

## Placement of Inflatable Penile Implants in Patients With Prior Radical Pelvic Surgery: A Literature Review

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### ABSTRACT

**Background:** Penile prosthesis for erectile restoration remains the only surgical option for medical refractory erectile dysfunction. Many expert prosthetic surgeons recommend special care when placing a reservoir in a patient who has undergone prior radical pelvic surgery (PRPS) due to distortion of anatomy and obliteration of the dead space in the traditionally used space of Retzius.

**Aim:** Review all the current literature on penile prosthesis implantation in patients with prior pelvic surgery, with an emphasis on tips and tricks for reservoir placement in this unique population.

**Methods:** A Medline PubMed search was used to identify articles of interest related to all topics surrounding pelvic surgery and penile prostheses. The following terms were included in the search for articles of interest: “bladder cancer,” “prostate cancer,” “rectal cancer,” “colon cancer,” “pelvic surgery,” “penile implants,” “penile implant reservoir,” and “penile prosthesis.” Articles were further screened for content and English language.

**Main Outcome Measure:** Outcomes and adverse event rates in this population. Review of options for reservoir placement.

**Results:** The outcomes, satisfaction, and adverse event profiles are similar between patients in the PRPS group and those who are not, regardless of the cause for pelvic surgery. For surgeons uncomfortable with placing a reservoir in the compromised pelvis, a 2-piece inflatable penile implant (AMS Ambicor) is a viable option. For surgeons who recommend 3-piece implants in this patient population, alternative positions for the reservoir have been developed in the hope of avoiding catastrophic bowel, bladder, and vascular injuries.

**Conclusion:** In patients with PRPS, placing an inflatable penile prosthesis is not only feasible, it is definitive therapy with excellent patient satisfaction. Reservoir placement outside the space of Retzius or placing a 2-piece inflatable device can be easily performed with equivalent safety and efficacy. **Madiraju SK, Hakky TS, Perito PE, et al. Placement of Inflatable Penile Implants in Patients With Prior Radical Pelvic Surgery: A Literature Review. Sex Med Rev 2018;XX:XXX–XXX.**

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### INTRODUCTION

Pelvic surgeries are one of the most common causes of sexual dysfunction (SD) in men. This pathophysiology is distinct due to multifactorial vascular, neurogenic, or psychological etiology. Pelvic surgeries associated with erectile dysfunction (ED) include

radical prostatectomy (RP), radical cystoprostatectomy (RC), low anterior resections, abdominoperineal resections (APRs), or other colorectal surgeries.<sup>1</sup>

The largest patient population with pelvic surgery associated with ED is those post RP. Prostate cancer is one of the most prevalent malignancies in men 60 years of age and older, with RP and radiation as primary treatment methods. After RP, neuropraxia occurs for as long as 12–18 months, which suppresses erectile function. Lack of vascular and neurogenic inputs promote penile hypoxia, causing formation of fibrosis of the corporal smooth muscle and severe, long-term ED.<sup>2</sup> With increased prostate antigen-specific screening, prostate cancer is being detected and treated earlier, leaving ED-associated quality-of-life issues prevalent in younger populations.<sup>3</sup> Walsh and Donker demonstrated that impotence after RP occurs mostly due to injury to neurovascular pedicle, with venous leak as a major

Received July 19, 2018. Accepted October 13, 2018.

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<https://doi.org/10.1016/j.sxmr.2018.10.002>

contributor to said impotence.<sup>4</sup> Despite implementing nerve-sparing surgery and its success in increasing percentages of patients with return of erectile function, ED remains prevalent. After undergoing nerve-sparing RP, 20–80% of patients still never have erections hard enough for penetration.<sup>5</sup> There are conflicting data on the benefits of laparoscopic and robotic RP compared to open RP regarding postoperative impotence, yet sexual dysfunction continues to plague patients regardless of approach.<sup>1</sup>

RC with pelvic lymph node dissection and urinary diversion is the gold standard for treating high-grade invasive bladder carcinoma and for some forms of high-volume or recurrent low-grade or non-invasive cancers. The procedure consists of removing the bladder, prostate, and seminal vesicles with template pelvic lymph node dissection and vas ligation. ED, a common complication after RC, is likely multifactorial similar to RP and is believed to be caused by direct neurovascular trauma or from physical and emotional disturbances. Horenblas et al and Meinhardt and Horenblas attempted sexuality-preserving cystectomy in which only pelvic lymph node dissection, cystectomy, and neobladder surgery were performed and the vas, prostate, and seminal vesicles were preserved. However, ED still remains a concerning side effect in 20.8% (5/24) of the cohort.<sup>6,7</sup> Another study used an alternative nerve-sparing approach including a transurethral resection of the prostate before cystectomy. Again, despite implementation of nerve-sparing surgery, only 6 patients (10%) had partial potency and 5 (8.1%) were completely impotent.<sup>8</sup>

