

Case Report

Emphysematous cystitis: Rapid resolution of symptoms with hyperbaric treatment: A case report.

J. B. MCCABE,¹ W. MC-GINN MERRITT,² D. OLSSON,³ V. WRIGHT,⁴ E. M. CAMPORESI⁵

¹Professor, Department of Emergency Medicine, SUNY Upstate Medical University; ²Hyperbaric Medicine Unit, SUNY Upstate Medical University; ³Assistant Professor, Department of Emergency Medicine, SUNY Upstate Medical University; ⁴Hyperbaric Medicine Unit, SUNY Upstate Medical University; ⁵Professor & Chair, Department of Anesthesiology, SUNY Upstate Medical University.

McCabe J.B., Mc-Ginn Merritt W, Olsson D, Wright V, Camporesi EM. Emphysematous cystitis: Rapid resolution of symptoms with hyperbaric treatment: A case report. *Undersea Hyperb Med* 2004; 31(3):281-284. Introduction: Emphysematous cystitis is a rare disease that occurs most often in elderly diabetic patients characterized by gas formation in the bladder wall due to infection. The infecting organism is usually an aerobic bacterium, most commonly *E. coli* although anaerobic species have also been reported. We report the use of hyperbaric oxygen in a patient with emphysematous cystitis and air in the femoral vein in which the treatment rapidly resolved the symptoms and radiological abnormalities. Methods: A 65-year-old female presented to the Emergency Department with altered mental status, weakness, dark urine, dysuria and fever. She was febrile and lethargic. Abdominal exam showed suprapubic tenderness. Urinalysis was positive for white blood cells and bacteria. A CT scan of the abdomen demonstrated extensive air in the bladder wall with an air bubble in the femoral vein. Presumptive diagnosis was urinary tract infection, emphysematous cystitis, and sepsis. A question of air embolism was raised due to the intravascular gas. The patient was treated with hyperbaric oxygen (2.85 atm abs, 90 minutes) on two separate occasions in the first 12 hours. Within 24 hours, the patient's condition rapidly improved. Repeat CT scan 48 hours after admission showed near complete resolution of the emphysematous cystitis. The patient grew *Klebsiella pneumoniae* from her urine. Conclusions: Emphysematous cystitis is a rare condition caused by either aerobic or anaerobic bacteria and may be associated with both bladder wall and intravascular gas formation. Hyperbaric oxygen therapy has not been previously reported as a treatment modality. The rapid improvement in our patient may indicate a role for hyperbaric oxygen in addition to IV hydration and antibiotics in this disease.

INTRODUCTION

Emphysematous cystitis is a rare condition occurring in elderly diabetic and immunocompromised patients. It consists of infection in and around the bladder, accompanied by bacterial fermentation of glucose resulting in the formation of gas bubbles throughout the wall of the bladder and surrounding tissues (1). Hyperbaric oxygen is a well-recognized therapy for gas-producing infections in other tissues (2).

The authors are unaware of prior description of the treatment of emphysematous cystitis utilizing hyperbaric oxygen. We present the case of a patient with emphysematous cystitis, and concomitant air bubble in the femoral vein, who improved rapidly following the institution of hyperbaric therapy. We believe that hyperbaric oxygen may be an additional useful therapy in the treatment of this rare but debilitating entity.

CASE DESCRIPTION

A 65-year-old woman presented to the Emergency Department with altered mental status complaining of fatigue. She had experienced two days of fatigue, generalized muscle weakness and an altered mental status. She was also noted to have foul urine and complained of diffuse abdominal pain. She was transported to the hospital and in route, intravenous access was established, oxygen administered, and blood glucose was found to be 257 mg/dl. She had no history of chest pain, shortness of breath, recent fever or chills, vomiting or diarrhea. Her past medical history was positive for coronary artery disease, hypertension, hyperlipidemia, type II diabetes, sarcoidosis, and congestive heart failure. She was noted to have had frequent urinary tract infections in the past. Her medications included alendronate, nortriptyline, metoprolol, furosemide, atorvastatin, and prednisone.

The initial examination showed a tired-appearing 65-year-old woman in no acute distress. Her oral temperature was 37.1°C, blood pressure 143/69 mm/Hg, pulse 82 beats and respirations 26 per minute. The mucus membranes were slightly dry, the chest was clear and cardiac examination was unremarkable. The abdomen was soft, non-tender and non-distended, with bowel sounds present. She was somnolent, and would only open her eyes and answer a few questions at a time. Neurological examination was non-focal.

Pertinent admission laboratory data included normal WBC and electrolytes, BUN 74 mg/dL, and creatinine 2.3 mg/dL. Urinalysis showed pH 5.5, WBC 21/HPF (casts), and 4 + bacteria. Chest radiograph and CT examination of the head were clear.

A working diagnosis of urosepsis with hyperglycemia was made and the patient was begun on IV fluids and IV Levaquin. Due to persistent abdominal pain, CT of the abdomen and pelvis was obtained. CT of the pelvis revealed emphysematous cystitis, with air in the right femoral vein. (Figure 1) Because of the concern regarding altered mental status, associated with air in the right femoral vein, a question of air embolism was entertained, and the hyperbaric medicine service was consulted.



Fig. 1. Pelvis at time of admission. Scan shows air in bladder wall, consistent with diagnosis of emphysematous cystitis. Arrow shows air in the right femoral vein.

