

## REVIEW

# Intravesical penile implant reservoir: case report, literature review, and strategies for prevention

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To present a case of intravesical erosion of an infected multiple-component inflatable penile prosthesis (IPP) reservoir. We retrospectively reviewed a case of complete intravesical erosion of an infected IPP reservoir. We also reviewed the prior urologic literature concerning bladder-related reservoir complications, and formulated potential strategies to prevent these complications in the future. This patient was successfully managed with complete explantation of the cylinders and pump, along with cystostomy, intravesical reservoir removal and cystorraphy. Several months later, he was successfully reimplanted with a multiple-component IPP, and, with 7 months follow-up, has had no further complications. Management of intravesical placement or erosion of an IPP reservoir should be tailored to the clinical scenario. In cases with peri-prosthetic infection and subsequent intravesical reservoir erosion, complete explantation and delayed subsequent reimplantation has been successful. Inadvertent intravesical reservoir placement has been successfully managed via immediate cystostomy, reservoir repositioning and cystorraphy. Reservoir insertion via a counter-incision, an infrapubic approach and under direct vision can avoid this complication. Bladder laceration during reservoir reinflation has been successfully managed with cystorraphy and reservoir repositioning.

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## INTRODUCTION

Inflatable penile prostheses (IPPs) are comprised of two intracorporal cylinders, a scrotal pump and a fluid reservoir. IPP reservoirs come in a variety of sizes and configurations. These reservoirs may be placed in the space of Retzius, in a pre-peritoneal or retroperitoneal location, or in the layers of the abdominal wall. Occasionally an IPP reservoir will find its way into the urinary bladder, either via inadvertent surgical placement, via gradual erosion with or without the presence of peri-prosthetic infection or during reservoir reinflation. We present a case of intravesical reservoir erosion in a patient with smoldering peri-prosthetic infection, and review management strategies and the prior urologic literature.

## CASE REPORT

A 60-year-old male with obesity, diabetes, coronary artery disease and organic erectile impairment presented to us for evaluation of a painful American Medical Systems (AMS) 700 IPP (Minnetonka, MN, USA). He had undergone four prior IPP surgeries, all at outside institutions. His first AMS 700 IPP was placed in 2003, and healed uneventfully. Owing to malfunction, in May of 2010, he underwent cylinder and pump replacement with inhibizone-coated components. The existing reservoir was not removed; the new pump was attached to the original reservoir. In August of 2010 the patient presented to the original surgeon with a reservoir hernia in the right groin. At that point, all components were removed and replaced with AMS 700 inhibizone-coated components. The new reservoir was inserted via a right lower quadrant counter-incision. In October of 2010 the patient again presented to his original

surgeon with an IPP malfunction. A new cylinder–pump combination was placed via a scrotal incision, and connected to the existing reservoir. By March of 2011, the patient reported gradual onset of pain, fever, transient gross hematuria and scrotal drainage, and was referred to our center. Examination at that point revealed typical IPP infection, with induration around the pump and purulent drainage from the scrotal incision.

The patient was emergently admitted to the hospital, and placed on parenteral antibiotics. A CT scan was performed to document the position of the reservoir and facilitate its removal. This study revealed that the IPP reservoir was completely within the urinary bladder (Figure 1). After medical optimization, he was taken to surgery to rectify this Clavien Grade IIIb surgical complication. Cystoscopy revealed no sign of cylinder erosion into the urethra, but the IPP reservoir was fully within the urinary bladder, as seen on the CT scan. The cylinder–pump combination was explanted via the scrotal incision; the intravesical reservoir was removed via midline laparotomy, cystostomy and cystorraphy. All infected areas were lavaged with antibiotic irrigation (rifampin and gentamicin, 1 mg of each per ml.) Drainage was accomplished via an 18-French suprapubic cystostomy tube, a 20-French urethral catheter, a scrotal Penrose drain and a flat closed-suction drain in the pre-vesical space. The patient was given a 10-day course of antibiotics, as directed by wound cultures from the infected IPP, and was discharged 3 days postoperatively. Cystography several weeks postoperatively documented bladder integrity, and all catheters and drains were subsequently removed.

After complete recovery, in November of 2011, he was successfully reimplanted with a Coloplast Titan Narrow IPP (Minneapolis, MN, USA). The cylinder–pump combination was implanted via a long penoscrotal incision, and the reservoir was

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**Figure 1.** Non-contrast axial CT scan reveals AMS reservoir located completely within the urinary bladder; inflammatory reaction is seen in peri-vesical space at site of erosion.

placed under direct vision through a low midline abdominal incision. Reimplantation in this setting was quite challenging because of severe intracorporal fibrosis. However, reimplantation was successful and, with 7 months follow-up, the patient currently has a functioning, non-infected IPP that has been satisfactory for sexual activity.