ED is also a postoperative complication after colorectal-related pelvic surgeries. Simple proctocolectomy is often performed for inflammatory bowel disease and low anterior resection, and APRs are curative procedures for rectal cancer. Neoadjuvant and adjuvant chemotherapy or radiation in the context of rectal cancer and bladder cancer also compound rates of SD. Rectal sphincter-saving procedures have been developed, which have dropped ED percentages after APR from 15–92% to 14–73%. Although these rates have decreased, a large percentage of these patients still report ED. Total mesorectal excision with preservation of the neurovascular bundles has also reduced impotency rates; however, it is still a common postoperative complication.<sup>1</sup>

Currently, oral therapy with phosphodiesterase inhibitors is the first-line treatment for ED. Vacuum erection devices, urethral suppositories, topical gels, and intracavernosal injections offer alternative treatment. However, 15–80% of patients who have undergone RP are unresponsive to oral therapy.<sup>9</sup> This is largely thought to be due to severe venous leak and injury to nervous inputs. Penile prosthesis for erectile restoration remains the only surgical option for medical refractory ED.<sup>1</sup> Many expert prosthetic surgeons also recommend special care when placing a reservoir in a patient who has undergone prior pelvic surgery, especially RC with pouches or neobladder urinary diversions, due to distortion of anatomy and obliteration of the dead space in the space of Retzius.<sup>10–12</sup> Prosthetic surgeons have seen an evolution

in their placement of reservoirs, as they have strived to diminish some of the most severe complications seen in inflatable penile prosthesis (IPP) placement: bowel, bladder, and vascular injuries.<sup>13</sup>

This study aims to review all the current literature on penile prosthesis implantation (PPI) in patients with prior radical pelvic surgery (PRPS), including tips and tricks for reservoir placement in this special patient population.

## METHODS

A Medline PubMed search was used to identify articles of interest related to all topics surrounding pelvic surgery and penile prostheses. The following terms were included in the search for articles of interest: “bladder cancer,” “prostate cancer,” “rectal cancer,” “colon cancer,” “pelvic surgery,” “penile implant,” “penile implant reservoir,” and “penile prosthesis.” Articles were further screened for content and English language.

