Case - Artificial urinary sphincter pressure-regulating balloon perforation following increased intra-abdominal pressure

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INTRODUCTION

Stress urinary incontinence (SUI) following prostatectomy can persist in 8–25% of patients.[1,2] Conservative management with pelvic floor physiotherapy is the initial recommendation to patients.[3] In contrast, persistent incontinence despite pelvic floor therapy might require a surgical approach using an artificial urinary sphincter (AUS), male slings, and periurethral balloons.[3]

The AUS consists of an inflatable urethral cuff, a pump secured within the scrotum, and a pressure-regulating balloon (PRB). When activated, the pump transfers fluid from the cuff to the PRB, temporarily deactivating the cuff and allowing urine to pass.[4] AUS is currently considered the modality of choice for refractory urinary incontinence in men.[5] Despite its efficacy, it has documented complications, such as urethral atrophy, erosion, infection of hardware, and mechanical failure (e.g., leakage, perforation) requiring surgical revisions.[6]

CASE REPORT

A 62-year-old male opera singer with a history of robotic-assisted laparoscopic prostatectomy in 2018 and subsequent AUS implantation in 2023 presented to our urology clinic complaining of urinary incontinence. The patient disclosed that he noticed urine leakage after singing forcefully while seated and leaning forward with a full bladder. He attempted to reactivate the pump to no avail. He underwent a computed tomography (CT) scan of the abdomen, demonstrating a lack of fluid within the PRB (Figure 1A). Furthermore, the cystoscopic evaluation revealed a patent urethra without signs of urethral erosion from the cuff.

He was scheduled for a revision of the AUS. Intraoperatively, a 2 mm defect was observed in the PRB (Figure 1B), which was then replaced and returned to its position in the rectus sheath. The patient was discharged home the same day with the AUS inactive.

DISCUSSION

Urinary incontinence following prostatectomy is the strongest predictor of patient quality of life.[7] While most patients regain continence within two months of surgery,[8] incontinence persists in 8–25% of patients.[1,2] Population-based data show that only a small proportion of men ultimately require surgical intervention, with cumulative rates of AUS or sling procedures reaching 4.8% at 15 years post-prostatectomy.[9] For these patients, AUS is the gold standard surgical intervention,[5] with a meta-analysis showing a significant reduction in pad usage and improvement in the frequency of no-pad use for at least one day.[10] Despite its efficacy, complications and recurrent incontinence remain clinically relevant, and guidelines emphasize a structured diagnostic workup to identify the underlying etiology.[11]

Current guidelines identify infection, erosion, urethral atrophy, and mechanical failure as the main causes of postoperative incontinence.[11] Infection requires urgent explantation of AUS, while cystoscopy is recommended for the other etiologies. If there is evidence of erosion, urgent explantation with long-term urethral catheterization is required following cystoscopy. Otherwise, further workup with cross-sectional imaging is needed to assess the volume of PRB fluid.

A diminished fluid indicates mechanical failure requiring revision, whereas normal volumes (>20 mL) suggest urethral atrophy or sizing issues, potentially managed with cuff downsizing or parameter adjustment. Additional evaluation with history, uroflowmetry/postvoid residual, ultrasound or contrast X-ray, and selective urodynamics may identify bladder dysfunction.[12]

Within this framework, our case illustrates a novel mechanism of mechanical failure, which is due to

KEY MESSAGES

- Artificial urinary sphincter failure can result from increased intra-abdominal pressure.
- Patients with activities that increase intra-abdominal pressure (e.g., singing, straining, constipation) may be at risk of balloon rupture.
- Sudden urinary incontinence in a patient with a functioning device should raise suspicion for mechanical failure.
- Clinicians should include lifestyle-related pressure factors in preoperative counseling and postoperative assessment.

