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Case Report

Pneumomediastinum Secondary to Acute Emphysematous Pyelonephritis

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ARTICLE INFO

Article history:

Received: 18 May, 2020

Accepted: 1 June, 2020

Published: 17 June, 2020

Keywords:

Emphysematous pyelonephritis

pneumomediastinum

xanthogranulomatous pyelonephritis

ABSTRACT

Pneumomediastinum is a clinical and radiographic finding that is associated with a wide range of acute processes that allow gas to disseminate through the tissues of mediastinum that often necessitates prompt consideration for thoracic intervention. In some circumstances, pneumomediastinum may arise from processes extrinsic to the thoracic cavity and is a secondary process arising from a primary retropharyngeal or retroperitoneal etiology. Acute emphysematous pyelonephritis is a rare and severe infectious disease of the kidney associated with a very high mortality rate. We report a case of advanced emphysematous pyelonephritis presenting with pneumomediastinum successfully treated with simple nephrectomy in the absence of any direct mediastinal intervention.

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Background

Emphysematous pyelonephritis is an advanced infectious process originating from gas-forming organisms in the upper urinary tract. This is often associated with diabetes mellitus and obstruction of a single or bilateral renal unit. The offending organisms are often *Klebsiella pneumoniae* and *E. coli* with Enterobacter spp contributing to the fermentation that is responsible for gas production [1]. These typically require a minimum intravenous antibiotic with or without percutaneous drainage of the kidney, but often will necessitate simple extirpation of the kidney and retroperitoneal irrigation as a means of achieving appropriate infectious source control. Pneumomediastinum is more commonly a complication of a thoracic perforated viscus or a primary mediastinal infection and is rarely seen as a result of disseminated gas from intra-abdominal or retroperitoneal infectious etiologies. This report aims to address the unique clinical management considerations in the treatment of this advanced infectious process and to reveal an exception to prompt direct thoracic intervention in the context of pneumomediastinum.

Case Report

A 58-year-old Caucasian woman with a long history of insulin dependent diabetes mellitus presented to the emergency room with left flank and abdominal pain of several days' duration. Her abdominal examination revealed significant tenderness to palpation over the left side of her abdomen and left sided costovertebral angle tenderness. Her heart rate was 110 beats per minute and her oral temperature was 99 F. Her laboratory studies revealed a white blood cell (WBC) count of 13,000, a platelet count of 50,000, a serum creatinine of 3.2 and a urinalysis with TNTC WBC, and urine initial gram stain with gram negative rods. A CT scan of the abdomen and pelvis without contrast (Figures 1 & 2) was performed which revealed a large amount of gas in the tissue planes surrounding the left kidney. The patient was admitted to the ICU for IV fluids and antibiotics (IV Piperacillin -Tazobactam). The day after admission a CT with oral contrast was performed that showed progression of the emphysematous process in the retroperitoneum with extension into the mediastinum (pneumomediastinum) (Figure 3). On physical examination, Hamman's crunch was identified, and the left sided abdominal tenderness worsened.

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Figure 1: An axial view of the CT abdomen/pelvis noting a large volume of air in the left perinephric space and disseminating through the left retroperitoneum.



Figure 2: A coronal view of the CT abdomen/pelvis noting air extending from the left hemidiaphragm to the left pelvic brim encompassing the entire left retroperitoneum.

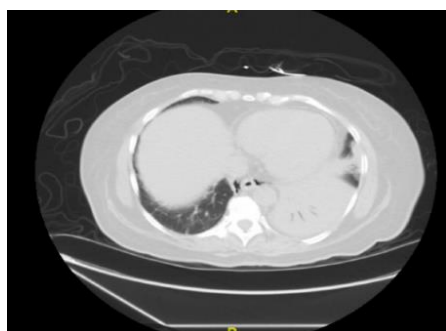


Figure 3: Axial view of the CT abdomen/pelvis with air noted along the distal esophagus in the mediastinum.