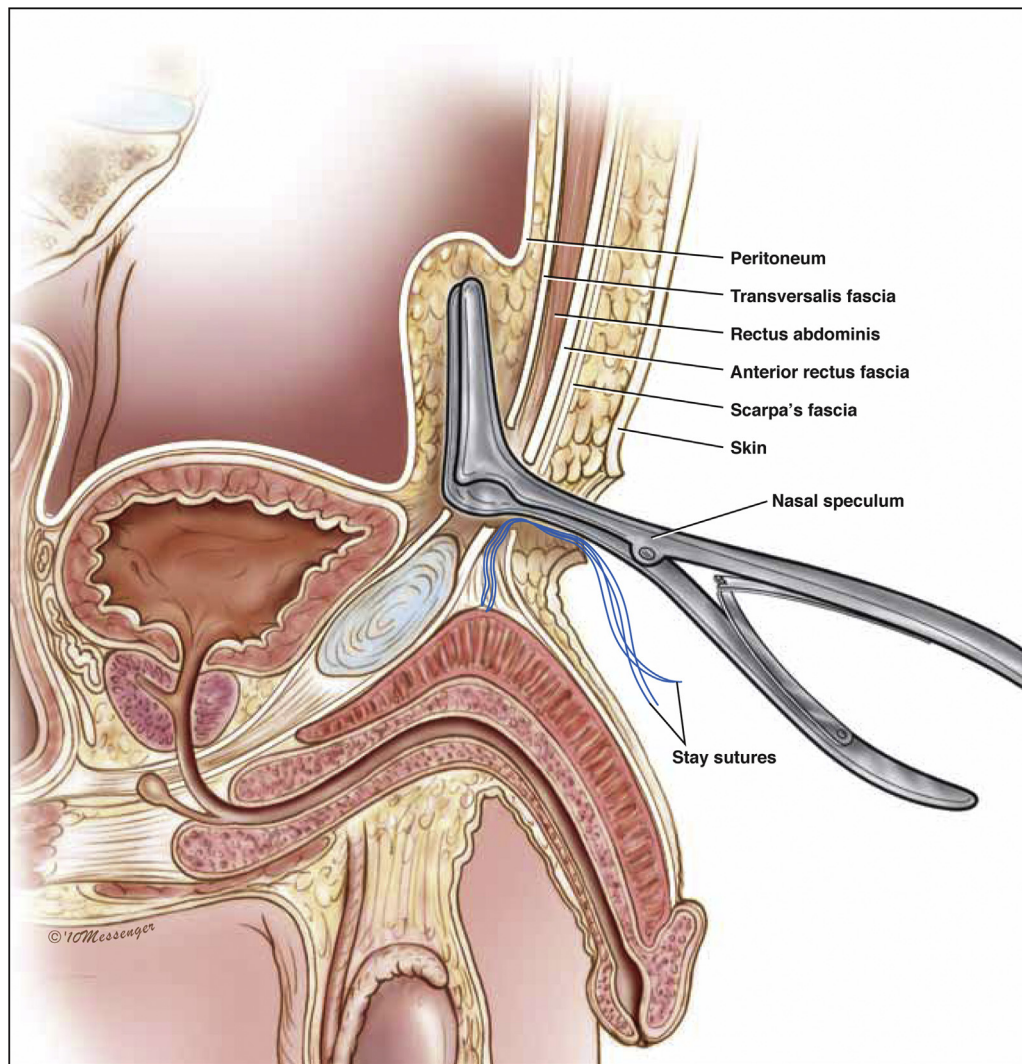
## RESULTS

### Erectile Dysfunction Secondary to Radical Prostatectomy

A study of the Medicare database was done to first determine demographics of those undergoing surgical vs medical therapy and predictive factors for prostate cancer survivors to choose penile implant.<sup>14</sup> Penile implant application was uncommon in patients over the age of 65. Younger men, African Americans, or Hispanics, and those who underwent RP were more likely to undergo prosthesis implantation after prostate cancer treatment.

### Inflatable Penile Prosthesis After Radical Prostatectomy

To date, prevention of smooth muscle apoptosis and fibrosis has not been seen in patients undergoing medical therapy for ED post RP. A study<sup>15</sup> identified phosphodiesterase type 5 inhibitor (PDE-5I) as the first-choice therapy in ED after nerve-sparing RP and its advantage over PDE-5I medical therapy in improving erection, frequency, firmness, maintenance, and penetration. 54 patients who underwent RP were stratified into 2 cohorts: 1 cohort only received medical therapy (tadalafil 3 times/wk), while the other underwent surgical therapy via PDE-5I with the AMS 700 LGX (Boston Scientific). Using the International Index of Erectile Function Questionnaire, a greater degree of change was reported in erectile function at the 2-year follow-up in the penile prosthesis group. Erection frequency, firmness, penetration ability, maintenance, and erection confidence were also superior in the IPP cohort. Patients have high non-compliance rates with medical therapy; therefore, surgical intervention could address that obstacle especially with its success in erection quality. An additional advantage of early implantation in the patient who has undergone RP is better outcomes in preserving penile length. In a retrospective study<sup>16</sup> in men undergoing first-time IPP, stretched flaccid penile length and penile



**Figure 1.** In posterior to transversalis fascia reservoir placement, the long nasal speculum tip is posterior to the transversalis fascia.

length at 100% stiffness significantly increased (at least 1 cm longer) at 6 and 12 months. A mean 10% increase ( $1.3 \pm 0.4$  cm) in length was seen 1 year postoperatively.

