

Bacteremia Caused by *Comamonas kerstersii* in a Patient with Diverticulosis

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We report for the first time a case of bacteremia caused by *Comamonas kerstersii* in a 65-year-old patient with sign of diverticulosis. In addition, we review the isolation of *Comamonas* sp. and related organisms in our hospital over 25 years.

CASE REPORT

Comamonas kerstersii is a nonfermenting betaproteobacterium described in 2003 that has long been considered nonpathogenic (1). This organism has recently been associated with intraabdominal infection due to perforation of the digestive tract (2). Here we describe a case of polymicrobial bacteremia due to *C. kerstersii* and *Bacteroides fragilis* in a 65-year-old diabetic man who was admitted to the emergency department of a hospital because of the sudden onset of fever and chills. The patient reported episodes of vomiting and diarrhea and mentioned that he had drunk water from a small river. Stool cultures performed after the beginning of antibiotic treatment did not disclose *Salmonella*, *Shigella*, *Aeromonas*, *Campylobacter* species, or *C. kerstersii*. The detection of *Clostridium difficile* toxins A and B and glutamate dehydrogenase antigen with the commercial *C. difficile* detection kit from Teclab was also negative. Blood samples (two pairs of culture bottles) were drawn from a peripheral vein, and the patient was discharged under treatment with oral ciprofloxacin for gastroenteritis of unknown origin. The blood cultures were processed by a Bactec FX automated blood culture system (Becton, Dickinson, Sparks, MD). A first aerobic blood culture bottle became positive 16 h 8 min after sampling, and Gram staining revealed the presence of long, filamentous, Gram-negative bacilli (Fig. 1). Bacterial identification by matrix-assisted laser desorption ionization–time of flight (MALDI-TOF) mass spectrometry (Bruker Daltonics GmbH, Leipzig, Germany) was performed on the same day by using a protocol that we recently developed on the basis of the analyses of a bacterial pellet preparation from the blood culture bottles (3–5). The strain was identified as *C. kerstersii*, a Gram-negative nonfermenting bacterium, and prompted the hospitalization of the patient. The patient was afebrile at that time, but palpation of the left lower abdominal quadrant was painful. An abdominal computed tomography (CT) scan revealed diverticulosis without evidence of diverticulitis. The anaerobic blood culture bottles from the same pair of samples became positive for *Bacteroides fragilis* 24 h 2 min after sample collection. We determined the following MICs (mg/liter) for the *C. kerstersii* strain by the Etest method (bioMérieux, Lyon, France): ceftazidime, 0.75; meropenem, 0.004; imipenem, 0.06; minocycline, 0.38; levofloxacin, 4; co-trimoxazole, >32; ciprofloxacin, 32. For the *B. fragilis* strain, the MICs were as follows: amoxicillin-clavulanate, 1.5; piperacillin-tazobactam, 6; imipenem, 0.12; meropenem, 0.025; metronidazole, 0.25; clindamycin, 16; ciprofloxacin, 32. The patient was treated with imipenem-cilastatin for 10

days and recovered. The final diagnosis was mixed bacteremia with *C. kerstersii* and *B. fragilis* in a setting of diverticulosis.

Comamonads are Gram-negative, nonfermenting, oxidase- and catalase-positive bacteria that are motile largely because of the presence of polar flagella. The genus *Comamonas* originally contained *Comamonas terrigena*, *Comamonas testosteroni* (previously *Pseudomonas testosteroni*), and *Comamonas acidovorans* (previously *Pseudomonas acidovorans*) (6). It now contains 17 species, while *C. acidovorans* has been separated from the genus on the basis of its 16S rRNA gene and is now known as *Delftia acidovorans* (7). In 2003, Shigematsu and colleagues described a new species, *Delftia tsuruhatensis*, that is known to be able to cause bacteremia (8–10). Biochemical analysis often misclassifies these two *Delftia* species. Since *D. tsuruhatensis* is absent from our MALDI-TOF database, we cannot exclude the possibility of misclassification. For this reason, *D. acidovorans* refers to *D. acidovorans sensu lato*, which includes *D. tsuruhatensis*. Although they are ubiquitously distributed in the environment (soil and water), *Comamonas* and *Delftia* species are rarely associated with infections in humans. However, several publications have incriminated *C. testosteroni* and *D. acidovorans* in particular in human diseases, including severe invasive infections such as bacteremia and meningitis (7, 11–17).