The patient's overall clinical course was not improving. On the second hospital day, after the development of pneumomediastinum, the patient was taken to the operating room for an urgent left nephrectomy and washout. The operation was performed through a left subcostal incision. Gas was noted in the perinephric tissues, the retroperitoneum, and the gastro-colic omentum. The left kidney was involved in a purulent liquefactive necrotic process and diffuse inflammatory changes were noted throughout the left retroperitoneum. A 10 mm Jackson Pratt drain was left in this area. The nephrectomy was completed without difficulty and the patient was transported to the ICU where intravenous antibiotics were continued. Two days after surgery, the patient underwent a chest x-ray that documented resolution of the pneumomediastinum. The patient's post-operative course was uncomplicated, and her creatinine, WBC count, and platelet count all normalized in the post-operative period.

Discussion

Pneumomediastinum can arise from numerous etiologies that are typically mechanical or infectious in nature involving injury to the aerodigestive tract and require direct (or indirect) exploration and drainage of the mediastinum. The most common causes include Boerhaave's syndrome, iatrogenic esophageal perforations, and penetrating thoracic trauma. There are cases, however, where the pneumomediastinum is the result of ascending or descending dissection of gas from retroperitoneal or retropharyngeal processes in the absence of a primary mediastinal infection or source. In these instances, mediastinal exploration and drainage is not only unnecessary, but likely to result in iatrogenic complications.

Acute emphysematous pyelonephritis is a rare and severe infectious and inflammatory disease of the kidney associated with a very high mortality rate. The disease was first described in 1898 and the term emphysematous pyelonephritis was first coined by Schultz and Keein in 1962 [2]. The disorder is most common in diabetics and has a predilection for females. Renal stones, obstructive uropathies, alcohol abuse and immunocompromised states are also associated with this condition. The left kidney is affected more than the right and the condition is bilateral in 5-10% of cases [2]. The classic radiographic finding in this disorder is gas surrounding the kidney and the retroperitoneal tissues. CT scan without contrast is diagnostic in 100% of cases. Importantly, this condition is typically not accompanied with the presence of free intraperitoneal gas.

In very rare cases the gas produced by this infectious process can ascend in the retroperitoneal space along the tissue planes of the aorta and vena cava and cause pneumomediastinum. Wang and associates presented compelling radiographic data in 2006 tracing the anatomic path of the gas into the mediastinum in the tissue planes along the aorta and vena cava [3]. It is important to recognize that the gas produced by bacterial metabolism dissects into the mediastinum without any active mediastinal infection. As such, mediastinal exploration and drainage is typically not indicated as a contributing factor to source control.

The successful treatment of this disorder requires improved control of serum blood glucose, appropriate IV antibiotics, and management of fluid and electrolyte derangements [4]. Definitive control of this necrotizing infectious disorder can often require nephrectomy but can be managed with percutaneous drainage or intravenous antibiotics depending on the severity using Huang Class Mediastinal drainage procedures (operative or via radiographic approaches) are not required as the pneumomediastinum and septic process typically responds to the nephrectomy and antibiotic regimen [1, 5, 6]. Thoracic surgeons asked to evaluate critically ill patients with pneumomediastinum need to consider this rare ascending retroperitoneal infectious process in the differential diagnosis as the correct treatment is typically a simple nephrectomy not accompanied by any unnecessary and morbid mediastinal drainage procedure.

Declarations

None.

Consent for Publication

Consent for publication was obtained.

Competing Interests

Completed.

Funding

None.

Author Contributions

Michael Lopez: Assistant surgeon, Clinical Management, Authorship.

Anne M. Lopez: Clinical Management, Authorship.

Kenan B. Ashouri: Clinical Management, Authorship.

Jessica Buicko: Assistant surgeon, Clinical Management, Authorship.

Miguel Lopez-Viego: Surgeon, Clinical Management, Authorship.

Abbreviations

WBC: White Blood Cell

TNTC: Too Numerous to Count

ICU: Intensive Care Unit

CT: Computed Tomography

IV: Intravenous

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