical prostatectomy. BJU Int 2010;106:1719-1722.
37. Kohler TS, Pedro R, Hendlin K et al. A pilot study on the early use of the vacuum erection device after radical retropubic prostatectomy. BJU Int 2007;100:858-862.
38. Engel JD. Effect on sexual function of vacuum erection device post-prostatectomy. Can J Urol 2011;18:5721-5725.
39. Tal R, Teloken P, Mulhall JP. Erectile function rehabilitation after radical prostatectomy:practice patterns among AUA members. J Sex Med 2011;8:2370–2376.