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Case Presentation

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A Rare Case of Gas-Forming Chest Wall Abscess Caused by *Klebsiella Pneumoniae*

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Abstract

Gas-forming primary chest wall abscess caused by *Klebsiella pneumoniae* is an extremely rare, but life-threatening infection. We reported a primary gas-forming abscess case of a 73-year-old man with a 10-day history of chest wall swelling and pain. His laboratory results showed the presence of infection and diabetes mellitus. A computed tomography scan demonstrated minor fluid effusion in the left chest cavity and massive subcutaneous gas in the left chest wall. Gram-negative rods were isolated from the pus and determined to be *Klebsiella pneumoniae* by 16S rRNA gene sequencing. Based on the clinical characteristics, incision and vacuum sealing drainage were performed. We found that the purulent fluid was under the pectoralis major muscle, and part of the pectoralis minor muscle was ulcerated. A total of three surgical debridements were performed during hospitalization. The antibiotic therapy of piperacillin/tazobactam combined with clindamycin was administered. His postoperative course was uneventful.

Keywords: Gas-forming; Chest wall; Abscess; Klebsiella pneumoniae; Vacuum sealing drainage

Introduction

Gas-Forming Infections (GFI) progress rapidly and threaten the patient's life. However, GFI of chest wall abscess is extremely rare when it occurs without predisposing factors. Usually, chest wall infections are secondary infections related to open trauma, thoracic surgery, or other infectious diseases **[1].** We reported a case of gas-forming infection in the chest wall caused by Klebsiella pneumoniae. An old man with a 13-year history of diabetes mellitus suffered a pyogenic chest wall abscess.

Case Presentation

A 73-year-old man presented to the Emergency Department with a 10-day history of chest wall swelling and pain. The patient had performed examination and treatment in the previous hospital, but his condition was not improved. After that, the patient came to the Emergency Department of our hospital. He had a 13-year history of diabetes mellitus with irregular use of metformin. On physical examinations, the body temperature was 36.8 °C, heart rate was 89 beats/min, respiratory rate was 19 breaths/min, and blood pressure was 120/74 mmHg. Laboratory examination revealed a C-Reactive Protein (CRP) level of 238.6 mg/L, white blood cells (WBC) count of 6.35 × 109/L (92.1 % segmented neutrophils), Hemoglobin (HGB) level of 117 g/L, Albumin (ALB) level of 26.9 g/L, Procalcitonin (PCT-J) level of 10.25 ng/mL, and glycosylated Hemoglobin (HbA1c) of 14.2% **(Table 1).** The data showed that the patient suffered infection and diabetes mellitus. The Computed Tomography (CT) scan showed massive subcutaneous gas in the left chest wall and a small amount of fluid effusion in the left chest cavity as shown in **Figure 1**. Cultures from abscess samples yielded pan-sensitive *Klebsiella pneumoniae* (only resistant to ampicillin of the 15 tested antimicrobial agents). In addition, the *K. pneumoniae* strain was identified by sequencing the 16S rRNA gene with specific primers (kp-F: 5'-TCATGGCTCAGATTGAACGC-3', kp-R: 5'-TAAGGAGGTGA TCCAGCCG-3'). After consultation, incision and drainage of the abscess were performed. The purulent fluid in the cavity of the abscess was observed under the pectoralis major muscle, and part of the pectoralis minor muscle was ulcerated. Irrigation and debridement of infected tissues were carefully performed. Vacuum Sealing Drainage (VSD) was administered for the debridement and drainage of the wound. After admission, piperacillin/ tazobactam combined with clindamycin was administrated intravenously for anti-infection therapy. The patient improved with surgery and serial drainages. A total of 3 surgical debridements were performed during hospitalization. After 36 days of treatment, the patient's symptoms improved significantly.

Table 1: Clinical laboratory data on the patient.

Items	On admission	After admission
C-reactive protein (mg/L)	238.6	5.2
White blood cells count (/L)	6.35×10^9	3.92×10^9
Neutrophil (%)	92.1	64.6
Hemoglobin (g/L)	117	96
Red Blood Cells(10^{12}/L)	3.92	3.28
Sodium (mmol/L)	122.3	139.1
Chlorine (mmol/L)	93.2	110.1
Albumin (g/L)	26.9	33.4
PCT-J (ng/mL)	10.25	< 0.01
glycosylated hemoglobin (%)	14.2	-
Blood glucose (mmol/L)	12.60	5.74

