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Dinesh J. Telang

Riad N. Farah

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Dinesh J. Telang, MD,* and Riad N. Farah, MD*

Impotence commonly occurs as a result of treatment of carcinoma of the prostate. We review the etiology, evaluation, and treatment options available for these patients as well as our experience with fifty prostate cancer patients who underwent placement of penile prostheses. Several excellent alternatives are available for patients with impotence resulting from treatment of carcinoma of the prostate. (Henry Ford Hosp Med J 1992;40:111-3)

Impotence from treatment of carcinoma of the prostate occurs with all known modalities of treatment, including radical prostatectomy, external beam radiation therapy, and hormonal therapy.

The incidence of postoperative impotence was 91% to 100% (1) until Walsh et al (2) first described the nerve-sparing anatomic approach to radical retropubic prostatectomy in 1983. Walsh et al's description of the anatomy of the dorsal vein complex and the neurovascular bundles (which innervate the cavernosal bodies responsible for erection) revived interest in performing radical surgery for localized cancer of the prostate. These techniques brought morbidity, in terms of impotence, incontinence, and blood loss, to an acceptable level. Of 61 potent patients undergoing nerve-sparing prostatectomy by a single staff urologist at Henry Ford Hospital between January 1986 to June 1990, 57% regained potency within one year of their operation (3). Not all patients, however, are candidates for nerve-sparing prostatectomy because of the stage or the location of the tumor within the prostate. Regaining erectile function is also highly dependent on other factors, most importantly age (4).

External beam radiation therapy causes local fibrosis and sclerosis of tissues which may result in erectile dysfunction of vascular and/or neurologic origin. Impotence ranged from 40% to 60% in one reported series (5).

Hormonal therapy, usually reserved for locally advanced or metastatic adenocarcinoma of the prostate, consists of exogenously administered luteinizing hormone-releasing hormone analogues (leuprolide, goserelin acetate), estrogens (diethylstilbestrol), or surgical castration. While its mechanisms are not completely understood, circulating testosterone is responsible for libido and plays a role in maintaining erectile function.

Evaluation

The evaluation of impotence after treatment of prostate cancer is somewhat simplified since the etiology of the impotence is clear and, perhaps more importantly, method of treatment is guided by the patient and his partner's preference. A detailed history and physical and neurological examinations are necessary. Other testing, such as nocturnal penile tumescence testing and psychometric examinations, may be requested in some instances. Intracavernosal injection of vasoactive substances such as papaverine or prostaglandin E can be used in evaluation as well as in treatment.

Treatment

Treatment options for impotence (from least to most invasive) include oral pharmacologic therapy, hormonal therapy, vacuum suction and penile constriction devices, intracavernosal injection therapy, penile revascularization and venous ligation procedures, and an array of available penile prostheses. Hormonal therapy (testosterone injection) is contraindicated in patients with a history of prostate cancer because of the androgen-dependent nature of the disease. Revascularization procedures are generally reserved for younger patients with isolated arterial inflow disease (from trauma, for example). Our discussion will be limited to those modalities of clinical use in the prostate cancer patients.

Oral pharmacologic therapy

Yohimbine HCL is an indolic alkaloid obtained from the yohimbine tree. Yohimbine blocks presynaptic alpha-2 adrenergic receptors; the net effect on the peripheral autonomic nervous system is to decrease sympathetic outflow and increase parasympathetic activity. It may act to elevate mood and anxiety and has been used in the past as an aphrodisiac. Since erection is cholinergically mediated through the parasympathetic nervous system, yohimbine may potentiate penile inflow, decrease out-

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*Department of Urology, Henry Ford Hospital.
Address correspondence to Dr. Farah, Department of Urology, Henry Ford Hospital, 2799 W Grand Blvd, Detroit, MI 48202.

flow, or both (6). A recent published report noted no improvement in performance when comparing yohimbine to placebo (7).

Vacuum suction and penile constriction devices

Vacuum suction and penile constriction devices involve placement of a cylindrical apparatus over the penis, which pumps out air and creates vacuum to engorge the penis; a constricting band is then placed over the base of the phallus to maintain the erection. Advantages include low cost, low morbidity, and high satisfaction rates in patients with excellent manual dexterity who are highly motivated and have a supportive partner (8). There have been no reports of serious complications, although some patients complain of numbness while the constricting band is in place. These devices have been utilized successfully in some patients who have had penile prostheses explanted and can be used in combination with intracavernosal injection therapy (9).

