

[CASE REPORT]

Severe Community-acquired Pneumonia Caused by *Acinetobacter baumannii* Successfully Treated with the Initial Administration of Meropenem Based on the Sputum Gram Staining Findings

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Abstract:

A 62-year-old man with diabetes mellitus and a two-day history of fever and dyspnea presented at our hospital. He was diagnosed with community-acquired pneumonia (CAP), septic shock, and respiratory failure. Sputum Gram staining revealed Gram-negative coccobacilli. Based on the Gram staining findings and history, *Acinetobacter baumannii* was considered as one of the causative organisms of his CAP. Consequently, he was successfully treated with the initial administration of meropenem. We suggest that *A. baumannii* should be considered as one of the possible causative organisms of CAP based on a fulminant clinical course, and the presence of Gram-negative coccobacilli.

Key words: *Acinetobacter*, *Acinetobacter baumannii*, community-acquired pneumonia, empiric therapy, Gram stain

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Introduction

Acinetobacter baumannii is a common antibiotic-resistant organism that causes hospital-acquired pneumonia (HAP) (1). *A. baumannii* can also cause community-acquired pneumonia (CAP); however this is rare, with only nine cases of *A. baumannii*-induced CAP (CAP-Ab) reported in Japan to date (2-4). In addition, the clinical presentation of CAP-Ab differs drastically from that of HAP caused by *A. baumannii* (HAP-Ab). HAP-Ab usually develops in previously colonized patients, and the onset is indolent (1). In contrast, CAP-Ab often develops in patients with diabetes mellitus and a smoking history, regardless of previous colonization. Moreover, it rapidly progresses and often presents with respiratory failure and septic shock with an acute onset (5). Previous studies have reported that CAP-Ab is associated with a higher mortality rate than HAP-Ab (40-64% vs. 35%) (6).

When we initially encountered the patient with CAP-Ab, it was difficult to suspect *A. baumannii* as a causative pathogen because of its rarity. On the other hand, the prognosis of CAP-Ab depends on the administration of an appropriate antibiotic that is effective in treating *A. baumannii* (5). Previous studies have reported that a fulminant clinical course and risk factors, such as smoking and diabetes mellitus, are important to consider when CAP-Ab is suspected (5). In addition, Gram staining has sometimes been useful for identifying the causative pathogens of CAP (7-9).

We herein present a case of severe CAP-Ab with respiratory failure and septic shock that was successfully treated with the initial administration of meropenem, the first-line therapeutic agent for *A. baumannii* pneumonia, based on the clinical course and the results of Gram staining.

Case Report

A 62-year-old Japanese man with diabetes mellitus and

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Table. Laboratory Data on Admission.

Complete blood count		Biochemistry	
WBC	2,500 / μ L	TP	5.3 g/dL
RBC	512 $\times 10^4$ / μ L	Alb	2.6 g/dL
Hb	16.5 g/dL	LD	253 IU/L
MCV	86.7 fL	AST	109 IU/L
Plt	5.6 $\times 10^4$ / μ L	ALT	138 IU/L
PT (INR)	1.38	T.Bil	0.7 mg/dL
APTT	47.2 second	BUN	49 mg/dL
D-dimer	5.2 μ g/L	Cre	1.39 mg/dL
		Na	135 mEq/L
		K	3.1 mEq/L
Arterial blood gas (O ₂ 15 L reservoir mask)		Cl	99 mEq/L
pH	7.44	CRP	28.9 mg/dL
PaCO ₂	31.3 mmHg	Glucose	150 mg/dL
PaO ₂	72.8 mmHg	HbA1c(NGSP)	6.3 %
HCO ₃ ⁻	20.8 mmol/L		
Lactate	3.8 mmol/L		
Others			
HBs antigen	negative	<i>Legionella</i> urinary antigen	negative
HCV antibody	negative	<i>Pneumococcal</i> urinary antigen	negative
HIV antibody	negative		

WBC: white blood cell count, RBC: red blood cell count, Hb: hemoglobin, MCV: mean corpuscular volume, Plt: platelet, PT: prothrombin time, APTT: activated partial thromboplastin time, TP: total protein, Alb: albumin, LD: lactate dehydrogenase, AST: aspartate aminotransferase, ALT: alanine aminotransferase, T.Bil: total bilirubin, BUN: blood urea nitrogen, Cre: creatinine, CRP: C reacting protein, NSGP: National Glycohemoglobin Standardization Program

hypertension, complaining of fever and dyspnea of two days in duration, was transported to our emergency department. He also presented with a productive cough and yellow purulent sputum. Moreover, the patient had smoked 20 cigarettes a day for approximately 40 years. He worked as a house painter and had visited a hot spring 10 days prior to the onset of pneumonia. He had no history of immunosuppression, recurrent infection, chemotherapy, or steroid use.