C. kerstersii, which was described in 2003 (1), has recently been reported as an agent of intraabdominal infection by Almuzara and colleagues (2). The present case is the first report of *C. kerstersii* bacteremia. We initially identified the strain at the species level directly from a positive blood culture bottle by MALDI-TOF (3–5). The MALDI-TOF spectral score for *C. kerstersii* was 2.176 according to the manufacturer's scoring system. Since no other species reached a score above 2.0, this identification was considered valid at the species level (18). Subsequently, it was recovered both

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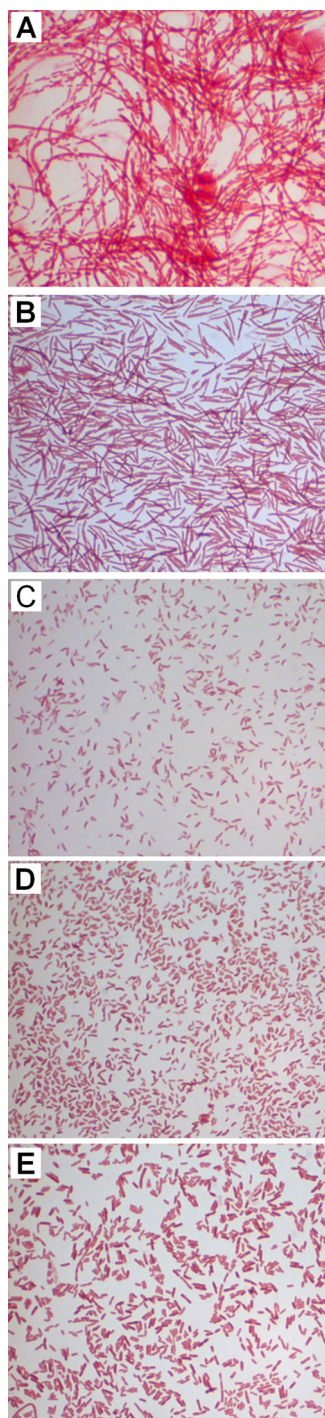


FIG 1 Gram staining of *C. kerstersii*, *C. testosteroni*, and *D. acidovorans* strains isolated in clinical samples from Lausanne University Hospital. The *C. kerstersii* strain in the present case report was obtained directly from a blood culture bottle (A) and after culture on blood agar medium (B). The strain displays long filaments, unlike the other strains, which appear as Gram-negative short bacilli or rods. (C) A *C. kerstersii* strain identified in an intraperitoneal infection of an 11-year-old child with a perforated appendix. (D) *C. testosteroni* involved in bacteremia in a 33-year-old man. (E) *D. acidovorans* identified in blood cultures from a 61-year-old man.

