

## Case Report

# A Case of a Persistent Postoperative Infection Caused by Multidrug-Resistant *Kluyvera ascorbata* in the Oral and Maxillofacial Region

Si-Hai Zou,<sup>1</sup> Lu-Ying Zhu,<sup>1</sup> Yong Li,<sup>1,2</sup> and Fu-Gui Zhang <sup>1,2</sup>

<sup>1</sup>Department of Oral and Maxillofacial Surgery, Affiliated Hospital of Stomatology, Chongqing Medical University, Chongqing 401147, China

<sup>2</sup>Chongqing Key Laboratory of Oral Diseases and Biomedical Sciences, Chongqing 401147, China

Correspondence should be addressed to Fu-Gui Zhang; 500290@hospital.cqmu.edu.cn

Received 2 October 2018; Revised 29 December 2018; Accepted 9 January 2019; Published 31 January 2019

Academic Editor: Paola Di Carlo

Copyright © 2019 Si-Hai Zou et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Introduction.** *Kluyvera ascorbata* infection is rare, but it has been extensively studied because of its potential to cause a wide range of infections and its ability to transfer the gene encoding for CTX-M-type extended spectrum  $\beta$ -lactamases (ESBLs) to other Enterobacteriaceae. **Case Presentation.** The authors report a case of a 61-year-old Chinese male with a persistent postoperative infection caused by a multidrug-resistant ESBL-producing *K. ascorbata*. Following antimicrobial susceptibility testing, he was aggressively treated with gentamicin and levofloxacin with a favorable outcome. **Conclusion.** To our knowledge, this is the first case report of a persistent postoperative infection caused by a multidrug-resistant *K. ascorbata* in the oral and maxillofacial region. The authors suggest that *K. ascorbata* infection warrants prompt identification and aggressive antibiotic management, given that ESBL-producing *K. ascorbata* is resistant to penicillins and first-generation to third-generation cephalosporins.

## 1. Introduction

*Kluyvera ascorbata* is a Gram-negative microorganism belonging to the family of Enterobacteriaceae and was first identified by Farmer et al. [1]. Although it infrequently causes infections, it can cause a wide range of infections including acute appendicitis [2]; biliary tract infection [3]; urinary tract infection [4]; bacteremia with neutropenia and fever [5]; bacteremia and severe sepsis [6]; sepsis accompanied with multiorgan dysfunction [7]; hock and pulmonary hemorrhage [8]; enteritis, central venous catheter infections, and peritonitis [9, 10]; solid organ transplant recipient infection [11]; acute cholecystitis [12]; and cholecystitis and bacteremia [13]. However, no *K. ascorbata* infections have been reported to date in the oral and maxillofacial region. Therefore, the authors describe the first case of a persistent postoperative infection caused by *K. ascorbata* in the oral and maxillofacial region after a combination of radical neck dissection with gingivectomy and

mandibulectomy. A brief literature review of the clinical features of *K. ascorbata* infections in humans is also included.

## 2. Case Presentation

A 61-year-old Chinese man was admitted to hospital with a gingival squamous cell carcinoma of the left mandible. He was treated with a combination of radical neck dissection with gingivectomy, mandibulectomy, and strengthening of the mandible with a reconstructive plate (Figure 1). *K. ascorbata* was identified from the drainage specimen taken on postoperative day five and confirmed with the Hefei Star HX-21 blood culture analyzer (Hefei Star Technology Development Co., Ltd., Anhui, China). Antimicrobial susceptibility testing showed resistance to ceftazidime and piperacillin but susceptibility to levofloxacin and gentamicin (Table 1). *K. ascorbata*'s ability to produce ESBLs was also detected by the same system. The patient's blood culture was