Intracavernosal injection therapy

Use of intracavernosal injection of vasoactive agents is a relatively recent development in the treatment of impotence. Early reports used papaverine with or without phentolamine; more recently prostaglandin E, alone or in various combinations with papaverine and phentolamine, has found favor. Advantages of intracavernosal injection include a physiologic erection that can be produced "on demand," the temporal nature of the treatment, and ease of administration. Insulin-dependent diabetic patients seem to be especially well suited to this type of therapy. Risk of infection is exceedingly low when used with proper sterilization techniques.

As with vacuum constriction devices, injection therapy requires a high level of manual dexterity as well as a highly motivated patient. It does not preclude use of other treatment options should it not be an acceptable solution for a couple's sexual dysfunction. Disadvantages include pain with injection and the need to stock necessary syringes, needles, and medication. Complications include corporeal fibrosis (more common with papaverine) and priapism. One-year dropout rates from pharmacologic erection programs have been as high as 40% to 50% (10).

Penile prostheses

Modern silicone penile prostheses were introduced in the mid 1960s. Several options are available. Semirigid prostheses are solid silicone with a central silver or stainless-steel wire to give rigidity. Mechanical failures are uncommon, and patient satisfaction is high. The prosthesis is simply bent into position as desired, requiring minimal manual dexterity. While these prostheses are simple to use, some patients complain of difficulty concealing these devices when not in use.

The first inflatable penile prosthesis was developed in 1973; plagued with problems early on, subsequent design improvements have made the inflatable models reliable with 97% functioning at three years in one study (11). The inflatable models closely mimic the appearance of a normal physiologic erection, are self-contained, and require no external paraphernalia. Patient satisfaction ranges from 83% to near 90%, with partner satisfaction somewhat lower (12-14). Complications range from the need for simple revisions for mechanical failure to infection and erosion to gangrene of the penis. These complications are more likely to occur in poorly controlled diabetics; patients with neurogenic bladders on clean intermittent catheterization; patients with urinary diversions, cystostomy tubes, or colostomy; and paraplegics (15).

We have extensive experience with penile prostheses at Henry Ford Hospital, with over 870 devices placed by a single staff urologist. We recently reviewed the medical records of 50 patients with a history of carcinoma of the prostate who underwent placement of a penile prosthesis. Patients ranged in age from 50 to 78 years (mean 65 years). Thirty-five patients elected inflatable prostheses; the remainder chose semirigid implants. Overall mean follow-up is 4.3 years (7.4 years for semirigid prostheses and 3.0 years for inflatable devices). The shorter follow-up for inflatable prostheses is attributed to improvements in design in these prostheses in recent years.

Five men underwent removal or revision of the prosthesis. One patient had his semirigid prosthesis removed because of problems with concealment; he refused revision to an inflatable model. Two patients had simple revisions (one from a semirigid to an inflatable prosthesis for erosion and the other for a pump malfunction); both of these patients currently have functioning implants. The other two men had two or more unsuccessful revisions or replacements of their inflatable prosthesis ultimately resulting in removal of the device because of erosion or infection. These two patients have not been interested in further evaluation or treatment.

The long-term complication rate in our series is 8%, half of which have been managed successfully. Risk factors for complications included diabetes in one patient and history of urinary tract infection in two patients. Thirteen of 15 patients with semirigid implants have had an uncomplicated postoperative course; 32 of 35 patients with inflatable implants have had no mechanical or technical problems with the device. The 90% complication-free rate and the 94% functional prosthesis rate are excellent in a cancer patient population. These rates are comparable to a previously reported series (10). Patient and partner satisfaction with penile prostheses at our institution is currently being studied. In a series from the Mayo Clinic (12), patients who required more than one procedure for implantation of the prosthesis or who experienced pain or were dissatisfied with the cosmetic appearance of the device were least likely to be satisfied with the prosthesis.

Cost

The relative cost of intracavernosal injection versus semirigid and inflatable penile prostheses has been studied. Buch et al (16) compared the calculated projected cost of intracavernosal injection over a five-year period ($3,450) to the cost of a semirigid ($3,150) or inflatable penile prosthesis ($9,000) and concluded that prostheses were more cost-effective than intracavernosal injection for young patients. However, this study did not calculate the cost of complications, revisions, or life expec-

tancy of the patient or the prosthetic device. Vacuum suction and penile constriction devices cost approximately $300. Prostaglandin E1 ranges from $3 to $10 per injection depending on the dose required to obtain a satisfactory erection. Interestingly, insurance companies are highly variable with respect to coverage for evaluation and treatment of organic impotence.

Conclusion

Impotence secondary to carcinoma of the prostate is becoming increasingly more common as new methods of early detection have been developed (specifically prostate-specific antigen and transrectal sonography) and are now widely available. Several excellent treatment alternatives are available to prostate cancer patients with sexual dysfunction. With careful evaluation an acceptable and effective method of treatment is available to almost all of these patients.

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