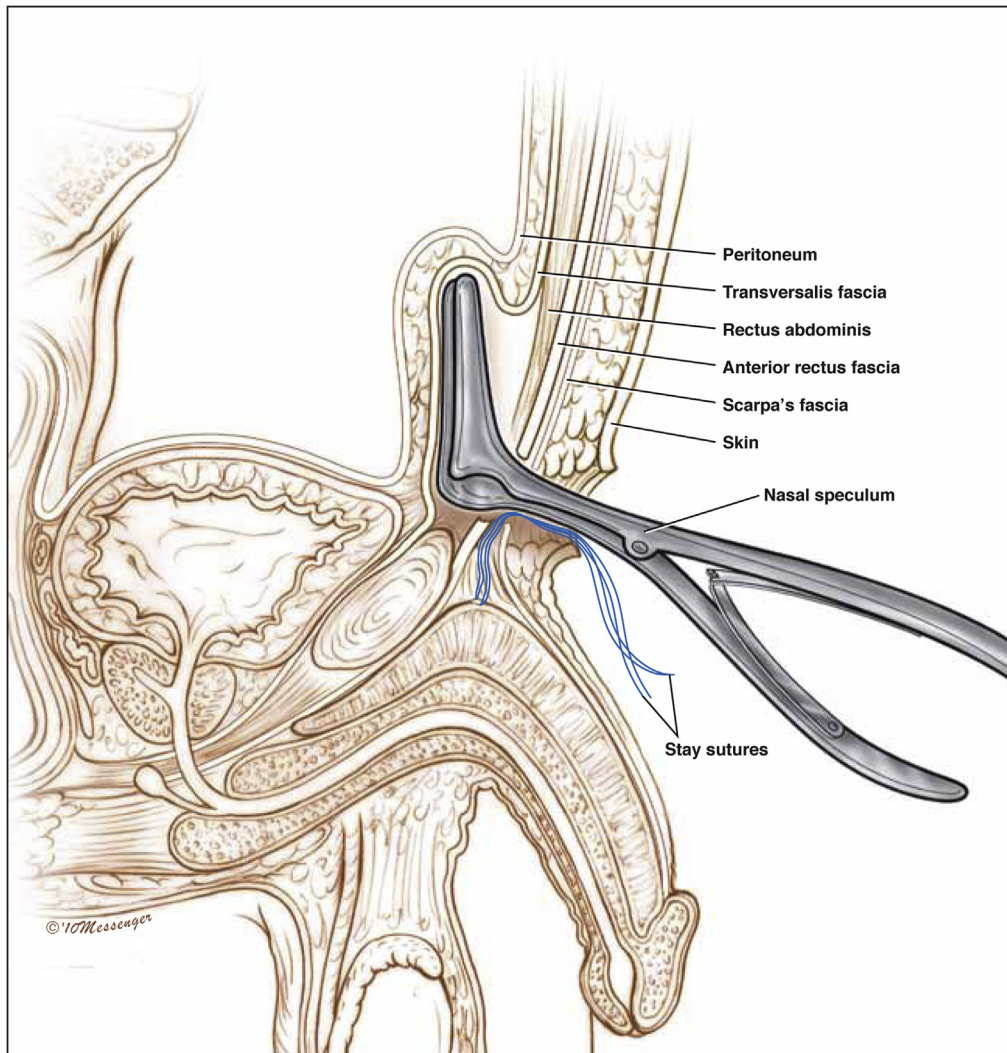
Psychological benefits are also seen in patients post RP undergoing IPP placement. Another study<sup>17</sup> followed 71 patients (and 43 partners) who underwent penile implantation after RP from 2010 and 2015. At an average of 31 months postoperatively, 94% of this cohort were satisfied with treatment, 77% stated good function, and 97% reported a fully or mostly functioning prosthesis, which depicts results significantly better compared to other ED treatment methods.

Surgical techniques in IPP placement have advanced significantly in efforts to reduce operating room (OR) time and improve outcome. A study<sup>18</sup> enrolled 1,019 patients from 11 sites, of whom 28% (285) underwent RP. 280 men (98.2%) of the RP population received an AMS 700 LGX. In this AMS RP subgroup, 65.0% (182) had the reservoir placed in the retropubic space, whereas 31.8% (89 of 280) had their reservoir placed in the high submuscular position, or anterior to the transversalis fascia.

Various reservoir placements can be seen in [Figures 1 and 2](#) where both are placed through a submuscular tunnel. The reservoir is either placed in the traditional space of retzius posterior to the transversalis fascia or in a submuscular location anterior to the transversalis fascia. A statistically significant difference was seen in sexual function between etiology subgroups. Patients with an RP etiology had the lowest International Index of Erectile Function 5 and Sexual Health Inventory for Men scores, longest OR times, and increased observation rate in the hospital for at least 1 night. During RP and RC, the peritoneal veil is taken down, which disrupts the space of Retzius and the bladder becomes mobilized. During subsequent reconstruction and healing, this potential preperitoneal space becomes obliterated. The use of submuscular reservoir placement with 3-piece IPP can minimize surgery-related risks such as inguinal herniation, bladder, or bowel erosion, visceral/vascular injury, autoinflation, and infection.<sup>19</sup>

In another study, 115 IPP placements were done in patients who had undergone RP.<sup>20</sup> Outcomes studied were intraoperative and postoperative complications (such as mechanical failure and





**Figure 2.** In anterior to transversalis fascia reservoir placement, the long nasal speculum tip is anterior to the transversalis fascia.

infection). There were no intraoperative complications such as bowel, bladder, or vascular injury. In the patient who has undergone PRPS, the fascia can have increased scarring due to previous pelvic surgery, which makes perforating through the external inguinal ring difficult. However, blind entrance into the retropubic space was successfully done in all patients, and a reservoir was placed after bladder decompression. Unfortunately, there were 3 prosthetic infections (2.6%) and 8 mechanical failures (7%) within a 3-year postoperative period. The Kaplan-Meier probability estimation of no infection or mechanical failure at 3 years is 97% and 95.5%, respectively.

