

# A Case of Emphysematous Cystitis with Bone Metastasis Infiltrating from Hepatocellular Carcinoma: Case Report and Literature Review of the Disease

Ryo Tomaru MD MPH\*

Medical Corporation Shomikai Sakurashinmachi Clinic, Department of Nephrology, Setagaya-ku, Tokyo, Japan

**Corresponding author:** Ryo Tomaru MD MPH, Medical Corporation Shomikai Sakurashinmachi Clinic, Department of Nephrology, Setagaya-ku, Tokyo, Japan, Tel: 8190111288743; E-mail: rtomaru916@gmail.com

**Received date:** April 09, 2020; **Accepted date:** April 23, 2020; **Published date:** April 30, 2020

**Citation:** Tomaru R (2020) A Case of Emphysematous Cystitis with Bone Metastasis Infiltrating from Hepatocellular Carcinoma: Case Report and Literature Review of the Disease. J Nephrol Urol Vol.4 No.1:01.DOI: 10.36648/Nephrology-Urology.04.01.01

**Copyright:** © 2020 Tomaru R. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## Abstract

Emphysematous cystitis (EC) is a rare infection of the bladder caused by gas-forming bacteria. EC was first reported in 1671 and was described as 'presenting with pneumaturia' infectious emphysema of the bladder was first reported at autopsy in the late 1800s. Since then, many papers have reported on infectious emphysema- mainly in the urological field; but existence of infectious emphysema of the bladder has not been reported in the internal medicine and nephrology fields, and it seems that it has not been recognized. We witnessed a case of EC that was accidentally discovered, and we decided to report upon it, adding literature considerations. In addition, based on a literature search, many cases of EC develop with insufficient control of blood glucose as part of diabetes; furthermore, most cases of EC are lighter, but others may become severe. The progression of EC in this case is another example that illustrates the importance of managing diabetes to prevent the onset of infectious diseases.

**Keywords:** Emphysema cystitis; Pneumaturia; Case report; Literature review of disease

## Introduction

Emphysematous cystitis (EC) is a very rare urinary tract infection (UTI) caused by gas-forming microbes. The presence of air within the urinary tract was first reported in 1671 in the case of a man who presented with pneumaturia. Infectious emphysema of the bladder was first reported from an autopsy performed by Eisenlohr in the late 1800s; it was later defined as "cystitis emphysematosa" by Bailey in 1961 [1-4].

Case reports of EC have been accumulating in recent years, but there are few reports describing onset and causes of onset. In each case, urological conditions such as urinary retention and neuropathic bladder are present, but glycemic control has not been reported; nonetheless, many consider it to be involved.

Here, we decided to conduct a review of case reports from the last 10 years (since 2008) to understand the epidemiology and pathology of EC.

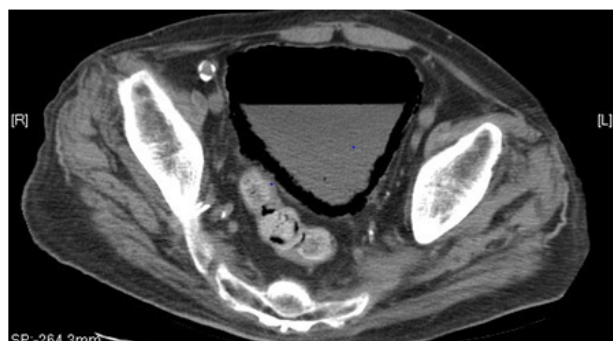
## Case report

A 67-year-old male, who was HCV (Hepatitis C virus infection) negative and HBV (Hepatitis B virus infection) negative presented with hepatocellular carcinoma infiltrating to the thoracic spinal cord (T11, T12) (no detailed description here). He also had type 2 diabetes mellitus and a neurogenic bladder, and had recently fallen down at home and broken a bone in his left ankle. He was admitted to the hospital to receive analgesic therapy for osteocopic pain caused by bone metastasis and for rehabilitation. One month after admission, he fell down in the hospital and suffered a fracture of the lumbar spine, and could no longer walk on his own.

He suddenly developed abdominal distension, nausea, and vomiting three months after admission. The results of urine testing showed a urinary protein concentration of 100 mg/dl and a urine occult blood reaction of 3+. Microscopic examination of urinary sediment revealed 20-29 red blood cells per high power field and >100 white blood cells per high power field, but the peripheral blood test showed normal renal function (serum creatinine concentration of 0.50 mg/dl, estimated Glomerular Filtration Rate (eGFR) of 124 ml/min, and serum urea nitrogen of 27.5 mg/dl). The patient had developed a urinary tract infection caused by *Klebsiella pneumoniae*.