## COMMENT

Intravesical placement or erosion of an IPP reservoir is an infrequent but severe complication of IPP insertion, replacement or infection. A number of prior publications have described IPP reservoir complications. Possibly the first two published cases of IPP reservoir erosion were described by Leach *et al.*<sup>1</sup> in 1984. One case involved reservoir erosion into the sigmoid colon in a patient who had previously undergone radical cystectomy; the other involved intravesical erosion in a patient with multiple sclerosis-related neurogenic bladder. Both patients were treated with complete explantation.

In 1986, Fitch<sup>2</sup> reported a case of intravesical reservoir erosion subsequent to an AMS 700 pump replacement, which was done to correct a tubing fracture. They speculated that the erosion occurred during reinflation of the existing reservoir, which caused the fibrous capsule around the reservoir to 'pop' and lacerate the adjacent bladder. During surgical exploration, a stellate bladder laceration was found and repaired. The old reservoir was removed and a new reservoir was inserted, resulting in a successful outcome. They advised prompt revision after a fluid leak is detected, to avoid formation of a thickened capsule around the reservoir.

In 1987, Godiwalla *et al.*<sup>3</sup> described erosion of an IPP reservoir into an ileal conduit in a patient who had undergone a radical cystectomy. This complication occurred subsequent to intraperitoneal IPP reservoir insertion during a revision procedure. Based on their case, they believed that 'placement of reservoirs intraperitoneally risks erosion into the bowel,' and we believe this remains true to this day.

In 1988, Dupont<sup>4</sup> reported erosion of an AMS 700 IPP reservoir into the bladder, 4 years after initial implantation, associated with bladder calculi on the reservoir. In this case there was no associated urinary tract or peri-prosthetic infection, and complete explantation was carried out.

In 1999, Munoz<sup>5</sup> described a patient who had a three-component IPP placed, but 2 years later had the cylinders and pump removed and replaced with a two-component IPP. Two years thereafter, with no signs of urinary tract or peri-prosthetic infection, he developed intravesical erosion of the defunctio-

nalized IPP reservoir, requiring laparotomy and reservoir removal. This case demonstrates that a retained, defunctionalized reservoir may cause delayed intravesical erosion.

In 2002, Jones *et al.*<sup>6</sup> reported four cases of intravesical erosion of retained, defunctionalized IPP reservoirs in patients who only had their cylinders and pump removed. These patients presented 3–15 years (mean 7 years) postoperatively, and required either endoscopic or open-reservoir removal. They concluded that 'erosion of retained prosthetic materials can have disastrous consequences,' which could have been avoided if complete explantation had been carried out initially.

In 2004, Rajpurkar *et al.*<sup>7</sup> published a series of 98 IPP revision surgeries in 85 patients. It was their practice to insert new cylinders, pump and reservoir, but to leave the original reservoir *in situ*. With a mean of 50 months of follow-up, they reported one infection, and no complications related to the originally retained reservoir. They concluded that routine removal of the original reservoir was not required during three-component IPP replacement.

In 2005, Brusky *et al.*<sup>8</sup> reported a case in which a retained, defunctionalized reservoir eroded into the bladder in a patient who underwent prior sigmoid colectomy, and also received external-beam radiotherapy for prostate cancer. Also in 2005, Park *et al.*<sup>9</sup> reported a case of reservoir erosion into the bladder in a patient who underwent two prior revision surgeries. There was no sign of peri-prosthetic infection in their case. They speculated that shortened tubing may have predisposed to this complication.

In 2009, Kramer *et al.*<sup>10</sup> reported two cases of intra-operative bladder perforation that occurred during reinflation of the original IPP reservoir, subsequent to cylinder and pump replacement. Both required bladder repair and reservoir repositioning. They believed that during reservoir reinflation, the capsule around the reservoir somehow stretched and lacerated the bladder.

In 2010, Eldefrawy<sup>11</sup> reported a case in which an IPP reservoir was inadvertently placed into the bladder. This patient had a prior radical prostatectomy, and had the reservoir inserted via the trans-inguinal route. Cystostomy and reservoir repositioning resulted in a successful outcome.

In 2012, Henry *et al.*<sup>12</sup> reviewed 195 clinically uninfected IPP revision procedures done by multiple urologists at four institutions. They noted one case of iatrogenic bladder laceration, but did not elaborate further.

Anecdotally, many other IPP reservoir-related complications have occurred, but have not been published in the urologic literature. Thus the use of evidence-based medicine (that is, relying on published series) yields an incomplete view of these complications. One notorious case from Philadelphia involved a patient who had a prior radical prostatectomy; this patient suffered inadvertent placement of an IPP reservoir into his bladder. There was a delay in diagnosis, a subsequent medical malpractice lawsuit and a settlement of \$650 000.<sup>13</sup> This underscores the seriousness of this complication, and should prompt all prosthetic urologists to take great care to avoid similar situations.

