

Inflammation and infection

Emphysematous pyelonephritis with gas in inferior vena cava

Chandra Mohan Vaddi, Paidakula Ramakrishna, Siddalinga Swamy, Soundarya Ganesan^{*}, Hemnath Anandan, Manas Babu

Department of Urology, Preeti Urology and Kidney Hospital, 307, Remedy Hospital Ln, MIG 1, Kukatpally Housing Board Colony, Kukatpally, Hyderabad, Telangana, 500072, India



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ABSTRACT

Emphysematous pyelonephritis (EPN) is a progressive necrotizing infection of the renal parenchyma, collecting system and perinephric tissue. A 36-year female with uncontrolled diabetes, presented with left emphysematous pyelonephritis, with air in the infra-hepatic inferior vena cava (IVC). She was hydrated, treated with intravenous antibiotics, insulin. Percutaneous nephrostomy with Double J stenting was done in modified supine position. Patient was discharged with nephrostomy. Two weeks later, flexible ureterorenoscopy was done and obstructing papillary necrosis removed. Pneumo-vena cava due to emphysematous pyelonephritis is quite rare and careful evaluation is required. Prompt intervention is life saving and obviates the need for nephrectomy.

Introduction

Emphysematous pyelonephritis (EPN) is an acute necrotizing infection of the renal parenchyma and perirenal tissue.¹ It occurs more commonly in diabetics. The high tissue glucose levels provide the substrate for fermentation, which results in carbon dioxide production.² The mortality rate has been reported to be around 19%.¹ The extension of gas into Inferior vena cava (IVC) in EPN is quite a rare phenomenon. We present a case of emphysematous pyelonephritis with gas in infra-hepatic IVC, who was managed with renal salvage strategy.

Case report

A 36-year female, with uncontrolled Diabetes mellitus, presented with fever, chills and left loin pain for a week. Vital signs included heart rate 130/min, blood pressure 80/60 mm Hg, respiratory rate 36/min, saturation 90% in room air. Abdomen examination revealed tenderness in the left loin. Laboratory evaluation revealed leucocytosis 21,200 cells/mm,³ haemoglobin 10.9 g%, blood sugar 585 mg/dl, creatinine 2.4 mg/dl. Urinalysis showed 20–25 leukocytes/HPF and presence of urine ketones. Urine culture was positive for pan-sensitive *Escherichia coli*. Arterial blood gas analysis revealed blood pH 7.14, bicarbonates 16 mEq/L, pCO₂ 42 mmHg.

X-ray KUB showed air pyelogram in the left kidney (Fig. 1a). CT KUB revealed enlarged left kidney, with architectural distortion, with air in

the pelvicalyceal system and parenchyma - Left emphysematous pyelonephritis (Grade II Huang Tseng classification¹) with pneumo - vena cava (air extension into infra hepatic IVC) (Fig. 1b and c). The patient was treated with intravenous crystalloids, Piperacillin + tazobactam, metronidazole, insulin, sodium bicarbonate and noradrenaline infusion. After stabilisation, under General Anaesthesia, patient in Galdakao modified Valdivia position, left percutaneous nephrostomy (PCN) was done using air pyelogram as contrast. In addition, retrograde left Double J (DJ) stent was placed. Post-operative CT KUB done after 48 hours revealed complete resolution of gas in IVC (Fig. 2a and b). Intense post-operative care was given and patient improved clinically and was discharged after 5 days. Two weeks later, left DJ stent was removed and flexible ureterorenoscopy (FURS) was done. Sloughed papilla was found obstructing the proximal ureter, which was basketed out, DJ stenting was done (Video 1) and nephrostomy was removed. DJ stent was removed after 2 weeks.

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.eucr.2020.101390>

Discussion

Emphysematous pyelonephritis is a life-threatening necrotizing infection of the renal parenchyma, pelvicalyceal system and surrounding tissue by gas producing organisms like *E. coli*, *Klebsiella*, *Proteus*.¹ Females, diabetics and immunosuppressed individuals are at high risk.

^{*} Corresponding author.

E-mail addresses: vcmohon2001@yahoo.co.uk (C.M. Vaddi), paidakula@hotmail.com (P. Ramakrishna), drsidda@gmail.com (S. Swamy), drsoundarya.ganesan@gmail.com (S. Ganesan), hemu_dr@yahoo.co.in (H. Anandan), manaschinni12@gmail.com (M. Babu).

