



# Spontaneous rupture of a bladder diverticulum with delayed open surgical repair

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## ABSTRACT

Spontaneous rupture of a bladder diverticulum is a rare entity typically associated with tissue weakness, bladder outlet obstruction, increased intra-abdominal pressure, or inflammation. Diagnosis is most often achieved via cystogram with a reported role for pelvic ultrasound. Extraperitoneal ruptures are typically treated with catheterization and antibiotics while intraperitoneal ruptures are most frequently treated with immediate surgical intervention. In this case, an adult female presented with an intraperitoneal rupture with no clear inciting event with diagnosis confirmed by pelvic transvaginal ultrasound following a non-diagnostic cystogram. The patient was treated successfully with delayed open surgical repair.

## 1. Introduction

Spontaneous rupture of a bladder diverticulum is a rare entity with reports of prior cases associated with congenital tissue weakness or acquired weakness due iatrogenic injury, chronic inflammation, or chronic bladder outlet obstruction exacerbated by increased intra-abdominal pressure or acutely worsened inflammation.<sup>1,2</sup> In this case, an adult patient presented with spontaneous bladder diverticulum rupture without clear etiology, successfully treated with delayed surgical repair.

## 2. Case presentation

A 43-year-old female with a history of congenital right ureteral duplication, appendectomy, two prior Caesarian sections, remote recurrent UTIs, and endocervical adenocarcinoma *in situ* treated with robotic-assisted laparoscopic hysterectomy and salpingectomy three years prior to presentation presented to our institution with acute onset abdominal pain. Per chart review of her hysterectomy course, her gynecologist noted that adhesions made dissection of the lower uterine segment from the bladder difficult, and the patient had difficulty voiding for several days post-operatively. Two years after hysterectomy, the patient developed recurrent post-coital UTIs. Urogynecology evaluation with cystoscopy was delayed due to the COVID-19 pandemic.

On the day of presentation, the patient was awoken from sleep with

sudden, moderate intensity, suprapubic and right lower quadrant abdominal pain that became severe with urination and defecation. The patient had associated nausea and vomiting. The patient was able to urinate, though small volume, with accompanying hesitancy and incomplete emptying. The patient denied fever, dysuria, hematuria, or back pain and had no preceding trauma.

Upon evaluation, the patient was hemodynamically stable and non-toxic appearing with a non-peritonitic abdomen and laboratory studies within normal limits. Her white blood cell count was 8.4 thousand/ $\mu$ L. Computed Tomography (CT) abdomen and pelvis with contrast showed a posterior bladder dome diverticulum and intraperitoneal free fluid in the pelvis. Transvaginal pelvic ultrasound demonstrated an active fluid jet from the posterior wall of the bladder diverticulum into slightly complex pelvic free fluid (Fig. 1). CT cystogram showed an increased volume of intraperitoneal free fluid with layering contrast and a 2.9  $\times$  2.5 cm bladder diverticulum with an irregularity along the anterior surface of the diverticulum but no clear perforation (Fig. 2). Given the suggestion of possible perforation, an indwelling urinary Foley catheter was placed, and the patient was admitted to the Urology service with plan for exploratory laparotomy within the next few days since the patient was hemodynamically stable and non-peritonitic with non-definitive imaging findings.

On hospital day 2, serum creatinine increased to 1.25 mg/dL though the patient remained stable and non-peritonitic. The patient had pain

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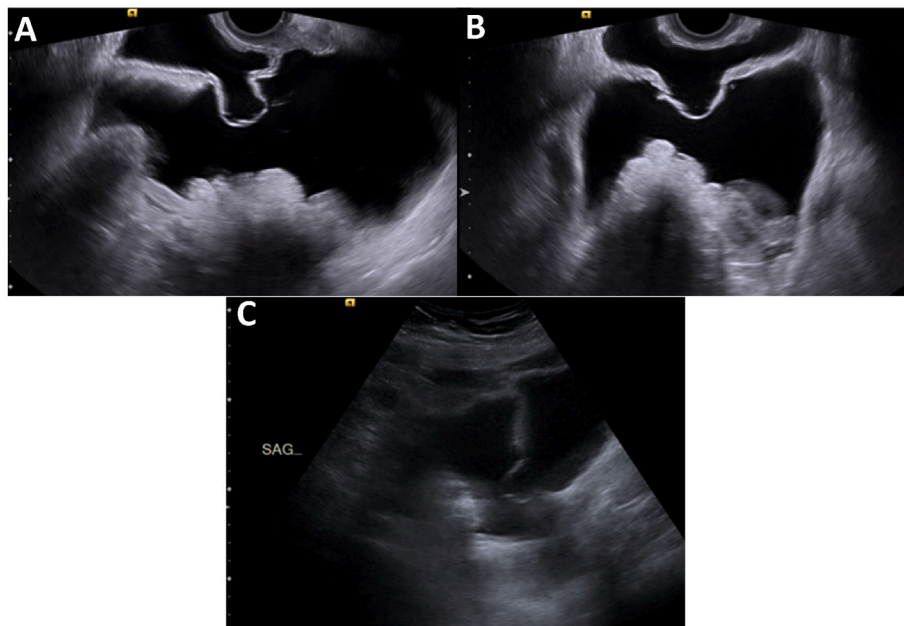
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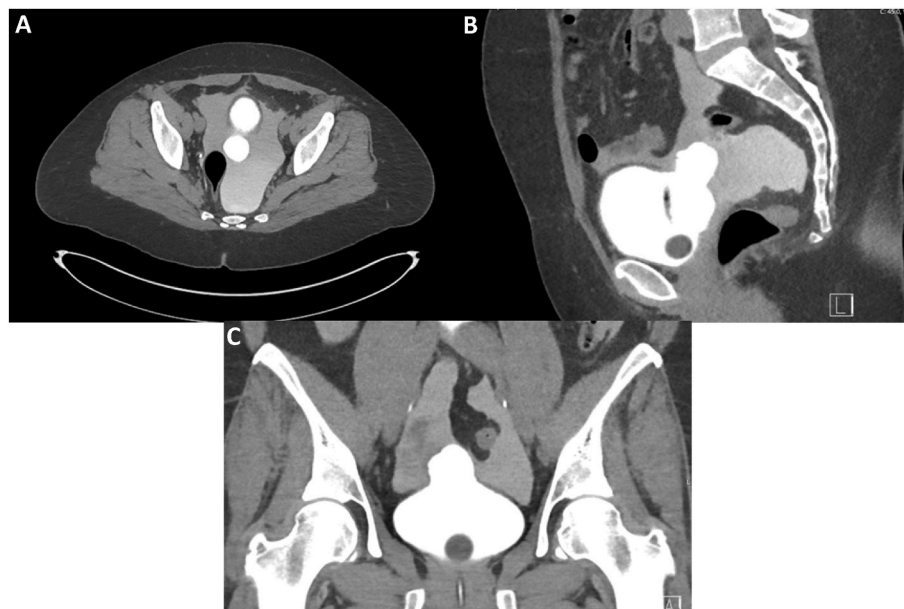
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**Fig. 1.** Pelvic ultrasound of the perforated bladder diverticulum. (A) Sagittal transvaginal ultrasound demonstrating a posterior bladder diverticulum with a fluid jet from perforation and intraperitoneal free fluid. (B) Transverse transvaginal ultrasound demonstrating bladder diverticulum and free fluid. (C) Sagittal trans-abdominal ultrasound of the diverticulum and free fluid.