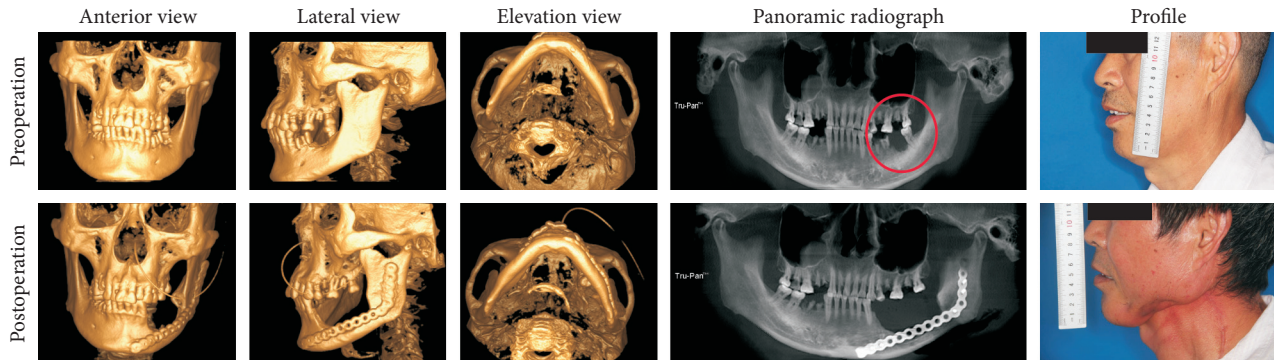


FIGURE 1: Images taken before surgery and two months after surgery. The circle shows the squamous cell carcinoma lesion of the gingiva in the left mandible. It took two months for the wound to heal after the *Kluyvera ascorbata* infection.

TABLE 1: Results of antimicrobial susceptibility testing (AST).

Name	Group	MIC ( $\mu\text{g/ml}$ )	AST
Cefazolin	A	$\geq 8$	Resistant
Ampicillin	A	$\geq 32$	Resistant
Gentamicin	A	$\leq 2$	Sensitive
PIZ	B	$\geq 128/4$	Resistant
Piperacillin	B	$\geq 128$	Resistant
Cefuroxime	B	$\leq 4$	Resistant
Cefotaxime	B	$\geq 64$	Resistant
Cefepime	B	$\leq 4$	Sensitive
Imipenem	B	$\leq 1$	Sensitive
Amikacin	B	$\leq 8$	Sensitive
Ciprofloxacin	B	$\leq 0.25$	Sensitive
Levofloxacin	B	$\leq 1$	Sensitive
SXT	B	$\leq 0.5/9.5$	Sensitive
Aztreonam	C	$\geq 16$	Resistant
Ceftazidime	C	$\leq 4$	Resistant
Chloramphenicol	C	$\leq 4$	Sensitive
Cefoperazone	O	$\leq 8$	Sensitive
Minocycline	O	$\leq 2$	Sensitive
CPS	O	$\geq 64/64$	Resistant
Nitrofurantoin	U	$\geq 128$	Resistant
Ofloxacin	U	$\leq 1$	Sensitive

Dose and usage are for adults. Group A (drug of first choice): priority selection; Group B (drug of first choice): selection of drug resistance or nonuse in Group A; Group C: selection of drug resistance or nonuse in Group A and B; A supplement to the urethra; Group O: other drugs. *Kluyvera ascorbata* with the ability to produce extended spectrum beta-lactamases is resistant to penicillins, first-generation to third-generation cephalosporins, and most beta-lactams, even with a sensitive result in vitro.

sterile. Intravenous administration of levofloxacin (200 mg, q24h) and gentamicin (240 mg, q24h) based on the susceptibility test of this microorganism was continued for 14 days. The wounds were continuously dressed twice a day for 2 weeks and daily for 1 week. The patient was discharged home with an iodoform sponge which was changed weekly for 1 month, and the wound gradually healed after 2 months.

### 3. Discussion

*K. ascorbata* is a relatively newly described member of the Enterobacteriaceae family that rarely causes infections in humans. These bacteria are usually considered a commensal [8]. Nosocomial infections pose significant threats to

hospitalized patients, especially immunocompromised patients, such as those with cancer [14]. The authors report what they believe to be the first case of a multidrug-resistant *K. ascorbata* isolated from the wound drainage specimen of an inpatient with a postoperative infection.

