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CLINICIAN'S WORKSHOP

Erectile Function

A novel approach for removal of an inflatable penile prosthesis reservoir using laparoscopic instruments

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In the setting of an infected inflatable penile prosthesis (IPP), removal of the reservoir is a surgical challenge. We describe a novel technique for IPP reservoir removal at the time of IPP explantation utilizing laparoscopic instruments. We present two cases of infected IPPs requiring complete removal of all components of the implant. The corporal cylinders and scrotal pump were removed via a single penoscrotal incision. Through the same incision, a lighted, hand-held retractor was used for visibility, and laparoscopic instruments were utilized to dissect the tissue surrounding reservoir and the attached tubing until free. Then, a completely intact reservoir was easily removed. Infected IPP reservoirs were successfully removed in this fashion without any complication. This new technique not only facilitated the safe removal of the reservoir, but also enhanced surgical efficiency by eliminating the need for additional incisions. We performed a review of current literature concerning techniques and indications for removal of IPPs and the reservoir. In the setting of an infected penile prosthesis, all components of the implant should be removed. Removal of the reservoir has been surgically difficult due to its location, either deep in the space of Retzius or high in the abdomen between the muscular fascias. Our new technique provides an innovative solution for reservoir removal with the use of laparoscopic instruments via a single

penoscrotal incision. We have found that this technique overcomes the challenge of a cumbersome blind dissection and the need for the second incision.

Inflatable penile prostheses (IPP) have been utilized reliably as a definitive treatment for medically refractory erectile dysfunction over the last four decades.¹ The device consists of two intracorporeal penile cylinders, a pump placed in the scrotum, and a fluid-containing reservoir. Since the advent of the penile prosthesis, technological improvements in these devices have resulted in a mechanically reliable product that produces high levels of patient satisfaction. Reported repair rates due to mechanical failure of IPP are approximately 15% at 5 years and 30% at 10 years.² A rare but potentially devastating complication of the procedure is infection of the implant. The advent of antibiotic-coated devices, implementation of prophylactic antibiotic regimens, and improvement in skin preparation has helped improve outcomes and decrease infections. Although the incidence of infection is low, 1%–3%, it can be very challenging to manage and treat.² In the event that an implant becomes infected, it is recommended that all components of the IPP are removed.¹ Leaving the infected reservoir in place results in serious complications. Kava and Burdick-Wil described several complications associated with failure to remove all foreign bodies associated with infected IPPs. These include persistent and relapsing drainage from cutaneous fistulae, cellulitis of the overlying infected reservoir, and chronic penile pain.³ If the IPP was initially placed via a penoscrotal incision, the same incision can be utilized for the removal of the cylinders and the pump. However, removal of the reservoir has been surgically challenging due to its location, either deep in the space of Retzius of the pelvis or high in the abdomen

between the muscular fascias. This manuscript describes a novel method for the removal of the infected reservoir utilizing laparoscopic instruments at the time of IPP removal.

PATIENTS AND TECHNIQUE

A 52-year-old male with a medical history of Lupus, on steroid therapy, and prostate cancer treated with radical retropubic prostatectomy followed by adjuvant androgen deprivation therapy and salvage radiation developed severe erectile dysfunction and Peyronie's disease. He underwent an implantation of inflatable penile prosthesis (AMS 700™ CX Penile Prosthesis, American Medical Systems, Minnetonka, MN, USA) and penile modeling for a dorsal curvature on December 24, 2015. The patient presented to the emergency room on January 18, 2016, with fever, chills, right lower quadrant pain, and scrotal swelling consistent with IPP infection. He received broad-spectrum IV antibiotics and was subsequently taken to the operating room for explantation of the IPP.

Similarly, a 60-year-old male with a history of chronic myelogenous leukemia and prostate cancer status post robotic assistant radical prostatectomy in 2011 developed refractory erectile dysfunction. He underwent insertion of an inflatable penile prosthesis (Coloplast Titan Coloplast, Minneapolis, MN, USA) on March 14, 2016. One month later, he presented to the emergency room with high fevers, 103.6°F, chills, and worsening abdominal pain. Scrotal examination revealed erythema, induration, and edema consistent with IPP infection. He received antibiotic treatment and was subsequently taken to the OR for penile prosthesis removal.

Both patients underwent removal of the IPP in a similar fashion. Removal of the reservoir was performed using laparoscopic instruments. A 4-cm transverse incision was made at the penoscrotal junction. Bovie

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electrocautery was used to dissect through the subcutaneous and scar tissue to expose the tubing leading toward the pump located in the scrotum. Dissection was continued until the pump was free and was able to be delivered out of the scrotal incision. A Lone-Star retractor was placed to provide adequate exposure to the surgical field. Again, bovie electrocautery was used to dissect along the two tubes connected to the corporal cylinders. Corporotomies were then made with the electrocautery to expose the cylinders. The cylinders were removed from corpora through the corporotomies bilaterally. The tubing connecting the reservoir and the pump was transected, and the fluid inside the reservoir was completely aspirated. The pump with two cylinders was sent off the field.

Attention was then turned to removal of the reservoir with the utilization of laparoscopic instruments via the initial penoscrotal incision. A 30° laparoscopic lens was brought into the field. A hand-held retractor with a light source was used for deep retraction and exposure (**Figure 1**). With the guidance of the camera, a 5 mm Harmonic, 5 mm LigaSure, and laparoscopic scissors were used to create a slow and gentle dissection cephalad along the tubing toward the reservoir (**Figure 2**). The laparoscopic camera was instrumental in providing a clear view, which allowed for a meticulous dissection directly above the tubing directed toward the reservoir. Care was made to avoid injury to nearby organs such as the spermatic cord. Once the port that connects the reservoir to the tubing was exposed, the reservoir was easily removed.