Finally, 90 patients with post-RP implants (79 primary, 11 secondary) were compared to 131 patients with implants due to vasculogenic ED to analyze patient satisfaction and surgical outcome.<sup>21</sup> In this study, 96.2% received inflatable (3-piece, 70.1%; 2-piece, 24.1%) implants. No significant difference was seen in the surgical complication or infection rate. Although the preoperative sexual satisfaction score was lower in patients who had undergone RP and remained lower than controls (86.1% vs

90.7%), scores for all categories significantly improved compared to those before implantation. A similar surgical approach was used as previously mentioned, however, 1 blind entry caused an epigastric vein injury requiring open incision for hemostasis. There were no postoperative complications.

Laparoscopic RP can compromise the potential space of Retzius, making conventional reservoir placement difficult or unwise. Placing the reservoir in a submuscular pocket in the abdominal wall in 28 patients after RP resulted in 2 patient complications of bladder injuries (0.07%), 8 reservoir herniations (0.29%), and 2 autoinflations (0.07%).<sup>22</sup> Patients with prior abdominal or pelvic surgery are perhaps at higher risk of intestinal reservoir-related complications, which should be taken into consideration.<sup>23</sup> Intraoperative damage to the bladder, iliac vessels, or other surrounding structures is limited but increased in specific populations including patients who have undergone previous radiation or surgery causing trauma to or obliteration of the prevesical space, such as robot-assisted RP and RC. Due to the risk of these complications in populations with previous or planned male

bulbourethral slings, an alternative surgical approach may be required.<sup>24</sup> In an attempt to reduce potential damage to the bladder and iliac vessels, Hartman et al<sup>24</sup> placed IPP reservoirs in the potential space of the lateral retroperitoneum due to fascial scarring and fibrosis after RP. A small incision was made above the anterior superior iliac spine in both lower lateral quadrants. A pocket in the potential space of the retroperitoneum was created for reservoir placement. The pump was implanted in a subdartos midline scrotal pouch. 62 patients received IPPs using this approach and 31 were patients who had undergone RP. Although this method requires a second fascial incision, which can cause increased operative time and postoperative discomfort, no intraoperative complications such as injury to the bladder, iliac vessels, or surrounding structures occurred in any of the 62 cases. The mean OR time was 10 minutes longer in the lateral placement cohort as compared to controls, but it was not statistically different. No intraoperative complications such as infection or mechanical failure occurred in any of the 31 patients after RP.

In general, increased fibrosis due to prior pelvic surgery may require alternate surgical approaches to IPP placement. Which IPP (3-piece vs Ambicor 2-piece) and which placement method (retropubic space vs submuscular) is most effective, remains to be studied.

### Simultaneous Inflatable Penile Prosthesis and Radical Prostatectomy

Although the previously mentioned studies depicted penile implantation success after RP, there is a theorized advantage in early intervention to achieve long-term ED eradication or improvement. A study<sup>25</sup> was done comparing simultaneous IPP placement during RP and patient satisfaction compared to other forms of therapy. 51 men who underwent simultaneous RP and penile prosthesis (PP+) were compared to 47 men who underwent RP alone (PP-). The PP+ cohort reported greater overall quality of life, erectile function, and more sexual activity per month than the PP- group. Additionally, 52.4% of the PP-group were using aids such as injections, sildenafil, and vacuum erection devices and still experienced less successful erectile function restoration.

In addition to restoring function, length preservation is also an important consideration. From June 2013 to June 2014, 10 patients simultaneously received an AMS IPP and underwent RP.<sup>9</sup> Biochemical cancer recurrence-free rate, penile length, and quality of life were the outcomes measured. The surgical method for IPP placement in this cohort consisted of positioning the reservoir adjusted between the bladder and pubis after the space of Retzius was carefully dissected. The external fascia of the rectus-abdominus muscle was perforated via blunt incision to gain entry into the space of Retzius through the external inguinal ring in standard fashion. The reservoir was inflated to recheck its location once again after which the prosthesis was implanted. 1 patient experienced a grade 3b Clavien- Dindo, having reservoir

migration into the bladder. This setback caused a contained superior bladder wall perforation and migration of the reservoir into the bladder due to formation of a pressure ulcer on an adjacent bladder diverticulum. The reservoir was removed and relocated via laparotomy. The bladder wall was repaired and a catheter was required for 1 week. Luckily, the prosthesis did not need to be removed and remained functional and non-infected. In terms of length, postoperative preservation of penile length was seen with only 20% of patients experiencing a 0.5-cm reduction. All patients reported satisfaction with sexual function after surgery and none described problems or dissatisfaction with length.

