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CASE REPORT

A case of gangrenous cystitis with bilateral hydronephrosis 10 years after radiotherapy

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Abstract

An 84-year-old woman who was admitted for protein-losing gastroenteropathy associated with radiation enteritis 10 years after pelvic radiotherapy developed pyelonephritis. She became anuric despite having an indwelling bladder catheter. Imaging studies revealed bladder wall thickening, bilateral hydroureter formation, and hydronephrosis. Autopsy findings led to a diagnosis of gangrenous cystitis (GC). Our case indicates that radiation-induced late effects may be an indirect cause of GC, not a direct cause as previously suggested, and that GC may induce bilateral vesicoureteral junction obstruction.

KEYWORDS
bilateral hydronephrosis, gangrenous cystitis, hypoalbuminemia, radiation-induced arteriopathy, radiation-induced late effects, urinary tract infection

1 | BACKGROUND

Gangrenous cystitis (GC) has been extremely rare since the advent of antibiotic therapy. There have been only 33 cases in the 75 years up to 2010,[1] and after that, only 10 cases have been reported in PubMed. Diagnosis could be delayed because of its nonspecific presentation, such as lower abdominal pain, dysuria, and pyuria, which contributes to high morbidity and mortality.[2]

However, the exact pathogenesis of bladder wall necrosis remains unknown. Causes were classified as indirect and direct.[1,3–6] Indirect factors are reduced blood flow and nutrition supply to the bladder, including chronic retention with overdistention, extravesical pressure, and occlusion of major vessels. In contrast, direct factors lead to cell death because of damage to the bladder wall and include various chemicals injected into the bladder, pelvic irradiation, and infection.

There are thus far no reports that radiation-induced late effects can be an indirect cause. There have also been no reports of bilateral hydronephrosis because of GC. Herein, we report a case of a patient with protein-losing gastroenteropathy 10 years after radiotherapy who developed GC and presented with bilateral ureteral obstruction.

2 | CASE PRESENTATION

An 84-year-old woman was admitted to our hospital with worsening hypoalbuminemia. At the age of 74 years, she was diagnosed with

uterine cancer and underwent uterine resection and radiation therapy for postoperative vaginal recurrence. At the age of 79 years, she was hospitalized for radiation proctitis. Five months prior to admission, the patient developed progressive edema in the bilateral lower extremities. Laboratory studies showed progressive hypoalbuminemia (Alb 1.4 g/dL). By 99mTc-DTPA-HSA scintigraphy and oral double-balloon enteroscopy, she was diagnosed with protein-losing gastroenteropathy because of chronic radiation enteritis.

Oral prednisolone 40 mg/day was commenced, and serum albumin was stabilized at around 2.0 g/dL. The prednisolone dose was reduced by 5 mg/day every 2 weeks and maintained at 20 mg/day. On Day 40, she developed adhesive small bowel obstruction (SBO). Conservative treatment relieved the SBO, however, the patient became oliguric, and a bladder catheter was inserted. Urinary drainage from the catheter was adequate. On Day 52, she became febrile owing to pyelonephritis and was successfully treated with antibiotics.

On Day 70, the patient became drowsy. Suspecting the reemergence of pyelonephritis, antibiotics were initiated. Urine and blood cultures were positive for *E. faecium*. Based on antibiotic sensitivity findings, we initiated vancomycin but later changed treatment to minomycin because of impaired renal function. After commencing antibiotics, her consciousness improved as the infection resolved. However, her edema worsened, and urine output from the catheter decreased. Suspecting a decrease in intravascular volume because of hypoalbuminemia, albumin was supplemented; however, her urine output continued to decline. Computed tomography (CT) revealed bladder wall thickening with high-density adhesions, full-length dilation of bilateral ureters, and bilateral hydronephrosis (Figure 1). Despite daily bladder lavage, the patient's bilateral hydronephrosis worsened, and acute anuric kidney injury was developed. Although the white blood cell counts were normalized by treatment with antibiotics, the patient died of sepsis on Day 88. On pathological autopsy, it was observed that the entire bladder, including both ureteral orifices, was necrotic (Figure 2), and fibrous adhesions were observed in the small intestine in contact with the bladder. Considering

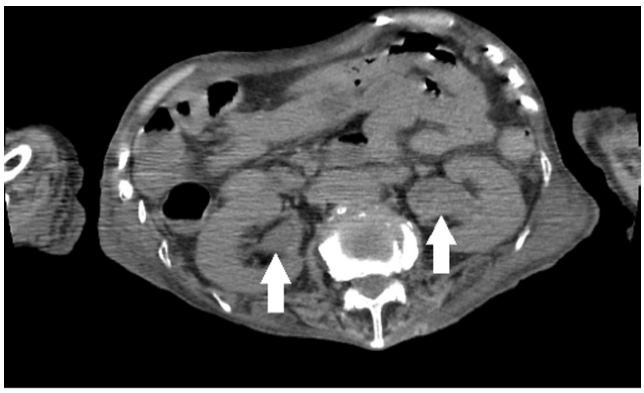

FIGURE 1 CT revealing bladder wall thickening, full-length dilation of bilateral ureters, and bilateral hydronephrosis (white arrow).

