



Case Report

Nosocomial bacteremia due to *Kluyvera cryocrescens*: Case report and literature reviewYusuke Yoshino^{a,b,*}, Susumu Nakazawa^b, Sumire Otani^b, Eiichi Sekizuka^b, Yasuo Ota^a^a Department of Internal Medicine, Teikyo University School of Medicine, 2-11-1 Kaga, Itabashi-ku, Tokyo 173-8606, Japan^b Department of Internal Medicine, Saitama National Hospital, 2-1, Suwa, Wako, Saitama 351-0102, Japan

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ABSTRACT

Kluyvera cryocrescens infection has been considered rare; clinical features of *K. cryocrescens* bacteremia remain unclear because few reports have been published. We report a case of *K. cryocrescens* bacteremia in an adult male patient and review the literature.

Our case was one with nosocomial bacteremia in a patient with interstitial lung disease. The primary infection site was undetermined, although he had an indwelling peripheral intravenous catheter and a urinary catheter.

Piperacilin/tazobactam was administered for 2 weeks and the bacteremia resolved. Unfortunately, there was acute exacerbation of the interstitial lung disease, which was fatal. According to our review, including our case, *K. cryocrescens* bacteremia tends to occur in immunocompromised hosts, and indwelling catheters might be risk factors. Extended spectrum cephalosporins, carbapenems, fluoroquinolones and tetracyclines are generally adequate agents for empiric therapy based on susceptibilities of *K. cryocrescens* clinical isolates.

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Introduction

Kluyvera spp. are Gram negative bacilli that had been initially thought to be benign saprophytes. This genus predominantly colonizes the respiratory, gastrointestinal, and urinary tracts [1]. Water, sewage, soil, milk, hospital sinks, and cows have been reported as environmental sources, suggesting that *Kluyvera* spp. are widely distributed. The biochemical profile is similar to that of other Enterobacteriaceae. A member of the Enterobacteriaceae, although initially described in 1936, the genus *Kluyvera* was not well characterized until 1981 by Farmer et al. [1]. Previous to 1981, the organism has also been referred to as CDC enteric group 8 and as API group 1. Currently the genus *Kluyvera* has four species, *K. cryocrescens*, *K. ascorbata*, *K. georgiana* and *K. cochleae*. *K. cryocrescens* is known to be an opportunistic pathogen and its infection is considered to be rare [2–6]. The overall clinical significance of the organisms, however, is uncertain. Here, we report *K. cryocrescens* bacteremia in an adult and review the literature in order to highlight

the clinical features, antimicrobial susceptibilities and treatments used in recent clinical reports.

Case

An 81-year-old Japanese man with a history of interstitial lung disease and 3 years of home oxygen therapy made regular clinic visits and took a blood test every month. Anemia was detected and he was admitted to the hospital to treat the anemia. On admission, blood test findings included hemoglobin 6.6 g/dL, serum iron 16 µg/dL and serum ferritin 4.2 ng/mL. The fecal occult blood test was negative. He had no other significant clinical history including injection drug use, human immunodeficiency virus infection and treatment with immunosuppressive agents. A proton pump inhibitor and a blood transfusion were administered. On admission day 3, upper gastrointestinal endoscopy was carried out and multiple superficial gastric ulcers without bleeding (Forrest classification: III) were found around cardia. Administration of the proton pump inhibitor was continued.

On admission day 4, fever of 39.3 °C developed, along with an altered level of consciousness and hypotension. Laboratory findings revealed elevated serum C-reactive protein and serum and urine white blood cell counts. Peripheral intravenous catheter

* Corresponding author at: Department of Internal Medicine, Teikyo University School of Medicine, 2-11-1 Kaga, Itabashi-ku, Tokyo 173-8606, Japan.

Tel.: +81 3 3964 1211x7731; fax: +81 3 3579 6310.

E-mail address: yyoshino@med.teikyo-u.ac.jp (Y. Yoshino).

was exchanged immediately. Two samples of blood and one sample of urine were cultured and *K. cryocrescens* was detected from the blood samples. Chest and abdominal computed tomography was carried out and there were no significant findings. Transthoracic echocardiography showed normal findings.

Piperacillin/tazobactam (4.5 g every 6 h) was initiated on hospital day 5. The fever and symptomatology decreased promptly after initiation of antimicrobial therapy. It was suspected that the *K. cryocrescens* bacteremia was related to the peripheral venous catheter because the urine culture was negative and there were no significant findings to suggest an alternative source, though peripheral catheter tip was not cultured. Gastric ulcer was less likely source of infection because of endoscopy findings. *K. cryocrescens* isolates from blood were susceptible to extended spectrum cephalosporins, ampicillin/sulbactam, piperacillin/tazobactam, fluoroquinolones, aminoglycosides, tetracycline, and carbapenems, and resistant to ampicillin and 1st and 2nd generation cephalosporins.