increased intra-abdominal pressure leading to perforation of the PRB. Our patient, a 62-year-old male, developed sudden urinary incontinence following forceful singing with a distended bladder. Radiologic and cystoscopic findings suggested balloon perforation, which was confirmed intraoperatively as a 2 mm defect in the PRB. Our case highlights the potential impact of intra-abdominal pressure on AUS failure. We postulate that forceful singing while seated in a bent-forward position with a full bladder generated enough intra-abdominal pressure that led to the perforation of the PRB. Placement within the rectus sheath might have contributed due to compression by abdominal muscles. Hernandez et al documented a 0.8% leak rate in 612 patients who underwent an alternate placement of the PRB.[13]

Mechanical failure due to circuit leakage has been reported in up to 52.5% of cases, most commonly involving balloon or pump dysfunction (e.g., internal air deformations).[3] Reservoir leakage has also been reported in penile prosthesis implants, which share structural similarities with AUS.[14] Known risk factors for leakage are material fatigue and patient-specific factors, like body mass index or prior radiation therapy.[13] Nevertheless, increased intra-abdominal pressure has not been previously recognized as a cause of PRB perforation. This report underscores the need for further investigation into the role of intra-abdominal pressure in device integrity and highlights the importance of individualized patient counseling to mitigate such risks.

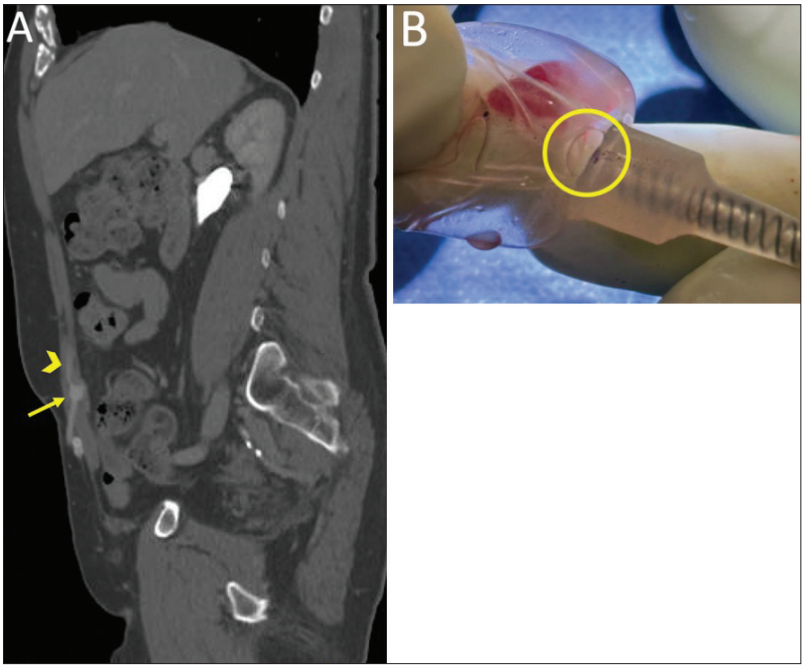

Figure 1. Computed tomography (CT) scan and gross visualization of the pressure-regulating balloon (PRB). (A) A sagittal CT image showing the membranous collapsed PRB (arrowhead) connected to the tubing (arrow) with no discernible fluid collection. (B) Intraoperative photo showing the PRB with visible perforation (circle).

CONCLUSIONS

AUS implantation remains the gold standard for managing refractory SUI, offering significant improvement in patient quality of life.[5] Nevertheless, complications such as urethral atrophy, infection, and mechanical failure may necessitate surgical revision.[6]

In our case, we present a rare instance of delayed PRB perforation in a 62-year-old opera singer, which was likely precipitated by increased intra-abdominal pressure during forceful singing. This case highlights an uncommon mechanism of mechanical failure resulting in sudden urinary incontinence years after AUS implantation. Accordingly, clinicians should inquire about activities that can elevate intra-abdominal pressure, such as excessive straining, singing, or constipation, when evaluating patients with sudden incontinence, as they may provide important diagnostic clues.

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