*K. ascorbata* is virulent in terms of clinical features. It causes a wide range of infections over a wide age span, namely, from adults as old as 78 years [15] to children [9], infants [16], low birth weight infants [8], and neonates as young as five days old [17]. The authors report a case involving a 61-year-old patient.

*Kluyvera* species can be isolated from sputum, urine, stools, and blood [18, 19], hospital sewage [20], human milk samples [21], as well as wound drainage specimens as in our case.

*Kluyvera* strains are rare but potentially dangerous pathogens due to their ability to transfer the gene encoding for ESBLs [18], which was elucidated by Literacka et al. [22]. CTX-M beta-lactamases, which are plasmids mediated in other Enterobacteriaceae, originate from the chromosomal beta-lactamases of its reservoir, *K. ascorbata*. *ISEcp1B*, which is an insertion element [23] and a genetic mobile element [24], has been reported to be associated with gene transfer [25, 26]. Besides *bla*<sub>CTX-M-3</sub>, *K. ascorbata* also bears the *bla*<sub>TEM-1</sub>, *aacC2*, and *armA* genes, as well as integronic *aadA2*, *dfrA12*, and *sul1*, which together confer resistance to the majority of beta-lactams, aminoglycosides, and trimethoprim-sulfamethoxazoles [27]. Antimicrobial agents active against *Kluyvera* strains include third-generation cephalosporins, fluoroquinolones, aminoglycosides [8], beta-lactams with beta-lactamase inhibitors and carbapenems [7], and meropenem [26]; however, as shown by the authors, ESBL-producing *K. ascorbata* is resistant to penicillins and first-generation to third-generation cephalosporins. Clinicians should be aware of the spectrum of disease and the increasing clinical importance of this pathogen. Purified KLUA-9 from *K. ascorbata* showed the highest catalytic efficacy towards benzylpenicillin, ampicillin, piperacillin, first-generation cephalosporins, cefuroxime, and cefoperazone and the lowest efficacy towards dicloxacillin, ceftiofen, and imipenem [28].

*K. ascorbata*, which is a potentially dangerous pathogen in both immunocompetent and immunocompromised

hosts, warrants prompt identification by antimicrobial susceptibility testing and a correct and aggressive antibiotic management [16, 29].

## Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

## Authors' Contributions

Acquisition, analysis, and interpretation of data were performed by Si-Hai Zou, Lu-Ying Zhu, and Yong Li. Drafting or revision and final approval of the article were performed by Fu-Gui Zhang.

## Acknowledgments

We are grateful to Qi-Ming Wang and Cheng Deng for providing technical support. We extend our sincere thanks to Yan Sun for proofreading the microbiological part. We thank Helen Jeays, BSc AE, from Liwen Bianji, Edanz Editing China (<http://www.liwenbianji.cn/ac>), for editing the English text of a draft of this manuscript. This study was sponsored by the National Natural Science Foundation of China (No. 81400493), High-level Medical Reserved Personnel Training Project of Chongqing, Scientific Research Project of Chongqing Health Commission (No. 2017MSXM074), and project supported by the Program for Innovation Team Building at Institutions of Higher Education in Chongqing in 2016.