from a blood agar plate (with a spectral score of 2.26), on which its growth was maximal, and from a “chocolate” agar plate supplemented with NAD (factor V) and hemin (factor X). The reliability of MALDI-TOF for discrimination between *Comamonas* species is shown by the fact that *Comamonas aquatica*, the closest species also present in the MALDI-TOF database, gave a score of 1.542. The database that was used contains five *Comamonas* species (*C. kerstersii*, *C. testosteroni*, *C. aquatica*, *C. terrigena*, and *C. nitrativorans*) and five strains of *D. acidovorans*. The recently identified species *D. tsuruhatensis* is absent from this database (9), and we cannot exclude the possibility that some of the *D. acidovorans* bacteria identified in our laboratory by MALDI-TOF were *D. tsuruhatensis*. In the absence of MALDI-TOF, numerous biochemical tests (at least 11) are necessary to discriminate *Comamonas* species (1, 2); such identification requires isolation on an agar plate and cannot be performed on the same day of positivity directly by blood culture. Because of the excellent identification obtained with MALDI-TOF, we rather proceeded to 16S rRNA gene sequencing. Using primers described in references 19 and 20, we obtained a 780-bp partial 16S rRNA gene sequence. A BLAST search for this sequence on the NCBI website revealed 99% identity (754/755 nucleotides with no gaps) with the *C. kerstersii* sequence (accession number AJ430348.1) submitted by Wauters and colleagues (1). The divergence corresponds to a polymorphism reported by the authors at position 298 (1). This method is limited by the low number of *C. kerstersii* 16S rRNA sequences. Nevertheless, the first sequence identified as *C. aquatica* (accession number FJ493173) displays 98% identity (749/763 with two gaps). From both the blood culture bottle and the agar plate, the strain appeared as an extremely long Gram-negative filamentous bacillus, which is a very unusual phenotype for bacteria of this genus (Fig. 1). The *Comamonas* and *Delftia* strains previously isolated in our hospital are Gram-negative short bacilli or rods (Fig. 1), which is the morphology described for these organisms (1, 7).

Translocation from the digestive tract seems to be a predominant cause of infections by *Delftia* and *Comamonas* species. Recently, Hagiya and colleagues reported a *D. acidovorans* bacteremia in a 46-year-old woman caused by translocation of the bacteria after pesticide poisoning (15). Bacteremia caused by *C. testosteroni* was previously reported in a 22-year-old man with a perforated appendix (21). In the four cases reported by Almuzara and colleagues, the *C. kerstersii* strains were isolated from intra-abdominal infections (2). We previously identified another *C. kerstersii* strain in an intraperitoneal infection of an 11-year-old child with a perforated appendix (Table 1 and Fig. 1). Herein, the digestive origin of the *C. kerstersii* strain is supported by the facts that (i) the patient reported abdominal pain, vomiting, and diarrhea; (ii) a CT scan revealed evidence of diverticulosis; and (iii) the enteric bacterium *B. fragilis* was isolated from a blood culture. *B. fragilis* is a gut commensal of humans that can cause severe diseases such as bacteremia and abscesses due to the production of several virulence factors such as capsule, endotoxins, and enterotoxins (22). *C. kerstersii* infection could originate from the water that the patient drank in the countryside.

Comamonas species have rarely been associated with infection in humans despite their ubiquitous distribution in the environ-

TABLE 1 *Comamonas* sp. and *D. acidovorans* isolates from clinical samples in the Lausanne University Hospital from 1997 to 2013

Organism or parameter	No. of patients (no. of samples)							Total no. of patients (samples)	% of patients
	Respiratory and ENT ^a	Urogenital ^b	Intraabdominal ^c	Skin	Blood culture	Surgical wound	Other ^d		
<i>D. acidovorans</i>	19 (20)	12 (13)		5	1 (13)		1 (4)	38 (55)	54.3
<i>C. testosteroni</i>	2 (4)	3	8	1 (4)	1	4 (5)	1	20 (26)	28.57
<i>C. kerstersii</i>			1		1			2	2.86
<i>C. aquatica</i>		1 (4)						1 (4)	1.43
<i>Comamonas</i> sp. ^e	2 (2)		6 (8)	1 (1)				9 (14)	12.86
Total no.	23 (26)	16 (17)	15 (8)	7 (5)	3 (13)	4 (5)	2 (4)	70 (99)	100
Total %	32.86 (25.74)	22.86 (21.78)	21.43 (16.83)	10 (9.9)	4.29 (14.85)	5.71 (4.95)	2.85 (5.94)	100	

^a ENT, ear, nose, and throat.

^b Urine, vaginal swab, and placenta.

^c Ascitic fluid, peritoneal fluid, penrose liquid, Kehr drain.

^d Stool sample ($n = 1$), bone fragment ($n = 1$), orifice smear ($n = 1$).