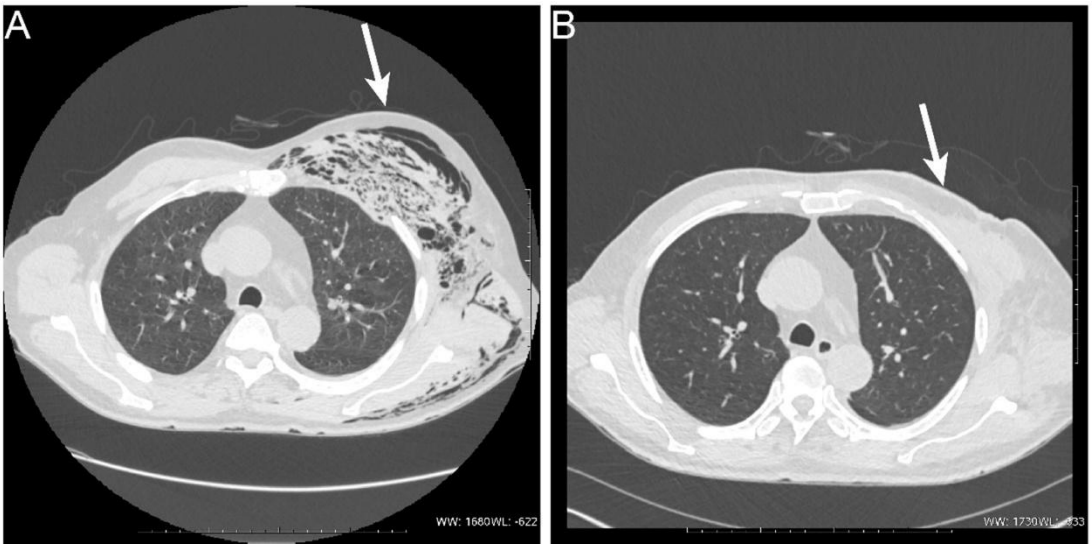

Figure 1: The Computed Tomography (CT) scan of the chest wall of the patient. A. The CT image of the gas-forming chest wall on admission. B. The CT image of the chest wall after admission. The gas-forming abscess on and after admission were indicated by white arrows.

Discussion

Gas-forming primary chest wall abscess is an unusual clinical entity without predisposing factors. Such abscess may suffer from a hematogenous spread of infections occurred ectopically [1,2]. However, secondary chest wall abscesses are complications that are usually caused by blunt chest wall trauma, thoracic wall surgery, direct extension from the lung, or pleural infection [3]. The reported primary chest wall abscess cases have been attributed to *Mycobacterium tuberculosis*. In addition, the abscesses of the chest wall can be also caused by nontuberculous pathogens such as *Actinomyces*, *Escherichia coli*, *Salmonella*, and *Staphylococcus aureus* [3]. The treatment of chest wall abscess includes antibiotic therapy, incision and drainage, and even complex reconstructive surgeries depending on the diagnosis. We reported a case of primary chest wall abscess with a strong gas accumulation caused by *K. pneumoniae*. It is extremely rare that gas-forming chest wall abscess without predisposing factors. Gas-forming *K. pneumoniae* has rapid catabolism capacity, while the transport of the end products is impaired within the abscess [4,5]. The gas-forming abscess caused by *K. pneumoniae* has been commonly reported in other tissues, such as the liver, spine, and iliopsoas [6-8]. In the previous studies, more cases of gas-forming abscesses caused by *K. pneumoniae* occurred in diabetes mellitus patients than non-diabetes patients [4,6]. The reasons behind this phenomenon are not determined. Diabetes mellitus may induce systemic metabolic disorders and compromised immunity, which is easy for bacterial colonization and abscess development [9].

On admission of the patient, the gas-forming abscess in the chest wall had been formed and developed rapidly. The space-occupying lesion could not effectively eliminate with the therapeutic intervention of antibiotics alone. Importantly, the patient has been diagnosed with diabetes and compromised immunity. Therefore, the surgical therapy was carried out with incision and VSD, which is initially developed to treat soft tissue defects due to trauma and infection and shows an advantage in wound repair and infection control [10]. Compared with conventional therapy, VSD can effectively improve bacterial clearance rate, reduce inflammation-related indicators, promote granulation tissue coverage and thickness, and short wound repair time and hospital stay in

patients with soft-tissue wounds **[11].** The antibiotic therapy of piperacillin/ tazobactam combined with clindamycin was administered, as the result of the isolated K. pneumoniae being susceptive to most test antibiotics, except for ampicillin.

Conclusion

We reported an extremely rare case of primary gas-forming chest wall abscess caused by *K. pneumoniae* under the pectoralis major muscle. The gas-forming infection develops rapidly and needs to be treated as soon as possible, especially in patients with diabetes or immunocompromised. The therapy of incision and VSD with appropriate antibiotics is the recommended treatment for this condition of gas-forming chest wall abscess. The correct diagnosis at the early stage is important to decrease the risk of complications, especially in immunocompromised patients.

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