**Fig. 2.** CT cystogram showing a posterior bladder diverticulum in transverse (A), sagittal (B), and coronal planes (C).

episodes correlating with periods of decreased Foley drainage that were controlled with a belladonna and opium suppository. Since CT cystogram did not show definite perforation, CT urogram was performed and demonstrated a decreased amount of pelvic free fluid, no evidence of bladder perforation, and no appreciable diverticulum in addition to right proximal ureteral duplication with fusion distally around the mid-ureter. On admission day 3, serum creatinine returned to baseline.

Given the imaging findings of possible perforation, on hospital day 4, the patient underwent exploratory laparotomy via a low midline incision. Upon entry into the abdomen, the bladder was exposed, and the posterior bladder was well visualized. Sterile saline was instilled into the bladder, and a posterior bladder dome diverticulum with pinhole perforation at the tip of the diverticulum was identified, which was

communicating with the intraperitoneal space. The diverticulum was excised, and the bladder was closed in two layers. A Jackson-Pratt (JP) drain was placed, and the incision was closed. The patient recovered well post-operatively with normal JP drain creatinine. The patient was discharged on post-operative day 4 after issues with pain control. Follow-up voiding cystourethrogram two weeks after discharge showed no evidence of bladder leak. Pathology of the excised diverticulum demonstrated reactive surface epithelium and underlying muscularis propria with no carcinoma.

### 3. Discussion

Spontaneous rupture of a bladder diverticulum is rare with

approximately 15–20 reported cases.<sup>1</sup> Previously reported cases have occurred in the setting of acutely worsening bladder inflammation and/or increased intra-abdominal pressure.<sup>1–3</sup> These cases presented with acute-onset abdominal pain, post-void abdominal pain, distension, urinary ascites, or biochemical evidence of pseudo-acute renal failure due to auto-dialysis of urine.<sup>1–3</sup> Definitive diagnosis of spontaneous rupture has mostly been reported with CT cystogram visualizing the diverticula and the perforation although a role for ultrasound has been reported if CT cystogram is non-diagnostic.<sup>2,4,5</sup> Most cases of extraperitoneal bladder diverticulum rupture have been treated with urinary catheterization and intravenous antibiotics.<sup>5</sup> Immediate surgical repair, either open or laparoscopic, is most common for intra-peritoneal ruptures, although non-operative management has been performed successfully.<sup>1–3</sup>

This patient's bladder diverticulum was likely formed due to iatrogenic causes during hysterectomy. Possibly, urinary stasis resulted in recurrent infections causing further weakening that was further stressed by recent heavy lifting. However, there was no straining or acutely worsened inflammation at symptom onset unlike in most prior cases. Her clinical presentation with abdominal pain worsened by voiding and elevated creatinine is consistent with prior reports, though the patient did not display significant distension or urinary ascites. CT cystogram was not definitively diagnostic, although transvaginal ultrasound clearly demonstrated the site of perforation, suggesting a diagnostic role for ultrasound. Open surgical repair was performed on hospital day 4 without complication suggesting that delayed repair is viable in a hemodynamically stable and non-peritonitic patient.

#### 4. Conclusions

Spontaneous intraperitoneal rupture of a bladder diverticulum is an uncommon cause of acute abdominal pain that can present with pain worsened by voiding and biochemical evidence of acute renal failure. CT cystogram should be first-line in evaluation, although there is a role for pelvic ultrasound in some unclear cases. In cases of intraperitoneal rupture in stable, non-peritonitic patients, delayed open surgical repair may be considered a feasible strategy.

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#### Author contributions

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#### Declaration of competing interest

There are no directly relevant conflicts of interest to declare from any author.

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#### ABBREVIATIONS

UTI: Urinary Tract Infection  
CT: Computed Tomography  
JP: Jackson-Pratt