47-year-old female patient with history of diabetes mellitus (DM) and chronic urinary tract infection (UTI) presented with chronic right-sided flank pain. No history of fever.

**Imaging Findings:**

Ultrasound showed centrally located renal stone with dilated calyces without the shadowing from the calculus (Fig. 1). CT urography showed a centrally localized 1.5 cm renal calculus surrounded by multiple air bubbles in the right kidney (Fig. 2 a, b, c) without involving renal parenchyma or perirenal fat. The patient was referred to the urology department with the diagnosis of emphysematous pyelitis (EP). Upon admission the patient was afebrile with normal vital signs. Normal laboratory findings with leukocytes $6 \times 10^9/\text{L}$, CRP $<2$, 9 mg/L, Kreatinin 18 µmol/L. Urine test was positive for leukocytes, erythrocytes and glucose, but negative for nitrite. Urine culture was positive for growth of E. coli. She was treated with intravenous antibiotics and ureteral stenting with double -J stent. Control scanning showed subtotal regression of emphysema with stationary renal calculus (Fig. 3 a, b).

**Discussion:**

Renal emphysema is a rare, fulminant, gas forming infection of the kidneys caused by gas forming organisms fx E. coli, Klebsiella, Aerobacter aerogenes etc. Recurrent UTI is a risk factor. Kelly and MacCallum initially described renal emphysema in 1989. It presents with fever, nausea, vomiting, abdominal pain, shock, confusions and uncommonly with diabetic ketoacidosis [1]. It can be divided into two groups with different prognosis and severity: emphysematous pyelitis (EP) and emphysematous pyelonephritis (EPN). 50% of patients with EP have DM, while EPN is associated with diabetes mellitus in 90% of cases [1].

EP is a milder form with a better prognosis, in which gas is limited to the pelvicalyceal system and mostly associated with obstructive uropathy due to stone, stricture and neoplasm. It responds to conservative therapy with or without drainage procedure, however, removal of the obstructing calculus is important [2]. Female to male ratio is 5:1 [3].

EPN is a potentially fatal necrotizing gas-forming acute infection of the renal parenchyma, in which gas is present in renal parenchyma and/or perinephric tissues and even in the retroperitoneum. It occurs rarely due to obstructing
stone. Management of EPN includes medical treatment, percutaneous drainage of the gas and, when necessary, nephrectomy.

Wan et al. have divided EPN into two types. Type I presents with > 1/3 of renal parenchyma destruction with streaky mottled gas collection within renal parenchyma without fluid collection. Type II presents with < 1/3 destruction of the renal parenchyma with renal or extrarenal collections associated with bubbly or loculated gas, or gas within pelvicalyceal system. EP falls under type II category [2]. Huang and Tseng et al. defined a classification based on CT findings having a prognostic value and an impact on the therapeutic decision of EPN, where EP appears to be stage I, i.e. gas in the collecting system only [1].

The overall mortality of EP and EPN is 20% and 50% respectively [4]. Abdominal radiographic detection is only 33%. Ultrasonographic detection of renal emphysema requires a high index of suspicion and the recognition of echogenic foci with ‘dirty’ shadowing in a non-dependent position. CT is the modality of choice for diagnosis and differentiating emphysematous renal disease [2].

There are only few cases in global studies of EP. This could be explained by the rarity of the disease but also because it shares aetiopathogenic and epidemiological characteristics with emphysematous pyelonephritis and it clearly differs from it only by its prognosis and treatment [3].

**Differential Diagnosis List:** Emphysematous pyelitis, Emphysematous pyelonephritis, Iatrogenic aetiology

**Final Diagnosis:** Emphysematous pyelitis

**References:**


Description: Coronal view showing calculus and emphysema around it. Emphysema localised in the collecting system. No involvement of renal parenchyma and perirenal fat. Origin: Department of Radiology Slagelse Hospital denmark
Description: Axial view showing pericalyceal emphysema. Origin: Department of Radiology Slagelse Hospital denmark
Description: Sagittal view showing calculus surrounded by emphysema. Origin: Department of Radiology Slagelse Hospital Denmark
Figure 2

Description: Post JJ-stenting showing no change in renal calculus with subtotal regression of emphysema. Origin: Department of Radiology Slagelse Hospital denmark
**Description:** Axial view showing stationary renal calculus along with JJ-stent. **Origin:** Department of Radiology Slagelse Hospital Denmark
Description: Ultrasound showing a central calculus (arrow) without shadowing and dilated collecting system. Origin: Slagelse Hospital Department of radiology Denmark