When he arrived at the hospital, the patient's vital signs were as follows: blood pressure, 118/60 mmHg; heart rate, 130 beats/min; respiratory rate, 28/min; percutaneous oxygen saturation 95% (10 L/min via reservoir mask), and body temperature, 37.5°C. On physical examination, holoinspiratory coarse crackles were detected in the right lung. An arterial blood gas analysis showed high anion gap metabolic acidosis with increased lactate. Laboratory tests revealed leukopenia, thrombocytopenia, renal dysfunction, and elevated transaminase (Table). A chest radiograph showed infiltration of the right upper and middle lobes (Fig. 1A), and chest computed tomography showed consolidation with air bronchogram in the right upper and middle lobes (Fig. 1B and C). Following these tests, he was diagnosed with CAP and then admitted to our hospital. Upon admission, the emergency physician consulted the infectious disease specialist, who observed Gram-negative cocci and coccobacilli on sputum Gram staining (Fig. 2). The quality of the sputum was deemed excellent according to the criteria of both Miller and Jones (P3) (10) and Geckler (Class 5) (11). In accordance with the patient's acute and severe clinical

course and computed tomography findings, pneumonia caused by *S. pneumoniae* was initially suspected; however, it was deemed unlikely, as Gram staining revealed monoflora and no Gram-positive cocci. An infectious disease specialist and clinical microbiologist examined the Gram stain multiple times, and considered *A. baumannii* as a possible causative organisms based on the presence of large, round Gram-negative coccobacilli in the form of either single cocci or diplococci, which are typical findings of this bacterium. Thus, we initiated treatment with meropenem (1 g, every eight hours). Even though a *Legionella* urinary antigen test was negative, the patient had recently visited a hot spring and presented with severe pneumonia; thus, we could not exclude *L. pneumophila*. We therefore also administered azithromycin (500 mg/day, intravenously).

In the intensive care unit, the patient was intubated and noradrenaline was administered to treat septic shock. He recuperated from shock the following day, and his respiratory condition gradually improved. Three days after admission, *A. baumannii* was identified in a sputum culture (Fig. 2). The strain was susceptible to ampicillin/sulbactam; thus, we changed the antibiotic regimen from meropenem to ampicillin/sulbactam (3 g, every four hours); his creatinine clearance was 151 mL/min at this time. Two sets of blood cultures were negative. Four days after admission, the patient was extubated and set up for nasal high-flow therapy. Seven days after admission, he was transferred out of the intensive care unit. Twelve days after admission, *Serratia marcescens* was identified from a sputum culture. Thus, we diagnosed

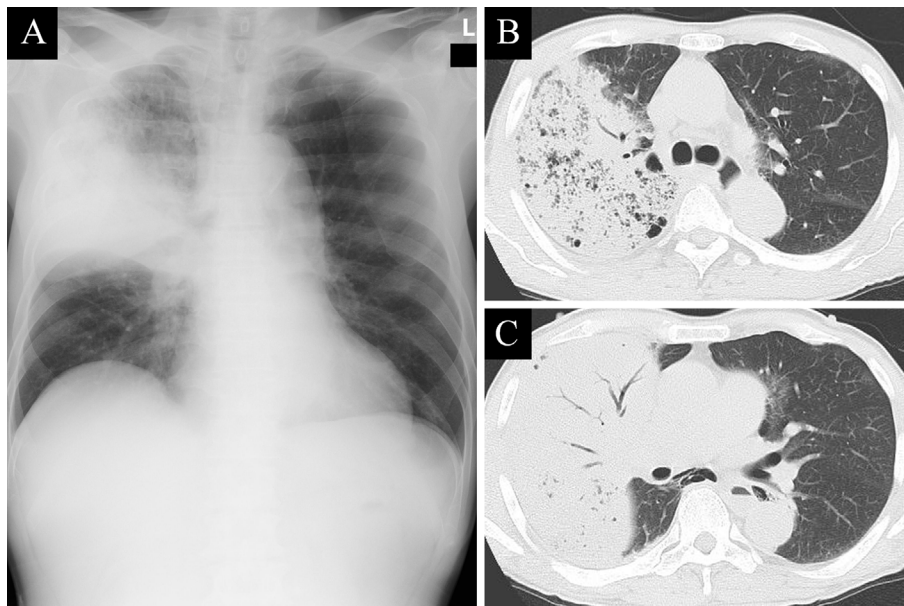


Figure 1. Chest X-ray and computed tomography on admission. Chest X-ray shows infiltrative shadow from the right upper and middle lung lobes (A). Computed tomography shows consolidation with air bronchogram in right upper (B) and middle (C) lobes. Lobar consolidation is often seen in *Acinetobacter baumannii*-induced community-acquired pneumonia.