The patient was admitted to the hospital, and received two hyperbaric oxygen treatments at 2.85 atm abs, for 90 minutes each within twelve hours of admission. She continued to receive intravenous fluids and Flagyl was added as a second antibiotic. A Foley catheter was placed at

the time of admission. Subsequent urine cultures grew a *Klebsiella sp* sensitive to ciprofloxacin and the antibiotics were changed.

The patient's mental status improved dramatically over the first 48 hours following admission. Repeat CT scan of the abdomen and pelvis obtained 48 hours after admission showed marked improvement in the emphysematous cystitis (Figure 2). Due to the patient's rapid improvement, no further hyperbaric treatments were provided. She was discharged from the hospital four days following admission. She continued to do well, until two months later when she died from septic shock secondary to enterococcal sepsis.

DISCUSSION

Gas-producing infections of the urinary tract are rare but important because of potential morbidity and mortality. The spectrum of gas-producing infections includes emphysematous nephritis, emphysematous pyelitis, and emphysematous cystitis. These are distinct clinical entities with different clinical course, management and prognosis (3).

Emphysematous cystitis was first reported by Hueper in 1926(4). It is a rare condition, often occurring in elderly diabetic and immunocompromised patients. The organisms most commonly responsible include *Escherichia coli* and *Enterobacter*. Less commonly, *Proteus*, *Klebsiella*, and *Streptococci* may be found.



Fig. 2. Pelvis two days post admission shows improvement in emphysematous cystitis

Bacterial fermentation of glucose resulting in the formation of carbon dioxide gas bubbles is thought to be responsible for the gas formation. Less commonly, *Clostridium*, or other anaerobic gas-producing organisms may be found (5). Gas produced in the bladder wall may migrate into the bladder itself producing air bubbles in the urine. In our case, air also migrated outside the bladder wall and into the femoral vein, a complication not previously reported. There is no way to be certain that the air observed over the femoral vein was intravascular. We theorize that air from the bladder wall migrated through disrupted venous drainage of the bladder. There were no attempts to establish femoral venous access or to obtain blood samples from femoral venous cannulation.

The diagnosis of emphysematous cystitis is often made incidentally on plain radiographs or CT examination of the abdomen obtained in sick or septic patients. Radiographically, gas is usually seen first within the bladder wall with possible migration of gas elsewhere (6).

Approximately 165 cases of emphysematous cystitis have been reported in the literature (7). Most reports are small case series, and there have been no large controlled trials of treatment options for this entity. Mortality is reported at approximately 20 percent. The mainstays of treatment of emphysematous cystitis, reported in the literature, mostly in case series, includes intravenous hydration, intravenous antibiotics, and decompression of the bladder (5, 8-9). There is no mention in previous case reports of the use of hyperbaric oxygen therapy.

We believe that the use of hyperbaric oxygen hastened the resolution of the disease in this patient because she had such rapid clinical improvement. The CT findings seem to support a decrease in the bladder wall air following hyperbaric therapy. It is also possible that some of the

observed CT changes are due to an increased urine volume in the bladder and more bladder compression compared to the initial CT.

Hyperbaric oxygen is a well-established modality for the treatment of necrotizing soft tissue infections and anaerobic infections, which produce soft tissue gas. In addition, hyperbaric oxygen is proven therapy in air embolism. The use of hyperbaric oxygen in our patient was followed by dramatic clinical improvement and resolution of the radiographic findings. While it is impossible to predict what the patient's course and prognosis would have been without hyperbaric therapy, there is sound physiologic rationale for its use in this rare entity associated with significant mortality.

Hyperbaric oxygen may play an important adjunctive role in addition to intravenous hydration and antibiotic administration in management of emphysematous cystitis.

REFERENCES

1. Quint HJ, Drach GW, Rappaport WD, Hoffman CJ. Emphysematous Cystitis: A review of the spectrum of disease. *J Urol* 1992; 147:134-137.
2. Lepawsky M. Necrotizing Soft Tissue Infections. In: Feldmeier JJ, ed. Hyperbaric Oxygen 2003, The Hyperbaric Oxygen Therapy Report. Kensington, MD: Undersea and Hyperbaric Medicine Society, 2003: 69-78.
3. Kumar A, Turney JH, Brownjohn AM, McMahon MJ. Unusual bacterial infections of the urinary tract in diabetic patients – rare but frequently lethal. *Nephrol Dial Transplant* 2000; 16:1062-1065.
4. Hueper W. Cystitis Emphysematous. *Am J Path* 1926; 2:159.
5. Wayland JS, Kiviat MD. Clostridial cystitis emphysematosa. *Urol* 1974; 5:601-602.
6. O'Connor LA, Guzman JD. Emphysematous Cystitis: A Radiographic Diagnosis. *American Journal of Emergency Medicine* 2001; 19: 211-213.
7. Katz D, Aksoy E, Cunha B. Clostridium perfringens emphysematous cystitis. *Urol* 1993; 41:458-460.
8. Biyani CS, Cornford PA, Scally JS, Powell CS. Emphysematous Cystitis. *Scan J Urol Nephrol* 1997; 31: 309-310.
9. Bartczak J, Schiedermayer D. Emphysematous Cystitis: A Case Report. *Wisconsin Medical Journal* 1999; 98:49-50.
10. West TE, Holley HP, Lauer AD. Emphysematous Cystitis due to Clostridium perfringens. *JAMA* 1981; 246:363-364.