An abdominal computed tomographic (CT) scan (**Figures 1 and 2**) revealed a characteristic accumulation of air in the wall and lumen of the urinary bladder. The patient was diagnosed with emphysematous cystitis, which was improved by urinary drainage, intravenous fluid transfusion (1 L/day), and intravenous antibiotic therapy (ceftriaxone, 1 g/day) for 6 days. CT scan was a sensitive method for detecting early signs and confirming the diagnosis.

We successfully treated this urinary infection, but the patient died from underlying disease six months after these events.



**Figure 1:** Computed tomography of a patient with emphysematous cystitis.



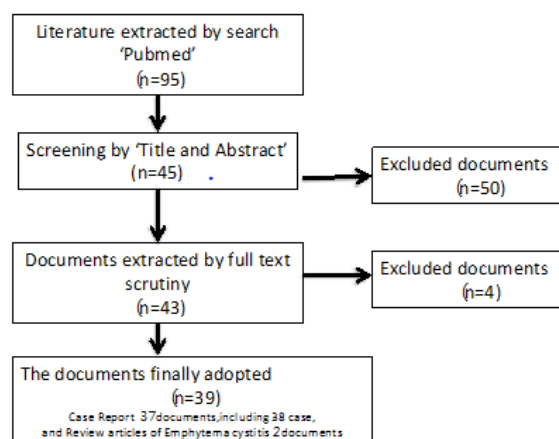
**Figure 2:** CT image of a patient with emphysema cystitis.

## Review of EC literature

We searched PubMed for the term “emphysema cystitis”. The specific search criteria used on February 8, 2019 were “emphysema cystitis” [Text Word], “English” [Language], and “2008” [Data-Publication] (**Figure 3**). Of the retrieved papers, case reports were requested and then carefully screened based on the “title & abstract” and the “full text”, after which 39 papers remained. From these 39 papers, we created an evidence table and investigated the characteristics of emphysema cystitis. According to our survey, the percentage of countries with reported cases was as high as 46.2% (18 reports) in the West, 38% (15 reports) in Asia including Japan, and 7.7% (3 reports) in Africa and the Middle East (**Table 1**). The underlying disease was diabetes in 52.8% of cases (20 of 36 cases) and chronic kidney disease (CKD) including end-stage renal disease in 13.2% of cases (5 of 36 cases). Among the diabetic cases, 34% (13 of 36 cases) had an unknown glycemic control status, but 23% (9 of 36 cases) had insufficient glycemic control. Symptoms at onset

(**Table 2**) included abdominal pain (44.7% or 17 cases), followed by fever (42.1% or 16 cases), and impaired consciousness (18.4% or 7 cases) (**Table 2**). As for a diagnostic method, 97% (37 cases) were easily diagnosed by CT. The most common causative bacteria were *E. coli*, which was found in 73% or 28 cases. 42% of cases (16 cases) did not cause complications and 78.9% (30 cases) improved, indicating a good prognosis, but 2.6% (1 case) developed sepsis, indicating that some cases were difficult to treat. In addition, death was the outcome for 13.2% (5 of 36 cases) (**Table 1**) [5-41].

### Flow chart of document selections;



**Figure 3:** Result of literature search for ‘Emphysema Cystitis’.

**Table 1:** Clinical characteristics of emphysema cystitis cases.

Age	72.0 ± 14.7	Age	
Sex	Female	15	cases
	Male	6	cases
Nations	Western country	18	cases
	Asia	15	cases
	Africa, Middle eastern countries	3	cases
Underlying diseases	DM	20	cases
	Type2 DM	9	cases
	Type1 DM	3	cases
	Unknown DM	3	cases
	CKD	5	cases
Blood glucose control status	Well controlled	1	cases
	Poor controlled	9	cases
	Unknown controlled	13	cases
Symptoms	Abdominal pain	17	cases
	Fever	16	cases
	Disturbance of conscious	7	cases
	Dusuria	5	cases