Mulcahey antibiotic irrigation was then performed.⁴ Three 10 French fluted Jackson Pratt drains were placed; one in the reservoir space and one in each corporal body. Corporotomies were closed with 2-0 PDS sutures. The skin incision was closed with interrupted 4-0 Monocryl sutures.

As a result, infected IPP reservoirs were successfully removed with the use of laparoscopic instruments via the penoscrotal



Figure 1: A hand-held retractor with a light source was used for deep retraction and exposure.

incision without any complication. This new technique not only facilitated the safe removal of the reservoir, but also enhanced surgical efficiency by eliminating the need for additional incisions.

Following surgery, patients were treated with 2 days of IV antibiotics and then transitioned to oral antibiotics. The drains were removed postoperative day two and the patients were discharged home. Patients were evaluated in clinic six weeks after the surgery with complete healing of the incision without any complication.

COMMENT

There are numerous IPP placement techniques described in literature: penoscrotal, infrapubic, and perineal. The two most common approaches are penoscrotal and infrapubic placement.⁵ Each technique offers its own advantages. The reservoir is commonly placed into the space of Retzius, a position that is situated deep in the pelvis. Ectopic placement of the reservoir has gained popularity in attempts to avoid vascular, bowel, and/or bladder injury. In patients with a history of pelvic surgeries, such as radical cystectomy or robotic assistant radical prostatectomy, the reservoir is placed above transversalis fascia or intramuscular fascia. Attempts are made to place the reservoir as high in the abdomen as possible to prevent herniation of the reservoir.

Product malfunction, patient dissatisfaction, and infection are complications associated with IPPs that may necessitate the removal. When removing the penile prosthesis for noninfectious reasons, there are conflicting opinions in choosing to remove the entire three-piece prosthesis or leaving the reservoir in place.⁶ The reservoir is thought of as an innocuous entity since it is made of silicone and polyurethane, both of which are considered inert and have not been shown to

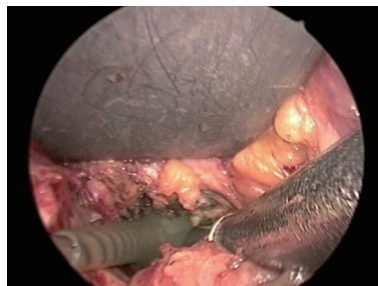


Figure 2: With the guidance of the camera, a 5 mm Harmonic, 5 mm LigaSure and laparoscopic scissors were used to create a slow and gentle dissection cephalad along the tubing toward the reservoir.

cause an inflammatory reaction in the human body.⁷ However, long-term studies of the reservoir's durability when left in place have not been studied.⁸

There have been various case reports published describing consequences of leaving the reservoir behind. These include compression of ureter leading to hydronephrosis,⁷ erosion of the reservoir into the bladder,⁹ migration of the reservoir into the left rectus abdominis muscle,¹⁰ migration of the reservoir into a subhepatic area, inguinal herniation of the reservoir,¹¹ and retained reservoir leading to the formation of a large reactive cyst compressing the bladder.¹² In a study and literature review performed by Rajpurkar *et al.*,⁸ prior pelvic surgery and infection were discovered to be risk factors for reservoir erosion. However, it is not standard practice to remove the reservoir in a noninfectious setting as the surgery is technically difficult and associated with various risks.¹² Depending on the location of the reservoir and the need for additional incisions, many surgeons may choose to leave the reservoir in place. However, in the setting of an infected penile prosthesis, the standard of practice is to remove the entire three-piece prosthesis.

Removing the reservoir poses a challenge due to its location, migration, and/or the need to make the second incision to obtain it. There has not been a standard technique developed to remove the reservoir during explantation of the prosthesis. Here, we report a novel technique with the utilization of laparoscopic instruments to remove the reservoir. To our knowledge, this is the first time that reservoir removal has been performed in this fashion. While this technique is novel, it also may prove beneficial to the patient. Namely, this technique eliminates the need for the second incision in an infected field. It also reduces the risk of exposure of abdominal organs to contaminants. Furthermore, postoperative pain control may be improved with fewer incisions. In the event that a reservoir has migrated, this technique offers a large range of view without requiring a larger or additional incision. The surgeon is able to remove a reservoir in a difficult location under direct and endoscopic vision in a minimally invasive fashion with a potentially decreased risk of damage to surrounding structures.

CONCLUSIONS

In the setting of an infected penile prosthesis, all

components of the implant should be removed in conjunction with the administration of antibiotics. Leaving the reservoir in place at the time of IPP removal may result in complications for the patient. Removal of the reservoir has been surgically challenging due to its location, either deep in the pelvis (in the space of Retzius) or high in the abdomen (between the muscular fascia). Traditionally, a separate incision has been utilized for adequate exposure in attempts to avoid adjacent organ injury. We believe that developing a successful technique for removing the reservoir proves to be beneficial for patients. Our new technique provides an innovative solution for reservoir removal with the use of laparoscopic instruments via a single penoscrotal incision.

AUTHOR'S CONTRIBUTIONS

RW contributed to the concept of the study. AS, CC, and RW drafted, revised and approved the manuscript. GW and RW contributed to the design and technique of the procedure.

COMPETING INTEREST

None of the authors declared competing financial interests.

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