## References

- [1] J. J. Farmer III, G. R. Fanning, G. P. Huntley-Carter et al., "Kluyvera, a new (redefined) genus in the family enterobacteriaceae: identification of *Kluyvera ascorbata* sp. nov. and *Kluyvera cryocrescens* sp. nov. in clinical specimens," *Journal of Clinical Microbiology*, vol. 13, pp. 919–933, 1981.
- [2] J. E. Carter and T. N. Evans, "Clinically significant *Kluyvera* infections: a report of seven cases," *American Journal of Clinical Pathology*, vol. 123, no. 3, pp. 334–338, 2005.
- [3] L. Wang, Y. Jing, K. Lai, J. An, and J. Yang, "A case of biliary tract infection caused by KPC-2-producing *Kluyvera ascorbata*," *Case Reports in Infectious Diseases*, vol. 2018, Article ID 5745708, 2 pages, 2018.
- [4] H. Narchi, "Kluyvera urinary tract infection," *Pediatric Infectious Disease Journal*, vol. 24, no. 6, pp. 570–572, 2005.
- [5] P. Linares, C. Castanon, C. Llano et al., "Bacteremia by *Kluyvera ascorbata* in a patient with neutropenia and fever," *Enfermedades Infecciosas y Microbiología Clínica*, vol. 18, no. 1, pp. 48–49, 2000.
- [6] M. Alfreijjat, "A case of urinary tract infection and severe sepsis caused by *Kluyvera ascorbata* in a 73-year-old female with a brief literature review," *Case Reports in Infectious Diseases*, vol. 2017, Article ID 3848963, 2 pages, 2017.
- [7] E. Karadag Oncel, Y. Ozsurekci, Y. Akyon, D. Gur, A. B. Cengiz, and A. Kara, "Kluyvera ascorbata infections in children: a case series," *Türk Pediatri Arşivi*, vol. 50, no. 2, pp. 123–128, 2015.
- [8] D. Sharma, T. Dasi, S. Murki, and T. P. Oleti, "Kluyvera ascorbata sepsis in an extremely low birth weight infant," *Indian Journal of Medical Microbiology*, vol. 33, no. 3, p. 437, 2015.
- [9] E. Ruffini, F. Pace, M. Carlucci, E. De Conciliis, P. Staffolani, and A. Carlucci, "Urinary tract infection caused by *Kluyvera ascorbata* in a child: case report and review of the *Kluyvera* infections in children," *Minerva Pediatrica*, vol. 60, no. 6, pp. 1451–1454, 2008.
- [10] R. Yogev and S. Kozlowski, "Peritonitis due to *Kluyvera ascorbata*: case report and review," *Clinical Infectious Diseases*, vol. 12, no. 3, pp. 399–402, 1990.
- [11] R. Cheruvattath, V. Balan, R. Stewart, R. L. Heilman, D. C. Mulligan, and S. Kusne, "Kluyvera co-infection in two solid organ transplant recipients: an emerging pathogen or a colonizer bystander?," *Transplant Infectious Disease*, vol. 9, no. 1, pp. 83–86, 2007.
- [12] N. Batista, Ó. Díez, A. Moreno, and J. Ode, "Colecistitis aguda por *Kluyvera ascorbata*," *Enfermedades Infecciosas y Microbiología Clínica*, vol. 20, no. 7, pp. 370–371, 2002.
- [13] J. Oteo, J. Luis Gómez-Garcés, and J. I. Alós, "Acute cholecystitis and bacteremia caused by *Kluyvera ascorbata* in a cirrhotic patient," *Clinical Microbiology and Infection*, vol. 4, no. 2, pp. 113–115, 1998.
- [14] H. M. Ashour and A. El-Sharif, "Species distribution and antimicrobial susceptibility of gram-negative aerobic bacteria in hospitalized cancer patients," *Journal of Translational Medicine*, vol. 7, no. 1, 2009.
- [15] G. Lopez-Larramona, E. Gomez-de-Ona, M. M. Maestre-Muniz, A. M. Ruiz-Chicote, E. Galan-Dorado, and L. Gonzalez-Delgado, "Kluyvera ascorbata bacteremia in an adult patient," *Revista Española de Quimioterapia*, vol. 26, p. 226, 2013.
- [16] A. Isozaki, K. Shirai, S. Mimura, M. Takahashi, W. Furushima, and Y. Kawano, "A case of urinary tract infection caused by *Kluyvera ascorbata* in an infant: case report and review of the literature," *Journal of Infection and Chemotherapy*, vol. 16, no. 6, pp. 436–438, 2010.
- [17] F. Ochi, H. Tauchi, M. Mizumoto, H. Miyamoto, and E. Ishii, "Kluyvera ascorbata infection in a neonate," *Pediatrics International*, vol. 59, no. 5, pp. 640–641, 2017.
- [18] R. Carrillo Esper, C. Pena Perez, J. Mucino Bermejo, J. R. Carrillo Cordova, and L. D. Carrillo Cordova, "Severe sepsis, septic shock and secondary multiple organ dysfunction in infection by *Kluyvera ascorbata*," *Gaceta Médica de México*, vol. 147, no. 4, pp. 355–360, 2011.
- [19] E. Padilla, P. Tudela, M. Gimenez, and J. M. Gimeno, "Kluyvera ascorbata bacteremia," *Medicina Clínica*, vol. 108, no. 12, p. 479, 1997.
- [20] F. Zhao and Z. Zong, "Kluyvera ascorbata strain from hospital sewage carrying the mcr-1 colistin resistance gene," *Antimicrobial Agents and Chemotherapy*, vol. 60, pp. 7498–7501, 2016.
- [21] P.-W. Chen, S.-Y. Tseng, and M.-S. Huang, "Antibiotic susceptibility of commensal bacteria from human milk," *Current Microbiology*, vol. 72, no. 2, pp. 113–119, 2015.
- [22] E. Literacka, B. Bedenic, A. Baraniak et al., "blaCTX-M genes in escherichia coli strains from Croatian Hospitals are located in new (blaCTX-M-3a) and widely spread (blaCTX-M-3a and blaCTX-M-15) genetic structures," *Antimicrobial Agents and Chemotherapy*, vol. 53, no. 4, pp. 1630–1635, 2009.
- [23] P. Nordmann, M.-F. Lartigue, and L. Poirel, "Beta-lactam induction of ISEcp1B-mediated mobilization of the naturally occurring (CTX-M) beta-lactamase gene of *Kluyvera ascorbata*," *FEMS Microbiology Letters*, vol. 288, no. 2, pp. 247–249, 2008.