^e No identification at the species level.

ment, possibly because of the difficulty in accurately distinguishing *Comamonas* species from *Pseudomonas* species in the pre-MALDI-TOF era (2). Alternatively, comamonads could have been underrecognized because of their common occurrence in a setting of a polymicrobial infection. In our 1,027-bed tertiary-care university hospital, 32 *Comamonas* sp. strains and 38 *D. acidovorans* strains were isolated from 1997 to 2013. They were isolated primarily from respiratory tract samples (33%), urogenital tract samples (23%), and digestive tract samples (21%); bacteremia represented 5% (three patients) of the cases (Table 1). The three bacteremias produced distinct clinical features but were all polymicrobial (Table 2). The first bacteremia case was due to *C. testosteroni* in association with *Streptococcus parasanguis* and *Ralstonia pickettii* in a 33-year-old man. A second case involved *D. acidovorans* in association with *Streptococcus agalactiae* in blood cultures from a 61-year-old man. The last case is the present *C. kerstersii* and *B. fragilis* coinfection.

Like *D. acidovorans*, *C. testosteroni* is the *Comamonas* species associated predominantly with bacteremia (Table 1) (7, 14, 15, 17, 21). Translocation from the digestive tract and catheters is the predominant source of infection (15, 17, 21, 23). Immunocompromised children or patients with compromised immune systems such as patients with AIDS or patients with cancer or treated with aplastic chemotherapies appear to be particularly at risk of developing *Comamonas* sp. or *D. acidovorans* bacteremia (16, 23).

Interestingly, Khan and colleagues reported a fatal outcome in an 4-year-old immunocompetent child with *D. acidovorans* bacteremia (16). The patient presented here did not display any sign of immunodeficiency, suggesting that such bacteremia may also occur in the absence of immunosuppression. The likely high inoculum concentration in the water that was drunk and the diabetic status of the patient are two significant cofactors that may explain the occurrence of bacteremia in a setting of a gastrointestinal infection. Similarly, *Comamonas* species bacteremia has been associated with exposure to possibly contaminated water in a fish tank (24).

C. kerstersii has long been considered nonpathogenic on the basis of a lack of association with severe infections. This could be explained in part by the recent description of this species and the difficulties in accurately identifying it. This first report of polymicrobial bacteremia involving *C. kerstersii* reveals that this organism can be involved in severe diseases. *C. kerstersii* pathogenicity could be due to the versatility of this organism, which enables it to grow under various conditions. This report highlights the usefulness of MALDI-TOF for the rapid and accurate identification of nonfermenting Gram-negative bacteria that were difficult to identify in the pre-MALDI-TOF era. This could help to redefine the epidemiology and clinical syndromes due to these organisms.

TABLE 2 Summary of clinical and microbiological bacteremia due to *C. testosteroni*, *C. kerstersii*, and *D. acidovorans* and of a case of intraabdominal collection of *C. kerstersii*

Age (yr), sex	Site of infection	Clinical presentation	Underlying disease(s)	Predisposing factors	Pathogens	Treatment
61, male	Blood	Fever	Lymphoma	Chemotherapy, agranulocytosis	<i>D. acidovorans</i> , <i>S. agalactiae</i>	Cefepime followed by imipenem and ciprofloxacin
33, male	Blood	High fever, hypotension, infected phlebitis on the arm due to cocaine injection	Chronic hepatitis C, chronic alcoholism, drug addiction	None	<i>C. testosteroni</i> , <i>S. parasanguis</i> , <i>R. pickettii</i>	Cefepime and vancomycin followed by moxifloxacin
65, male ^a	Blood	Fever, chills, vomiting, diarrhea	Diabetic	None	<i>C. kerstersii</i> , <i>B. fragilis</i>	Ciprofloxacin, imipenem
12, male	Peritoneal fluid	Abdominal pain	None	Appendicitis	<i>C. kerstersii</i> , <i>Escherichia coli</i> , <i>Streptococcus</i> sp. (group <i>anginosus/milleri</i>)	Co-amoxicillin, metronidazole, and amikacin followed by co-amoxicillin alone

^a Present case.