Our review has identified three general mechanisms whereby an IPP reservoir may injure the bladder:

1. Gradual erosion into the bladder;
2. Inadvertent surgical placement into the bladder; and
3. Laceration of the bladder when an IPP reservoir is reinflated during a revision procedure.

As seen in the present case report, gradual intravesical reservoir erosion may occur because of peri-prosthetic infection that is allowed to linger. If an infection is allowed to smolder and is not treated surgically, this will predispose to erosion of the reservoir into the bladder, erosion of the cylinders into the urethra and/or erosion of the pump through the skin. In patients with peri-prosthetic infection, the way to avoid this scenario is via prompt explantation and/or salvage procedure. Wilson<sup>14</sup>

published a recent review, which gives up-to-date guidance as to which patients are optimal candidates for a salvage procedure, versus those who are better suited for immediate explantation and delayed reimplantation.

There is conflicting evidence concerning the need to routinely remove an IPP reservoir during revision for mechanical malfunction. In patients with mechanical failure of a Coloplast IPP, the most common site of leakage is owing to a crack in the silicone tubing near the strain reliefs on the pump.<sup>15</sup> The author's preference in this scenario is to either reuse the reservoir (example, wash it out, confirm its integrity and attach it to a new cylinder-pump combination), or remove all old components and insert all new components. The pros and cons of either approach should be discussed with the patient preoperatively, and revision washout with antibiotic and antiseptic solutions is done in both instances. A lower abdominal incision may be required to replace an IPP reservoir, and patients should be so informed. When replacing a reservoir, the author routinely obtains a preoperative pelvic CT with oral contrast; this will precisely localize the reservoir, and greatly facilitate its replacement. A defunctionalized reservoir serves no purpose; rather, it can only cause trouble in the future. Consequently, the author does not leave defunctionalized reservoirs *in situ*.



**Figure 2.** Titan CL Cloverleaf reservoirs in 75 and 125 cm<sup>3</sup> sizes. Courtesy of Coloplast. [www.us.coloplast.com](http://www.us.coloplast.com)



**Figure 3.** AMS regular and flattened Conceal reservoirs. Courtesy of American Medical Systems. [www.americanmedicalsistemas.com](http://www.americanmedicalsistemas.com)

Some cases of inadvertent reservoir placement into the bladder have occurred during inguinal reservoir insertion in patients with prior pelvic surgery (for example, radical prostatectomy). This complication may also occur if the surgeon does not drain the bladder before reservoir insertion. The author's method to avoid inadvertent reservoir placement into the bladder is as follows:

1. The bladder is drained *immediately* before placing the reservoir.
2. Trans-inguinal reservoir insertion is only used in patients with no prior pelvic surgery or hernia repair.
3. Direct-vision reservoir insertion, via a counter-incision or via an infrapubic approach, is used in patients with prior pelvic surgery or hernia repair.

Obedying these principles has resulted in no instances of inadvertent reservoir placement into the bladder in over 2500 IPP procedures. However, the price for this margin of safety is a more liberal use of a counter-incision or an infrapubic approach. In addition, the author believes, it is very helpful to install an IPP reservoir in such a way that it will be easily accessible in the future. This forethought greatly facilitates any subsequent revision surgeries. A number of authors<sup>7,16</sup> have described methods for ectopic reservoir placement. However, long-term follow-up of the fate of ectopically placed reservoirs is not yet available.

Bladder laceration has been reported during IPP reservoir reinflation. Reservoir reinflation may be required when reusing an old reservoir, or when correcting a reservoir contracture. The author's method of avoiding bladder injury in this situation is to completely drain the bladder *immediately* before reinflating the reservoir, and to routinely install the reservoir anterior to the bladder. Although it may be helpful to revise these patients soon after a leak has occurred, many times this is not possible.

In summary, there are too few reported cases, and no randomized controlled trials, to allow us to make unequivocal recommendations on any of the above topics. In an attempt to improve their reservoir configuration, Coloplast has recently transitioned to a Titan CL Cloverleaf reservoir (Figure 2). American Medical Systems has recently introduced a flattened Conceal reservoir in addition to its standard round reservoir (Figure 3). It is unclear whether these new reservoir configurations will decrease the rate of reservoir-related complications. However, adherence to the aforementioned surgical principles may decrease the likelihood of a bladder-related reservoir complication.

#### CONFLICT OF INTEREST

Dr Bruce Garber has served as an occasional consultant to Coloplast and to American Medical Systems. Dr Andrew Morris declares no conflict of interest.

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