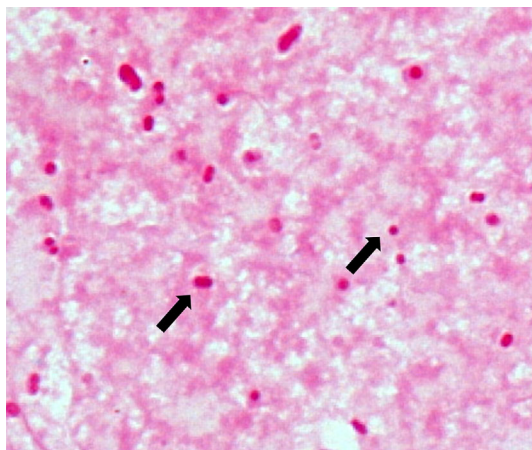


Figure 2. Image of a Gram stain of sputum on admission. (Gram stain; $\times 1,000$) This stain shows large, round gram-negative coccobacilli in the form of either single cocci or diplococci.



Figure 3. Chest computed tomography scan on day 13. Consolidation with multiple small cavities and a low attenuation area in the right upper lobe, supporting the necrotizing pneumonia are observed (5, 13, 14).

HAP and changed ampicillin/sulbactam to cefepime, based on culture susceptibility. Thereafter, the patients' respiratory condition gradually improved. As the patient presented with necrotizing pneumonia based on the chest computed tomography findings (Fig. 3), he was treated with intravenous antibiotics for 42 days (as an inpatient) and with oral ciprofloxacin (400 mg, every 12 hours) for 14 days (as an outpatient) (Fig. 4).

Discussion

We presented a case of CAP-Ab that was successfully treated with an initial administration of meropenem. In addition

to the clinical presentation of the patient, Gram staining of a sputum sample yielded supportive information that was useful in the diagnosis of CAP-Ab.

Gram staining is one of the quickest and most inexpensive methods for identifying etiologic agents in the management of CAP; however, its usefulness in the initial management of CAP remains controversial (12). The sensitivity and specificity of sputum Gram stains range from 15-100% and 11-100%, respectively; the results vary depending on the quality of the sample and the interpreter (12). Gram staining of good-quality sputum samples is a useful method for detecting causative agents when the samples are evaluated by well-trained interpreters, such as infectious disease specialists and experienced laboratory technicians (7-9). Previous studies have shown that Gram staining enables the diagnosis