- [24] C. Humeniuk, G. Arlet, V. Gautier, P. Grimont, R. Labia, and A. Philippon, “ $\beta$ -lactamases of *Kluyvera ascorbata*, probable progenitors of some plasmid-encoded CTX-M types,” *Antimicrobial Agents and Chemotherapy*, vol. 46, no. 9, pp. 3045–3049, 2002.
- [25] M.-F. Lartigue, L. Poirel, D. Aubert, and P. Nordmann, “In vitro analysis of ISEcp1B-mediated mobilization of naturally occurring  $\beta$ -lactamase gene blaCTX-M of *Kluyvera ascorbata*,” *Antimicrobial Agents and Chemotherapy*, vol. 50, no. 4, pp. 1282–1286, 2006.
- [26] S. Moonah, K. Deonarine, and C. Freeman, “Multidrug resistant *Kluyvera ascorbata* septicemia in an adult patient: a case report,” *Journal of Medical Case Reports*, vol. 4, no. 1, p. 197, 2010.
- [27] M. Golebiewski, I. Kern-Zdanowicz, M. Zienkiewicz et al., “Complete nucleotide sequence of the pCTX-M3 plasmid and its involvement in spread of the extended-spectrum  $\beta$ -lactamase gene blaCTX-M-3,” *Antimicrobial Agents and Chemotherapy*, vol. 51, no. 11, pp. 3789–3795, 2007.
- [28] M. M. Rodríguez, P. Power, C. Bauvois et al., “Characterisation of KLUA-9, a  $\beta$ -lactamase from extended-spectrum cephalosporin-susceptible *Kluyvera ascorbata*, and genetic organisation of blaKLUA-9,” *International Journal of Antimicrobial Agents*, vol. 29, no. 3, pp. 332–337, 2007.
- [29] D. Torre, E. Crespi, M. Bernasconi, and P. Rapazzini, “Urinary tract infection caused by *Kluyvera ascorbata* in an immunocompromised patient: case report and review,” *Scandinavian Journal of Infectious Diseases*, vol. 37, no. 5, pp. 375–378, 2009.