Gas in the kidney: a case of emphysematous pyelonephritis in a patient with uncontrolled diabetes mellitus

Abdul Wahab,¹ Muhammad Hashim Hayat,² Amman Yousaf ,³ Raseen Tariq⁴

¹Internal Medicine, The University of Iowa Healthcare, Iowa City, Iowa, USA

²Department of Medicine Division of Gastroenterology, Hepatology and Nutrition, Vanderbilt University Medical Center, Nashville, Tennessee, USA

³Internal Medicine, McLaren Health Care Corp, Flint, Michigan, USA

⁴Gastroenterology and Hepatology, Mayo Clinic Minnesota, Rochester, Minnesota, USA

Correspondence to
Dr Amman Yousaf;
ayousafmd2@gmail.com

Accepted 24 June 2021

DESCRIPTION

A 22-year-old woman with a history of type 1 diabetes mellitus (DM) presented with nausea, vomiting and epigastric discomfort for 3 days. On presentation, she had blood pressure of 80/50 mm Hg and a heart rate of 120 bpm. No significant findings were noted on systemic physical examination. She was resuscitated with intravenous fluids and started on insulin drip for a blood glucose level of 800 mg/dL. Labs were significant for a white cell count of $20 \times 10^9/L$, lactic acid of 54 mg/dL, bicarb of 26 mEq/L, anion gap of 10 and haemoglobin A1c of 18.2%. Urinalysis showed +2 leucocyte esterase, too numerous to count white blood cells and bacteria and negative nitrite. She was admitted as a case of hyperosmolar hyperglycemic state precipitated by possible urinary tract infection (UTI). She was started on ceftriaxone for UTI. Blood cultures came positive for Gram-negative bacilli. The next day, she reported of nonradiating right-sided flank pain of moderate intensity. CT scan of the abdomen and pelvis was done, which showed markedly enlarged right kidney with gas in the lower pole and a small volume of gas in the collecting system consistent with emphysematous pyelonephritis (EP) (figure 1A,B). Antibiotics were tailored to meropenem as per infectious diseases team recommendations. The urology team recommended continuing with medical treatment as the patient was improving clinically. Final blood and urine cultures showed *Enterobacter cloacae* sensitive to meropenem. She completed 14 days of antibiotics and improved symptomatically, and a follow-up imaging revealed total resolution of infection. Unfortunately, due to patient's noncompliance to the insulin use leading to uncontrolled DM (repeated HbA1c of 16.1 %),

our patient suffered from another episode of EP in the left kidney 1 year later, which was also treated medically (figure 1C).

EP is an acute necrotising infection of renal parenchyma and surrounding tissues, which leads to gas formation. It is associated with a mortality rate of up to 21%, but patients can have excellent prognosis with medical management without the need for invasive interventions.¹ DM is the most common risk factor for EP and has been reported in up to 95% of patients with EP. Other common risk factors include urinary tract obstruction, female gender and age ≥ 60 .² The pathogenesis of EP is not completely understood, and it is considered multifactorial. The proposed mechanism is that high tissue glucose levels and poor blood supply to renal parenchyma in patients with diabetes facilitate the microenvironment for gas-forming pathogens.¹ The most common bacteria to cause EP is *Escherichia coli*, followed by *Proteus*, *Klebsiella*, *Pseudomonas* and *Enterococcus*, which have also been reported as the causative microorganisms.² Usual symptoms include nausea, vomiting, flank pain, dysuria and fever. CT scan is the preferred imaging modality for diagnosis and shows air in the renal parenchyma or surrounding tissues. Radiological findings help with the estimation of prognosis and guide therapy. Initial treatment includes resuscitation with intravenous fluids, empiric antibiotics to cover Gram-negative organisms (cephalosporin, fluoroquinolones, β -lactamase inhibitors etc), glycaemic control and maintaining systolic blood pressure above 100 mm Hg.² Definitive treatment depends on the radiological findings and includes

Figure 1 CT abdomen and pelvis. Coronal view (A) and axial view (B) showing enlarged right kidney with gas in the lower pole (white arrow). Coronal view (C) demonstrating enlarged left kidney and gas in the collecting system (white arrow; second episode of EP after 1 year of the first episode). EP, emphysematous pyelonephritis.

Learning points

- ▶ Emphysematous pyelonephritis is a urological emergency with a very high mortality rate if not managed timely. Usually, the patients respond well to the antibiotics if other contributing factors, especially a high blood glucose level, are managed well.
- ▶ A high index of suspicion and a low threshold in performing imaging in patients with urinary tract infection and suspicion of pyelonephritis can result in an earlier diagnosis.
- ▶ Our case also highlights that noncompliance to the diabetes mellitus treatment leading to poor glycaemic control can result in the recurrence of the disease in ipsilateral or contralateral kidney.

© BMJ Publishing Group Limited 2021. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Wahab A, Hayat MH, Yousaf A, et al. *BMJ Case Rep* 2021;**14**:e243891. doi:10.1136/bcr-2021-243891

medical management with or without percutaneous drainage or percutaneous drainage and nephrectomy.³ Antibiotics should be switched based on final cultures and local antibiogram.

Contributors AW: drafted and revised the manuscript, MHH: drafted and revised the manuscript, AY: drafted and critically revised the manuscript, RT: drafted and revised the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD

Amman Yousaf <http://orcid.org/0000-0003-0646-508X>

REFERENCES

- 1 Ubee SS, McGlynn L, Fordham M. Emphysematous pyelonephritis. *BJU Int* 2011;107:1474–8.
- 2 Huang JJ, Tseng CC. Emphysematous pyelonephritis: clinicoradiological classification, management, prognosis, and pathogenesis. *Arch Intern Med* 2000;160:797–805.
- 3 Narlawar RS, Raut AA, Nagar A, *et al.* Imaging features and guided drainage in emphysematous pyelonephritis: a study of 11 cases. *Clin Radiol* 2004;59:192–7.

Copyright 2021 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <https://www.bmj.com/company/products-services/rights-and-licensing/permissions/>
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

Customer Service

If you have any further queries about your subscription, please contact our customer services team on +44 (0) 207111 1105 or via email at support@bmj.com.

Visit casereports.bmj.com for more articles like this and to become a Fellow