	Hematuria	3	cases
	Vomitting	3	cases
	Shock status	2	cases
	Shorten of breath	1	cases
Complications	None	16	cases
	Sepsis	1	cases
	Pseudomonous colitis	1	cases
	Right-sided Pneumoniae	1	cases
	Concomitany bilateral emphysematous ureteritis & pyelitis	1	cases
Outcome	hydronephrosis	1	cases
	Recovery	30	cases
	Death	5	cases
	unknown	3	cases
*DM; diabetes mellitus, CKD; chronic kidney disease			

**Table 2:** On the causative bacteria of Emphysema cystitis.

Causative bacteria	<i>E.coli</i>	28cases
	negative study	5cases
	<i>Klebsiella pneumoniae</i>	4 cases
	Fungus	2cases
	<i>Enterococcus cloacae</i>	1 case
	<i>Enterococcus serogens</i>	1 case
	Group B streptococcus	1 case
	unknown	1 case
*E.coli: <i>Escherichia coli</i>		
Methods of diagnosis 'emphysema cystitis'		
Methods of diagnosis	CT	37
	XP	6
	US	1
*CT: Computed Tropography, XP: X-ray Photograph, US: Ultrasonography		

## Discussion

EC is a relatively rare condition, which is characterized by gas collection within the bladder wall. EC was first identified in post-mortem examination in 1888. The collected gas is believed to consist of carbon dioxide produced by the fermentation of glucose or albumin by micro-organisms infecting the bladder. The common causative organisms are *Escherichia coli*, *Enterobacteriaerogenes*, and *Klebsiella pneumonia*. The clinical presentation is nonspecific and ranges widely from asymptomatic urinary tract infection to urosepsis and septic shock at the onset of disease. The majority of patients had a history of diabetes or neurogenic bladder.

A previous literature review by Grupperand colleagues found that 62.2% of patients were elderly diabetic women and that classic symptoms of UTI were present in only 53.3% of cases. Abdominal tenderness and hematuria were noted in 65.6% and 82.3% of cases, respectively. Plain abdominal x-ray was highly sensitive (97.4%), while abdominal CT was the most sensitive and specific diagnostic tool [42].

The exact mechanism of gas formation in emphysematous infections is unclear. It is presumed to be due to the presence of aerobic gas-forming organisms such as enterobacteriaceae that rapidly ferment glucose and produce carbon dioxide. In non-diabetic patients, it has been proposed that urinary lactose or tissue proteins may serve as substrates for the gas formation [43,44].

The prognosis for EC patients is favorable if the disease is promptly diagnosed and treated. However, the clinical course can be severe, progressing to rupture of the urinary bladder and emphysematous pyelonephritis that may require surgical procedures such as nephrostomy or nephrectomy.

We were able to find two review papers on EC. One reported on 23 cases of emphysema cystitis in a single institution. According to Yoshimatsu, of the 23 cases, 52.2% involved male patients, with an average age of 76.3 years. Co-existing diseases included: neuropsychiatric condition 69.6%, malignant tumor 65.2%, diabetes mellitus 43.5%, and urologic disorder 43.5%. The initial systematic symptoms were: hematuria 52.2%, urinary retention 47.3%, and fever 34.8%. In addition, 28.6% were blood culture positive cases and 88.2% were urine culture positive cases. Among these culture positive cases, 47.8% were positive for *E. coli* and 11.6% for *Klebsiella pneumoniae*. In treatment descriptions, antibiotics and urinary catheters were included in 60.9% of cases, and only antibiotics in 17.4%. In addition, death was observed in 17.4% of the cases. The second review paper was the only one to address emphysema cystitis in Japan, to the extent we have examined it here. According to Amano, PubMed and Ichuushi searches for articles submitted between 2006 and 2013 identified 72 cases of emphysematous cystitis published in the foreign literature and 30 cases published in the Japanese literature. The average age was similar to what we found: 68 years old abroad and 72 years old in Japan. The proportion of males was 30% in Japan and 31% overseas. The rate of coexistence with diabetes was almost the same 66% overseas and 70% in Japan. The percentage of cases resulting in death was slightly lower in Japan: 12% overseas and 3% in Japan. In addition, it was reported that the proportion of cases requiring surgical intervention was relatively high in Japan: 5% overseas versus 7% in Japan. As for the identification of pathogens, the percentages were *E.coli* 64% and *K.pneumoniae* 20% in Japan, compared to *E.coli* 56% and *K.pneumoniae* 10% overseas [45,46].

As described above, epidemiological considerations were very similar to our review. In addition, we could not identify the relationship between the malignant tumor and emphysema cystitis found in this case within the scope of the search.