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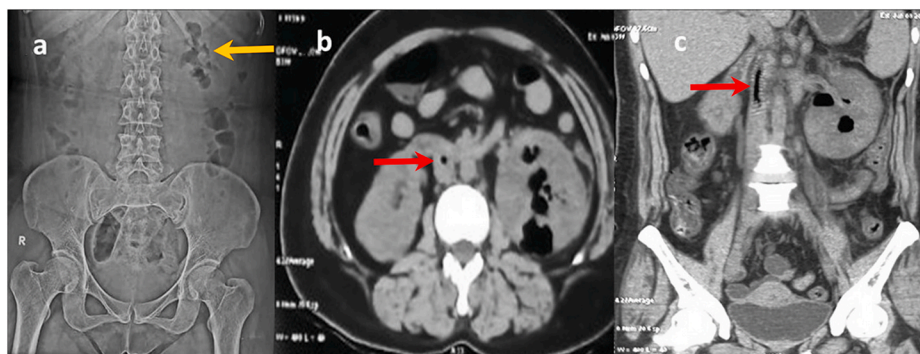


Fig. 1. (a) Xray KUB showing air pyelogram (yellow arrow), (b) and (c) CT KUB showing emphysematous pyelonephritis with gas in IVC (red arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

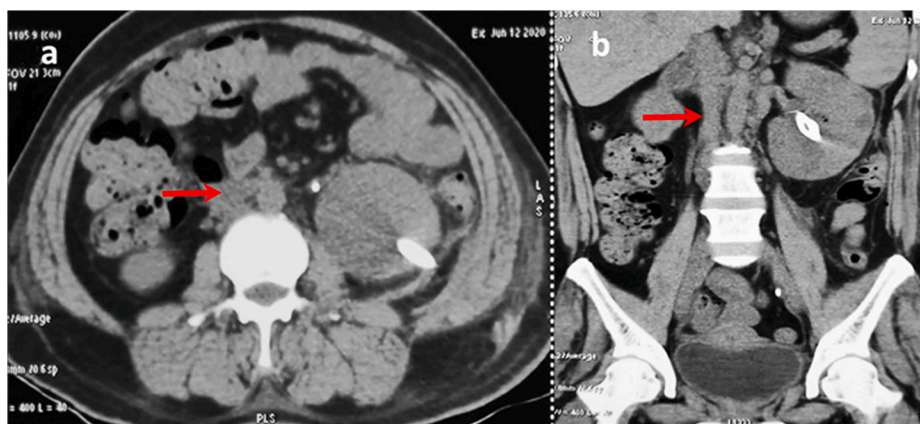


Fig. 2. (a) and (b) Post op CT KUB showing complete resolution of gas in IVC (red arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Fever with loin pain, vomiting are the presenting symptoms.¹

The pathogenesis involves 4 major factors – infection by gas forming bacteria, high tissue glucose, impaired tissue perfusion and defective immune response.² In the hypoxic state, metabolism of glucose by the gas forming bacteria leads to gas production, which is a mixture of hydrogen, carbon dioxide, nitrogen and oxygen. The gas slowly resolves into blood stream.²

CT KUB is the investigation of choice. Huang et al.¹ classified emphysematous pyelonephritis into four classes: Class 1 - gas confined to the collecting system; class 2 - gas in the collecting system and parenchyma without extension into extrarenal space; Class 3a - extension of gas or abscess into the perinephric space; Class 3b - extension of gas or abscess into the paranephric space and Class 4 - bilateral EPN or EPN in a solitary kidney. Gas extension into great vessels has not been included in any classification so far.

Air in the inferior vena cava can be asymptomatic or cause sudden cardiorespiratory collapse depending on the volume of air.³ Careful analysis of images is required for planning intervention. Our patient did not have any respiratory symptoms like chest pain, breathlessness. Our supine approach to performing percutaneous nephrostomy provided huge advantages like better access to cardiovascular and respiratory system, avoidance of inferior vena cava compression thereby alleviating the risk of embolism, avoidance of decrease in cardiac index, decreased risk of tracheal compression, accidental extubation/single lung ventilation during position change and less risk of pressure injury to peripheral nerves and ocular injury.⁴ This also facilitated retrograde DJ stent placement. Fluoroscopy guided puncture was done using air pyelogram as contrast, as ultrasound did not give a clear delineation of pelvicalyceal system.

Only two such cases have been reported in literature,⁵ one was treated by PCN and the other by radical nephrectomy. We performed percutaneous nephrostomy and DJ stenting in modified supine position, with a second stage FURS for removal of papillary necrosis.

Treatment of EPN is based on the stage. Aggressive medical management combined with percutaneous drainage and/or DJ stent placement form the initial line of management. Open drainage or nephrectomy is reserved for refractory cases.

Conclusion

Pneumo-vena cava occurring due to emphysematous pyelonephritis signifies severe infection, which may turn fatal if untreated. Prompt drainage, control of blood sugar and broad-spectrum antibiotics is essential. In addition, obstruction due to papillary necrosis or calculi must be dealt with appropriately.

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