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REFERENCES

1. Wauters G, De Baere T, Willems A, Falsen E, Vanechoutte M. 2003. Description of *Comamonas aquatica* comb. nov. and *Comamonas kerstersii* sp. nov. for two subgroups of *Comamonas terrigena* and emended description of *Comamonas terrigena*. *Int. J. Syst. Evol. Microbiol.* 53:859–862. <http://dx.doi.org/10.1099/ijs.0.02450-0>.
2. Almuzara MN, Cittadini R, Vera Ocampo C, Bakai R, Traglia G, Ramirez MS, del Castillo M, Vay CA. 2013. Intra-abdominal infections due to *Comamonas kerstersii*. *J. Clin. Microbiol.* 51:1998–2000. <http://dx.doi.org/10.1128/JCM.00659-13>.
3. Croxatto A, Prod'hom G, Greub G. 2012. Applications of MALDI-TOF mass spectrometry in clinical diagnostic microbiology. *FEMS Microbiol. Rev.* 36:380–407. <http://dx.doi.org/10.1111/j.1574-6976.2011.00298.x>.
4. Prod'hom G, Bizzini A, Durussel C, Bille J, Greub G. 2010. Matrix-assisted laser desorption ionization-time of flight mass spectrometry for direct bacterial identification from positive blood culture pellets. *J. Clin. Microbiol.* 48:1481–1483. <http://dx.doi.org/10.1128/JCM.01780-09>.
5. Prod'hom G, Durussel C, Greub G. 2013. A simple blood-culture bacterial pellet preparation for faster accurate direct bacterial identification and antibiotic susceptibility testing with the VITEK 2 system. *J. Med. Microbiol.* 62:773–777. <http://dx.doi.org/10.1099/jmm.0.049361-0>.
6. De Vos P, Kersters K, Falsen E, Pot B, Gillis M, Segers P, De Ley J. 1985. *Comamonas* Davis and Park 1962 gen. nov., nom. rev. emend., and *Comamonas terrigena* Hugh 1962 sp. nov. *Int. J. Syst. Bacteriol.* 35:443–453. <http://dx.doi.org/10.1099/00207713-35-4-443>.
7. Wen A, Fegan M, Hayward C, Chakraborty S, Sly LI. 1999. Phylogenetic relationships among members of the *Comamonadaceae* and description of *Delftia acidovorans* (den Dooren de Jong 1926 and Tamaoka et al. 1987 gen. nov., comb. nov. *Int. J. Syst. Bacteriol.* 49(Pt 2):567–576. <http://dx.doi.org/10.1099/00207713-49-2-567>.
8. Preiswerk B, Ullrich S, Speich R, Bloemberg GV, Hombach M. 2011. Human infection with *Delftia tsuruhatensis* isolated from a central venous catheter. *J. Med. Microbiol.* 60:246–248. <http://dx.doi.org/10.1099/jmm.0.021238-0>.
9. Shigematsu T, Yumihara K, Ueda Y, Numaguchi M, Morimura S, Kida K. 2003. *Delftia tsuruhatensis* sp. nov., a terephthalate-assimilating bacterium isolated from activated sludge. *Int. J. Syst. Evol. Microbiol.* 53:1479–1483. <http://dx.doi.org/10.1099/ijs.0.02285-0>.
10. Tabak O, Mete B, Aydin S, Mandel NM, Otlu B, Ozaras R, Tabak F. 2013. Port-related *Delftia tsuruhatensis* bacteremia in a patient with breast cancer. *New Microbiol.* 36:199–201. http://www.newmicrobiologica.org/PUB/allegati_pdf/2013/2/199.pdf.
11. Arda B, Aydemir S, Yamazhan T, Hassan A, Tunger A, Serter D. 2003. *Comamonas testosteroni* meningitis in a patient with recurrent cholesteatoma. *APMIS* 111:474–476. <http://dx.doi.org/10.1034/j.1600-0463.2003.1110404.x>.
12. Chotikanatis K, Backer M, Rosas-Garcia G, Hammerschlag MR. 2011. Recurrent intravascular-catheter-related bacteremia caused by *Delftia acidovorans* in a hemodialysis patient. *J. Clin. Microbiol.* 49:3418–3421. <http://dx.doi.org/10.1128/JCM.00625-11>.