## Conclusion

EC is a relatively rare form of complicated UTI characterized by the presence of gas within the bladder wall and lumen. The predisposing risk factors and conditions include older age, female gender, and severe DM.

Clinicians should be aware of the clinical presentations of EC. Based on our findings, suspicion of emphysematous cystitis should be aroused by abdominal pain in diabetic patients, with or without a clinical presentation suggestive of UTI, especially when hematuria is present. In such cases, we suggest conducting a plain abdominal x-ray for screening, followed by an abdominal CT when urinary bladder gas is present.

## Acknowledgement

The authors state that they have no Conflict of Interest (COI).

## References

1. Thomas AA, Lane BR, Thomas AZ, Remer EM, Campbell SC, et al. (2007) Emphysematous cystitis: a review of 135 cases. *BJU Int* 100: 17-20.
2. Taussig AF (1907) Pneumaturia with report of a case. *Boston Med Surg J* 156: 769-774.
3. Bailey H (1961) Cystitis emphysematosa; 19 cases withintraluminal and interstitial collections of gas. *Am J Roentgenol Radium TherNucl Med* 86: 850-862.
4. Quint HJ, Drach GW, Rappaport WD, Hoffman CJ (1992) Emphysematous cystitis: a review of the spectrum of disease. *J Urol* 147: 134-137.
5. Huang PW, Cha TL, Chang HC, Tang SH (2010) Target lesions in the bladder from emphysematous cystitis. *Kidney Int* 78:325.
6. Weedle J, Brunton B, Rittenhouse DR (1998) An unusual presentation of emphysematous cystitis. *Am J EmergMed* 16:664-666.
7. Hoepelman AIM, Meiland R, Geerlings E (2003) Pathogenesis and management of bacterial urinary tract infections in adult patients with diabetes mellitus. *Int J Antimicrob Agents* 22:35-43.
8. Lang EK, Rudman E, Zhang K, Thorner D, Hanano A (2011) Myceleal emphysematous cystitis complicating a renal transplant kidney. *IntBraz J Urol* 37:268-269.
9. Mizuno Y, Doi A, Endo A, Nishioka H (2016) Streptococcus pneumoniae Meningitis Presenting with Acute Urinary Retention and Emphysematous Cystitis. *Intern Med* 55:2101-2104.
10. Ni Raghallaigh H, Rintoul-Hoad S, Emsley E, Nawrocki J (2014) 'No bladder visible on ultrasound scan--has the patient had a cystectomy?' A case of emphysematous cystitis. *BMJ Case Rep* 2014:bcr2014207871.
11. Sezaki R, Tsujimoto T, Tokoyoda T, Sugiura Y (2012) A case of emphysematous cystitis. *Intern Med* 51:1149.
12. Ergün T, Eldem HO, Lakadamyalı H (2014) A rare cause of acute lower abdominal pain: Emphysematous cystitis. *Turk J Urol* 40:65-67.
13. Lundebj E, Tahir AR, Grøtta OJ, Frich L (2014) A woman in her 60s with pneumaturia. *Tidsskr Nor Lægeforen* 134:530-533.
14. Tummers-de Lind van Wijngaarden RF (2014) A woman with abdominal pain and swelling. *Neth J Med* 72:283-287.
15. Lu CC, Cheng TC (2009) Images in clinical medicine. Air in the urinary tract. *N Engl J Med* 361:388.
16. Medina-Polo J, Nuñez-Sobrin JA, Díaz-González R (2011) An unusual case of air within the bladder wall: bladder pneumatosis?. *Int J Urol* 18:375-377.
17. Alladina J, Lamas D, Cho J (2014) Cerebral air embolism. A case of disseminated Klebsiellapneumoniae infection. *Am J RespirCrit Care Med* 190:e60-e61.
18. Meira C, Jerónimo A, Oliveira C, Amaro A, Granja C (2008) Emphysematous cystitis--a case report. *Braz J Infect Dis* 12:552-554.
19. Kuriyama A, Nakajo K (2014) Emphysematous cystitis and bacteremia caused by Escherichia coli. *Intern Med* 53:349.
20. Ahmed N, Sabir S, Khan N (2008) Emphysematous cystitis due to Klebsiellapneumoniae. *Ann Saudi Med* 28:50-52.
21. vanGenderen ME, Jonkman JG, van Rijn M, Dees A (2014) Emphysematous cystitis due to recurrent Clostridium difficile infection. *BMJ Case Rep* 2014:bcr2014207265.
22. Toyota N, Ogawa D, Ishii K (2011) Emphysematous cystitis in a patient with type 2 diabetes mellitus. *Acta Med Okayama* 65:129-133.
23. Mok HP, Enoch DA, Sule O (2010) Emphysematous cystitis in an 80-year-old female. *Int J Infect Dis* 14:e361-e362.
24. De Coninck V, Michielsen D (2015) Emphysematous cystitis presenting as severe confusion and abdominal pain: two case reports. *J Med Case Rep* 9:54.
25. Nozu T (2008) Emphysematous cystitis with air bubbles in the inferior vena cava. *Int J Urol* 15:947.
26. Sadek AR, Blake H, Mehta A (2011) Emphysematous cystitis with clinical subcutaneous emphysema. *Int J Emerg Med* 4: 26.
27. Hajji F, Ameur A (2015) Emphysematous cystitis with concomitant bilateral emphysematous ureteritis and pyelitis in a diabetic patient. *Pan Afr Med J* 20:324.
28. Yoshida K, Murao K, Fukuda N, Tamura Y, Ishida T (2010) Emphysematous cystitis with diabetic neurogenic bladder. *Intern Med* 49:1879-1883.
29. Islam M, Bancil AS, Ingram O (2016) Emphysematous cystitis: a radiographic diagnosis. *BMJ Case Rep* 2016: bcr2016214455.
30. Dixon L, Winkler M. (2013) Emphysematous cystitis: a tympanic bladder. *BMJ Case Rep* 2013:bcr2013009050.
31. Sharma R, Mitra SK, Choudhary A, Majee P (2015) Emphysematous cystitis-gas in bladder: a rare urological emergency. *BMJ Case Rep* 2015:bcr2015210836.
32. Tzou KY, Chiang YT (2016) Emphysematous Cystitis. *N Engl J Med* 375:1779.
33. Leclercq P, Hanssen M, Borgoes P, Bruyère PJ, Lancellotti P (2008) Emphysematous cystitis. *CMAJ* 178:836.
34. Hung SF, Liu KL, Yu HJ, Huang KH (2010) Medical Imagery Emphysematous cystitis. *Int J Infect Dis* 14:e269-e270.
35. Chang HC, Chen HY, Chung SD, Liao CH, Yu HJ, et al. (2010) Emphysematous cystitis. *Int J Infect Dis* 14:e363-e364.
36. Hale NE, Tierney JP (2011) Emphysematous cystitis. *J Am Osteopath Assoc* 111:645.