In general, those who experienced some level of ED prior to RP as well as patients who did not undergo nerve-sparing procedures have higher rates of postoperative ED. Therefore, these patient populations should be considered for simultaneous implantation. Additionally, laparoscopic extraperitoneal RP should be considered the optimal surgical technique for a substantial safety margin to place a simultaneous prosthesis.<sup>9</sup>

### Radical Prostatectomy in Patients With Preexisting Inflatable Penile Prosthesis

Other studies have attempted to determine if patients with preexisting prostheses would be able to retain the IPP and still undergo RP. Moreover, questions exist regarding possible changes in sexual or device function in this patient subset. A rather small cohort of 4 patients with a preexisting prosthesis underwent RP.<sup>26</sup> During surgery, the fibrous capsule around the prosthesis was carefully dissected, and the prosthesis was inflated to transfer fluid from the reservoir to the cylinders for better visualization of the left pelvic side wall. After RP surgery, the prosthesis was cycled under direct supervision to ensure functionality and lack of trauma to newly made anastomoses. During this repair, the space of Retzius was explored very carefully, as not to damage the tubing or reservoir. However, 1 patient's tubing was punctured, and it was recognized and fixed intraoperatively. In this case, the reservoir was kept full, as flaccid reservoirs can be harder to visualize and are therefore at higher risk of puncture. All patients reported satisfactory sexual outcomes with well-functioning IPPs.

A second cohort of 4 patients with previous IPP secondary to severe ED underwent RP.<sup>27</sup> The OR time, estimated blood loss, and pathologic tumor outcome (no positive margins) for these patients was comparable to that of a non-indwelling IPP population. No complications such as IPP infection or decrease in IPP function were observed.

### LENGTH RESTORATION AFTER RADICAL PROSTATECTOMY

In recent years, the MUST trial has introduced a new approach to placing IPPs.<sup>28</sup> 138 patients underwent this multi-slit technique

(10.4% post RP). In this approach, 2 longitudinal incisions are made in Buck's fascia to create a flap and expose the tunica albuginea, 2 longitudinal incisions are then made into the tunica albuginea, and 1 semicircular relaxing incision is created under the urethra with an IPP placed through a subcoronal incision. Overall, no infections were seen and patient satisfaction increased. However, due to only a small percentage of this cohort being post RP, it is underpowered to determine whether this approach provides significant improvement in surgical ease and outcome for the patient subset of interest.

## Erectile Dysfunction Secondary to Radical Cystoprostatectomy

### Inflatable Penile Prosthesis After Radical Cystoprostatectomy

Although RP is the most common pelvic surgery etiology for ED, RC is another common surgery that not only causes ED but also requires preoperative planning for placing the reservoir due to the variety of urinary diversions. A single case study was done regarding a patient who underwent RC with urinary reconstruction with the orthotopic Studer neobladder technique and was experiencing ED.<sup>29</sup> An IPP was placed via a penoscrotal incision with placement of the flat conceal reservoir at the level of the umbilicus in the preperitoneal space. No perioperative complications were seen. The preperitoneal placement of the flat reservoir proved to be safe and effective. Most recently, in a retrospective study,<sup>30</sup> the authors primarily placed 3-piece IPPs (AMS 700 LGX) in 80 patients after RC and urinary diversion from 2003 through 2016. 71 patients underwent RC for bladder cancer, 8 for prostate cancer, and 1 for refractory interstitial cystitis. The reservoir was placed using an infrapubic approach in the lateral retroperitoneal space by making a counterincision from the pubic symphysis to the anterior superior iliac spine. After a mean follow-up of 53.9 months (6.5–150.7 months), 4 patients required an explanation due to prosthesis infection, but 3 of 4 had successful IPP salvage. 5 patients required revision surgeries (pump replacement,  $n = 3$ ; pump relocation,  $n = 1$ ; cylinder replacement for cylinder aneurysm,  $n = 1$ ) due to mechanical failure. Overall, however, IPP placement proves to be a safe and effective therapy in patients who have medication-refractory ED with all forms of urinary diversion.