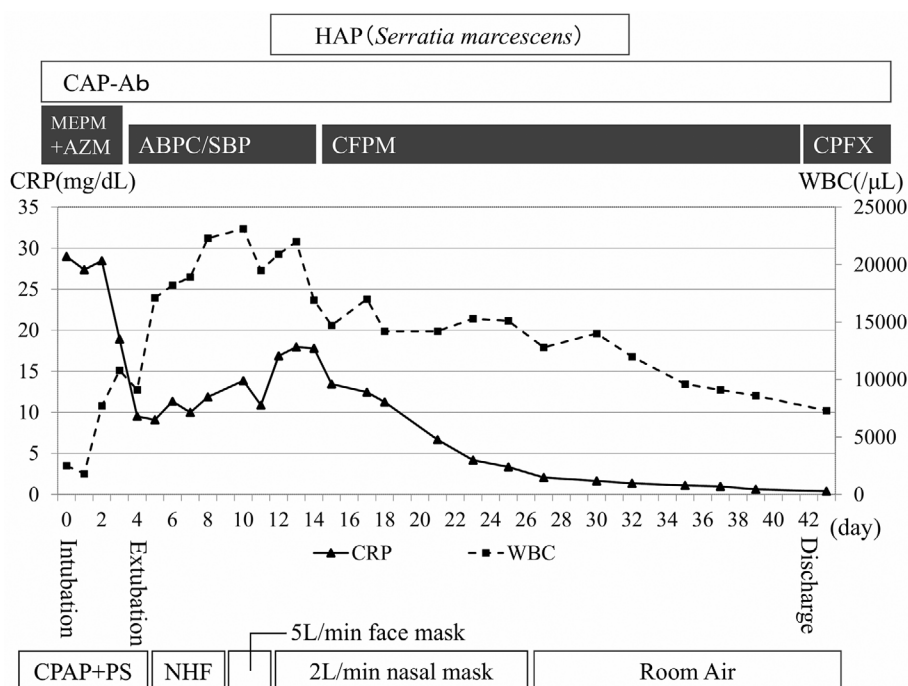


Figure 4. Clinical course. MEPM: meropenem, AZM: azithromycin, ABPC/SBT: ampicillin/sulbactam, CFPM: cefepime, CPMX: ciprofloxacin, WBC: white blood cell count, CRP: C reacting protein, CPAP: continuous positive airway pressure, PS: pressure support, NHF: nasal high flow

of causative pathogens in more than 80% of cases, when a good-quality purulent sample is obtained and examined by specialists (12, 13). In our case, an infectious disease specialist evaluated the Gram stains of a good quality sputum sample using the Miller and Jones (P3) and Geckler (Class 5) criteria. On a Gram stain, *A. baumannii* appears as Gram-negative coccobacilli, which are either single coccil or diplococcal in shape. *A. baumannii* resembles *Neisseria* spp. and *Moraxella* spp., although it is generally larger (14, 15). Moreover, the shape of *A. baumannii* depends on its life-cycle phase—it appears rod-shaped during the growth phase and coccobacillary during the stationary phase (16). In our case, Gram staining revealed Gram-negative coccobacilli, with some resembling diplococci (Fig. 2).

Globally, *A. baumannii* is generally found in water, soil, and food (17). Moreover, CAP-Ab is reported more frequently in Asia and Australia, whereas it is very rare in Japan (1). CAP-Ab accounts for 10% of bacteremic CAP in the northern regions of Australia (18). It is hypothesized that the occurrence of CAP-Ab may be related to aspects of the climate, such as high temperature and humidity (5, 17). In our case, the patient was admitted in July, which is the hot and rainy season—this is similar to the previously reported Japanese cases (2, 3). In addition, CAP-Ab takes a severe course with respiratory failure and septic shock, resulting in a high mortality rate (40-64%) (6). Bacteremia, acute respiratory distress syndrome, and disseminated intravascular coagulation are more frequent in CAP-Ab patients than in HAP-Ab patients (6). However, one study reported a mortality rate of only 11% (5). In that report, the patients were treated with antibiotics that were effective against *A. bau-*

mannii (5). Thus, the choice of antibiotics on admission appears to be important for reducing the mortality rate. Despite the fact that it is difficult to consider CAP-Ab on admission, because of its rarity in areas outside of Southeast Asia and Australia, it is crucial to establish an efficient diagnostic method and an appropriate treatment strategy for CAP-Ab in clinical practice.

Based on the Japanese Respiratory Society pneumonia guidelines, either carbapenems, piperacillin/tazobactam, third-generation cephalosporins, or ampicillin/sulbactam with azithromycin or respiratory quinolones are recommended for the treatment of severe CAP patients who are admitted to an intensive care unit (19). In this case, the Gram staining findings indicating the presence of Gram-negative coccobacilli suggested the possibility of CAP-Ab. In accordance with the antibiogram obtained at our hospital, *A. baumannii* is susceptible to meropenem (100%), ampicillin/sulbactam (93%), and cefepime (93%); accordingly, we chose meropenem as empiric therapy, which is the first-line treatment for *A. baumannii* pneumonia. Based on the sputum culture, results, we de-escalated the antibiotic from meropenem to ampicillin/sulbactam. For *Acinetobacter* infection, the recommended dose of sulbactam is at least 6 g/day; thus, we treated the patient with ampicillin/sulbactam (3 g, every four hours) (20).

In conclusion, we encountered a case of CAP-Ab that was successfully treated with the initial administration of meropenem. Because CAP-Ab is a rare and fulminant disease, the administration of appropriate antibiotics was necessary to improve our patient's prognosis. We suggest that *A. baumannii* should be considered as a possible causative pathogen of CAP, based on the fulminant clinical course and for

the presence of Gram-negative coccobacilli on Gram staining.

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

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