37. Wang Q, Sun M, Ma C (2018) Emphysematous pyelonephritis and cystitis in a patient with uremia and anuria: A case report and literature review. *Medicine (Baltimore)* 97:e11272.
38. Althaf MM, Abdelsalam MS, Rashwan M, Nadri Q (2014) Emphysematous pyelonephritis and cystitis in a renal transplant recipient. *BMJ Case Rep* 2014:bcr2014205589.
39. Li S, Wang J, Hu J, He L, Wang C (2018) Emphysematous pyelonephritis and cystitis: A case report and literature review. *J Int Med Res* 46:2954-2960.
40. Huang WL, Chen CC, Hsieh MH, Wang TY (2011) Gas in the kidney, ureter, and bladder in a newly diagnosed diabetes patient. *Intern Med* 50:939-940.
41. Yang Z, Sheng C (2017) Gas surrounding the urinary bladder in emphysematous cystitis. *IntBraz J Urol* 43:1190-1191.
42. Grupper M, Kravtsov A, Potasman I (2007) Emphysematous cystitis: illustrative case report and review of the literature. *Medicine (Baltimore)* 86:47-53.
43. Frank D, Harding S (2016) Elderly Woman With Severe Abdominal Pain. *Ann Emerg Med* 68:e73-e74.
44. Selley JK, Kane BG, Kane KE (2010) Importance of obtaining a detailed medical history in diagnosing emphysematous cystitis. *J Am Osteopath Assoc* 110:91-94.
45. Yoshimatsu Y, Takai T, Abe Y, Nakagawa T (2017) The Presence of Venous Gas Does Not Affect the Prognosis in Emphysematous Cystitis. *Intern Med* 56:637-640.
46. Amano M, Shimizu T (2014) Emphysematous cystitis: a review of the literature. *Intern Med* 53:79-82.