Another surgical tactic studied was a 2-step approach to IPP placement.<sup>31</sup> A separate muscle-splitting incision was created to place the reservoir in the retroperitoneal position off the iliac crest with tubing exiting above the external inguinal ring for patients with RC. The reservoir was placed in the retroperitoneum laterally above the psoas muscle, after which the pump was implanted into the scrotum. In a second procedure, after 6–12 weeks, the cylinders are placed and connected with the pump and reservoir. Of 42 patients who had undergone RP and RC, there was a 7% revision rate with 3.4% (5/147) due to infection and 0.7% (1/147) due to prolonged pelvic pain thought to be secondary to pelvic radiation. This surgical

technique theoretically provides the possibility for shorter OR times for IPP implantation and the time for scrotal edema and a newly placed pump to heal before cylinder placement.

### Simultaneous Inflatable Penile Prosthesis and Radial Cystoprostatectomy

Further analyzing other surgical methods of IPP intervention, 19 patients who underwent RC with prophylactic urethrectomy simultaneously had an IPP placed.<sup>32</sup> 13 had the urethrectomy at the same time as the RC, whereas 6 underwent the urethrectomy with glandular preservation 6–12 weeks after. The surgical procedure detailed that the cylinders were placed via an infrapubic incision. On the whole, the latter group experienced improved function due to better cylinder placement with glans support and had less postoperative scarring and deformity. In both groups, IPP placement during RC proved to be effective in improving sexual function; however, better cosmetic results and glandular sensation preservation is seen with an intact glandular urethra. Further studies are required to determine if early intervention within the RC group may provide better results.

## DISCUSSION

A recent study showed sexual satisfaction in all patients after placement of an IPP for severe, medical refractory ED. These patients had undergone prior pelvic urologic surgeries including RP and RC.<sup>33</sup> Studies have shown surgical intervention to be more effective than medical therapy, and there are possible advantages in early intervention. These advantages include limiting penile length loss, a more effective and reliable long-term solution to the patients' problem, and higher patient satisfaction. PPI is currently used as a third-line treatment and is normally used at least 1 year after ED onset and/or after failure of other therapeutic modalities.<sup>15</sup> During medical treatment for severe ED, long-term durability is difficult to achieve despite the use of intracavernosal injections or vacuum constriction devices, intra-urethral alprostadil, or oral phosphodiesterase type 5 inhibitors.<sup>15</sup>

Different surgical approaches in placing an IPP include infrapubic, penoscrotal, and subcoronal. There are also options for placing the reservoir in a standard space of Retzius, submuscular, or in a lateral location. Although most surgeons specialize in a specific approach, being versed in all techniques may allow individualization to the patient and his respective medical history. Infrapubic IPP placement allows for rapid reservoir placement, direct visualization through the same incision, and avoiding creating a scrotal incision. There is theoretical risk, however, of dorsal nerve damage causing sensory loss, limited view of distal corpora, and the lack of access to the scrotal area for pump fixation.<sup>34</sup> The penoscrotal approach allows exposure of proximal crura, prevents pump migration, minimizes scar formation, and decreases the probability of neurovascular bundle injury. This approach requires blind placement of the



reservoir, however, and has increased risk of scrotal swelling vs the infrapubic incision.<sup>35</sup> The subcoronal approach avoids extensive scar formation, allows direct access to dilation of corporal bodies for reconstructive maneuvers and for IPP placement; however, this technique is not advised when extensive dissection is required.<sup>36</sup> Submuscular or lateral reservoir placement can be used to avoid bowel, bladder, and vascular injuries and for function and cosmetic maintenance.<sup>37</sup> Although there is theoretical risk of deep pelvic complications with reservoir placement, this problem can be avoided by surgeon experience.<sup>38</sup> A 10-case cadaveric study evaluating the high submuscular ectopic placement of IPP reservoirs via the inguinal canal vs retropubic placement (orthotopic) suggests minimal complication risk and high patient satisfaction. However, further comparative studies between these approaches must be done within these patient populations to be ascertained.<sup>39</sup>

In addition to individualization of surgical approach, the Ambicor 2-piece IPP can be offered to patients with medical refractory ED. Blind retropubic reservoir placement as seen with 3-piece IPPs placement can be avoided. Additionally, surgeons who may not be comfortable with an ectopic approach can use a 2-piece device instead. The ideal Ambicor candidate is a patient with a current or future pelvic organ transplant, reduced manual dexterity, requires complete phallic reconstruction, or with known extensive previous abdominopelvic surgery.<sup>40</sup>