13. Cooper GR, Staples ED, Iczkowski KA, Clancy CJ. 2005. *Comamonas (Pseudomonas) testosteroni* endocarditis. *Cardiovasc. Pathol.* 14:145–149. <http://dx.doi.org/10.1016/j.carpath.2005.01.008>.
14. Ender PT, Dooley DP, Moore RH. 1996. Vascular catheter-related *Comamonas acidovorans* bacteremia managed with preservation of the catheter. *Pediatr. Infect. Dis. J.* 15:918–920. <http://dx.doi.org/10.1097/00006454-199610000-00021>.
15. Hagiya H, Murase T, Sugiyama J, Kuroe Y, Nojima H, Naito H, Hagioka S, Morimoto N. 2013. *Delftia acidovorans* bacteremia caused by bacterial translocation after organophosphorus poisoning in an immunocompetent adult patient. *J. Infect. Chemother.* 19:338–341. <http://dx.doi.org/10.1007/s10156-012-0472-x>.
16. Khan S, Sistla S, Dhodapkar R, Parija SC. 2012. Fatal *Delftia acidovorans* infection in an immunocompetent patient with empyema. *Asian Pac. J. Trop. Biomed.* 2:923–924. [http://dx.doi.org/10.1016/S2221-1691\(12\)60254-8](http://dx.doi.org/10.1016/S2221-1691(12)60254-8).
17. Nseir W, Khateeb J, Awawdeh M, Ghali M. 2011. Catheter-related bacteremia caused by *Comamonas testosteroni* in a hemodialysis patient. *Hemodial. Int.* 15:293–296. <http://dx.doi.org/10.1111/j.1542-4758.2010.00524.x>.
18. Bizzini A, Durussel C, Bille J, Greub G, Prod'hom G. 2010. Performance of matrix-assisted laser desorption ionization-time of flight mass spectrometry for identification of bacterial strains routinely isolated in a clinical microbiology laboratory. *J. Clin. Microbiol.* 48:1549–1554. <http://dx.doi.org/10.1128/JCM.01794-09>.
19. Zucol F, Ammann RA, Berger C, Aebi C, Altwegg M, Niggli FK, Nadal D. 2006. Real-time quantitative broad-range PCR assay for detection of the 16S rRNA gene followed by sequencing for species identification. *J. Clin. Microbiol.* 44:2750–2759. <http://dx.doi.org/10.1128/JCM.00112-06>.
20. Goldenberger D, Schmidheini T, Altwegg M. 1997. Detection of *Bartonella henselae* and *Bartonella quintana* by a simple and rapid procedure using broad-range PCR amplification and direct single-strand sequencing of part of the 16S rRNA gene. *Clin. Microbiol. Infect.* 3:240–245. <http://dx.doi.org/10.1111/j.1469-0691.1997.tb00604.x>.
21. Gul M, Ciragil P, Bulbuloglu E, Aral M, Alkis S, Ezberci F. 2007. *Comamonas testosteroni* bacteremia in a patient with perforated acute appendicitis. Short communication. *Acta Microbiol. Immunol. Hung.* 54:317–321. <http://dx.doi.org/10.1556/AMicr.54.2007.3.6>.
22. Wexler HM. 2007. *Bacteroides*: the good, the bad, and the nitty-gritty. *Clin. Microbiol. Rev.* 20:593–621. <http://dx.doi.org/10.1128/CMR.00008-07>.
23. Le Moal G, Paccalin M, Breux JP, Roblot F, Roblot P, Becq-Giraudon B. 2001. Central venous catheter-related infection due to *Comamonas testosteroni* in a woman with breast cancer. *Scand. J. Infect. Dis.* 33:627–628. <http://dx.doi.org/10.1080/00365540110026827>.
24. Smith MD, Gradon JD. 2003. Bacteremia due to *Comamonas* species possibly associated with exposure to tropical fish. *South. Med. J.* 96:815–817. <http://dx.doi.org/10.1097/01.SMJ.0000051869.86765.D9>.