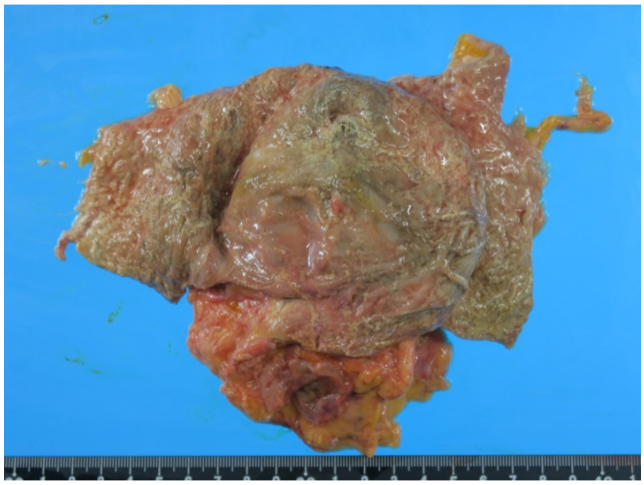

FIGURE 2 Entire bladder is necrotic on pathological autopsy.

all findings, we diagnosed the patient with GC after uterine cancer surgery and radiation therapy.

3 | DISCUSSION

Our case indicates that radiation-induced late effects may be an indirect as well as a direct cause of GC. The patient was malnourished and in an immunocompromised state because of steroid use, but these alone could not explain the necrosis of the entire bladder. The irradiation field at the time of radiotherapy covered the pelvic organs, including the bladder. Moreover, fibrosis, a pathologic feature of radiation enteritis, was observed in the small intestine adherent to the bladder. Therefore, radiation affects not only the small intestine but also the bladder.

Radiation-induced late effects can induce necrosis in the bladder wall. In 1945, radiotherapy was identified as a direct cause of GC in a literature review.[5] Since then, there has been only one case report of GC after radiotherapy.[6] This case report showed that after 20 years of radiotherapy for cervical carcinoma, a 67-year-old woman experienced necrosis of the bladder, except the trigone. The authors found a full-thickness infarction and focal irradiation obliterative endarteritis microscopically and suggested that radiation-induced late effects are a direct causative factor in GC.

Irradiation of blood vessels damages endothelial cells and accelerates each stage of atherosclerosis through the exact mechanism of spontaneous atherosclerosis, resulting in radiation-induced arteriopathy (RIA).[7,8] With radiation-induced fibrosis of the perivascular tissue, RIA increases the incidence of cardiovascular complications such as stroke, coronary artery disease, and critical limb ischemia. In our case, we hypothesized that the bladder was vulnerable to ischemia because of RIA. Malnutrition and immunocompromised status could contribute to refractory urinary tract infection, which increases the oxygen demand of the bladder tissue. Therefore, prolonged ischemia may lead to necrosis of the entire bladder. Thus,

radiation-induced late effects may be an indirect causative factor in GC.

We also found that GC can cause bilateral vesicoureteral junction obstruction. Imaging studies, such as CT, ultrasound, and cystoscopy, can be very helpful for diagnosing GC.[1,9] The CT image of our case showed an entire thickened bladder wall, dilation of the ureter above the vesicoureteral junction, bilateral hydroureter, and hydronephrosis. To the best of our knowledge, there have been no reports of hydronephrosis caused by GC. There are several reports of emphysematous cystitis (EC) causing bilateral hydronephrosis.[10] Emphysematous cystitis is characterized by gas within the bladder wall and lumen caused by gas-forming microbes. However, based on the absence of air in the bladder wall and no emphysematous changes in the excised bladder mucosa, we diagnosed the patient with GC rather than EC. Our case suggests that bladder tissue necrosis and edema associated with hypoalbuminemia may cause obstruction of the vesicoureteral junction.

Recent advancements in cancer treatment enables half of patients who undergo radiotherapy to achieve long-term survival beyond 10 years. Such patients have potential to develop late complications of RIA.[8] As they get older, they are more likely to have comorbidities that lead to malnutrition and weakened immune systems. This indicates that GC could be less uncommon than previously thought. In addition, such patients are increasingly cared for by general physicians after oncologists' follow-up is completed.

4 | CONCLUSION

Physicians should consider GC a possible diagnosis when a patient with a history of pelvic radiotherapy develops urinary retention, hydronephrosis, or sepsis.

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CONFLICT OF INTEREST STATEMENT

The authors state that they have no conflict of interest to declare.

PATIENT CONSENT STATEMENT

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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REFERENCES

1. Hinev A, Anakievski D, Krasnaliev I. Gangrenous cystitis: report of a case and review of the literature. Urol Int. 2010;85:479–81.
2. De Rosa A, Amer T, Waraich N, Bello A, Parkinson R. Gangrenous cystitis in a 42-year-old male. BMJ Case Rep. 2011;2011:bcr1120103526.
3. Rai R, Sikka P, Aggarwal N, Shankaregowda SA. Gangrenous cystitis in a woman following vaginal delivery: an uncommon occurrence – a case report. J Clin Diagn Res. 2015;9:13–4.
4. Manikandan R, Mehra K, Dorairajan L, Bokka S. Gangrenous cystitis: an extremely rare infectious condition managed by neobladder – a case report with review of literature. Urol Ann. 2019;11:317–9.
5. Cristol DS, Greene LF. Gangrenous cystitis. Surgery. 1945;18:343–6.
6. Devitt AT, Sethia KK. Gangrenous cystitis: case report and review of the literature. J Urol. 1993;149:1544–5.
7. Modrall G, Sadjadi J. Early and late presentations of radiation arteritis. Semin Vasc Surg. 2003;16:209–14.
8. Delanian S. Is radiation-induced arteriopathy in long-term breast cancer survivors an underdiagnosed situation?: a critical and pragmatic review of available literature. Radiother Oncol. 2021;157:163–74.
9. Ballas K, Rafailidis S, Pavlidis T, Marakis G, Psarras K, Anagnostara E, et al. Gangrenous cystitis. Int Urogynecol J. 2007;18:1507–9.
10. Gbadamosi WA, Miller A. An unusual case of complicated urinary tract infection: emphysematous cystitis. Cureus. 2021;13:e13590.

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