Patients in the PRPS group, as compared to their counterparts who have not undergone prior pelvic surgery, may require different approaches to reservoir placement. In patients who have undergone RP, the presence of fibrosis may require an extra incision or alternative location placement outside the space of Retzius in a submuscular fashion in the midline, through the inguinal ring, or in a lateral fashion. In patients who have undergone RC, a significant portion of caudal peritoneum is removed, thus preventing the ability to close the peritoneum. This leads to an increased risk of intestinal herniation and adherence to pelvic cavity and poses a theoretical risk to typical reservoir placement in the space of Retzius. Many surgeons advocate for reservoir placement in a submuscular fashion in these patients.<sup>29</sup> In fact, any incision in the infrapubic or prepubic areas may cause damage to the neobladder or inferior epigastric vessels. However, placing the reservoir into the peritoneum at the level of the umbilicus can also be an efficacious option.<sup>29</sup> There also exists a small (4) series of patients who underwent midline sub-rectus reservoir placement without complication due to previous lower extremity bypass, kidney or pancreas transplant, or bilateral inguinal hernia repair with mesh.<sup>41</sup> Finally, oncologic recurrence should be considered in all patients undergoing IPP who underwent previous pelvic surgery due to cancer. To our knowledge, no data have shown a prohibitive nature of an IPP in diagnosing or treating cancer recurrence.

Pelvic surgeries in which limited data exist in the literature regarding IPP as a treatment for ED include urethral reconstruction and radical surgery for rectal and/or colon cancer. During urethroplasty, the urethra is sometimes shortened, causing penile

shortening and/or curvature. If the corpus spongiosum is completely transected during urethroplasty, the blood flow to the glans may be compromised causing loss of sensation, poor glans tumescence, or cold glans. Psychological stress post reconstruction also plays a role in sexual function.<sup>42</sup> Several studies<sup>30,42</sup> depicted a decrease in satisfaction with ejaculation and orgasm after prior urethral surgery. This decrease is believed to be related to damage to the bulbourethral muscles. The rate of ED varies depending on the surgical approach to reconstruction. For example, 5% long-term ED was seen after anastomotic urethroplasty and 0.9% after patch urethroplasty.<sup>30</sup> However, no matter the surgical technique, ED prevalence is not well appreciated with respect to this pelvic surgery.

Sexual impotence is also common after abdominoperineal excision of rectal cancer; however, the outcomes of these studies are highly mixed. In a recent study of 10 prominent surgeons, 53–100% of patients reported some degree of ED. Additionally, a 10% incidence of impotence was seen after rectal excision indicated due to ulcerative colitis.<sup>43</sup> In a single-center 8-year study, 1.8% cases of impotency were attributed to patients who underwent radical operation for rectal and colon cancer.<sup>44</sup> Another study depicted 67% of males complaining of SD after radical surgery for rectal cancer.<sup>45</sup> In another study of 57 patients who underwent rectal surgery due to adenocarcinoma, 59.6% of patients reported SD.<sup>37</sup> A survey from the United Kingdom showed 75% of men have ED after treatment for colorectal cancer.<sup>46</sup> These patient populations are not as regularly offered information and treatment plans for their ED. No literature was found regarding IPP placement in this patient subset.

Further studies are warranted regarding IPP management in patients with all types of cancers that require pelvic surgery. This includes urethroplasty and radical surgery for rectal and colon cancer.

## CONCLUSION

Penile prosthesis surgery significance goes further than restoring penile rigidity and also promotes a favorable psychosocial outcome. It is consistently underutilized in patients post RP at only 1.9% undergoing IPP.<sup>47</sup> Overall, penile implant surgery has proven to be an effective treatment for ED with the best patient satisfaction percentage of all ED therapies. Penile prostheses have been shown to be significantly helpful in treating ED with the highest reported patient satisfaction rates at 90%. In fact, IPP placed before, during, or after radical pelvic surgery in patients with cancer is successful. PRPS placement of an IPP is feasible with good patient satisfaction. Reservoir placement outside the space of Retzius in a submuscular location in the midline, through the inguinal ring, or in a lateral fashion or placement of the Ambicor 2-piece inflatable device are suitable options to avoid dreaded bowel, bladder, or vascular injuries in the PRPS population.

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**Conflict of Interest:** Dr. Hakky is associated with Coloplast and Paul Perito is associated with Boston Scientific Corporation, Coloplast. The other authors have no conflicts of interest to declare.

**Funding:** None.

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