On admission day 11, two blood samples were cultured and no microorganisms were detected. On admission day 16, administration of the antimicrobial agent was terminated. However, on admission day 19, there was an acute and fatal exacerbation of the interstitial pneumonia.

Discussion

We present a case of bacteremia due to *K. cryocrescens* in a patient with interstitial lung disease. Clinical features of *K. cryocrescens* bacteremia remain unclear because there are few pertinent published reports. We reviewed the previously published cases, and the results, along with those of the current case, are summarized in Table 1.

There were no significant sex or age similarities. In contrast, there were some similarities of clinical backgrounds: 8 of 9 patients had severe comorbidities and another was a premature infant, suggesting that *K. cryocrescens* can cause severe infections such as septicemia in immunosuppressed patients. In all, 8 of the 9 cases were nosocomial infections, consistent with previous descriptions of *K. cryocrescens* as an opportunistic microorganism.

Primary infection sites were determined in only 2 cases, which were both central catheter-related blood stream infections. Although primary infection sites were undetermined in the remaining 7 cases, all of these had peripheral and/or central intravenous catheters. Results of catheter tip culture or culture of blood drawn through the catheter were not described in any of those 7 cases, suggesting that catheter-related blood stream

Table 1
Clinical characteristics of patients with *Kluyvera cryocrescens* bacteremia.

No	Citation	Age/sex	Comorbidities	Primary infection site	Indwelling device	Community acquired/nosocomial	Antibiotics	Outcome
1	[2]	12 months/male	Congestive heart failure, Tetralogy of Fallot	CRBSI	Broviac catheter	Nosocomial	Ampicillin and gentamicin	Cured
2	[3]	65 yo/female	Coronary artery disease, rheumatic heart disease	Unknown (outbreak case)	Peripheral intravenous catheter	Nosocomial	Cefazolin and gentamicin	Cured
3	[3]	71 yo/female	Coronary artery disease	Unknown (outbreak case)	Peripheral intravenous catheter	Nosocomial	Cefazolin and gentamicin	Cured
4	[3]	85 yo/female	Coronary artery disease, diabetes mellitus	Unknown (outbreak case)	Peripheral intravenous catheter	Nosocomial	Cefazolin and gentamicin	Cured
5	[3]	35 yo/male	Coronary artery disease	Unknown (outbreak case)	Peripheral intravenous catheter	Nosocomial	Cefazolin and gentamicin	Cured
6	[4]	2 yo/male	Primary neuroectodermal tumor	CRBSI	Central venous catheter	Community-acquired	Cefepime and amikacin	Cured
7	[5]	45 yo/female	Unknown	Unknown	Unknown	Nosocomial	Unknown	Unknown
8	[6]	17th day/male	Premature	Unknown	Umbilical artery/vein catheter	Nosocomial	Teicoplanin and ciprofloxacin	Cured
9	Our case	81 yo/male	Interstitial lung disease	Unknown	Peripheral intravenous catheter, urine catheter	Nosocomial	Piperacillin/tazobactam	Cured

yo, years old; CRBSI, catheter related blood stream infection.

Table 2
Antimicrobial susceptibility of *Kluyvera cryocrescens* in clinical isolates from bacteremic cases.

	No. 1	No. 2–5	No. 6	No. 7	No. 8	No. 9	Susceptibility
Ampicillin			R	R	R	R	0.0%
Amoxicillin/clavulanate			S	I		S	66.7%
Piperacillin/tazobactam				S	R	S	66.7%
1st gen cephalosporins (ex: cefazolin)			R		R	S	33.3%
2nd gen cephem (ex: cefotiam)			R		R	S	33.3%
3rd gen cephem (ex: ceftriaxone)		R	S	S/I		S	60.0%
4th gen cephem (ex: cefepime)			S			S	100.0%
Imipenem		S	S	S		S	100.0%
Amikacin		R	S	S		S	75.0%
Gentamicin		S	S	R		S	75.0%
Ciprofloxacin		S	S	S	S	S	100.0%
Doxycycline				S		S	100.0%

S, sensitive; R, resistant; ex, example.

infections might have been present in some of these. Intravenous catheter use might be a major risk factor.

Through production of beta-lactamases, resistance to ampicillin and 1st and 2nd generation cephalosporins can be expected. Antibiotic susceptibilities of *K. cryocrescens* isolates from bacteremic cases are summarized in Table 2.

Conflicts of interest

None declared.

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