



Case Report

Comamonas testosteroni bacteremia: A rare unusual pathogen detected in a burned patient: Case report and literature review

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ABSTRACT

Introduction and importance: Comamonas testosteroni is a rare human pathogen that is not part of the human microbiome. There are only 51 cases reported worldwide with 7 cases resulted in death.

Case presentation: We report a case of a 16-year-old boy with an extended burn complicated by catheter-related bloodstream C. testosteroni infection.

Clinical discussion: Comamonas species are usually community-acquired pathogens that are susceptible to a wide variety of antibiotics including aminoglycosides, fluoroquinolones, carbapenems, piperacillin-tazobactam, trimethoprim-sulfamethoxazole, and cephalosporins. However, in our case, we reported a nosocomial multidrug-resistant infection by C. testosteroni that responded only to colistin.

Conclusion: Reporting unusual cases of nosocomial sepsis due to rare multidrug-resistant pathogens is detrimental. As it sheds light on how virulent nosocomial infections are becoming, and can be very alarming to other practitioners and clinical microbiologists, in order to achieve a better awareness of the importance of controlled antibiotics use.

1. Introduction and importance

Comamonas testosteroni is a Gram-negative, aerobic, pink-pigmented, rod-shaped, motile, oxidase-positive bacillus that grows well on routine bacteriological media and is known to use testosterone as the carbon source in the culture media [1,2]. It is quite ubiquitous in the environment and has been isolated from soil, mud, and water. In addition, it has been isolated from denitrifying activated sludge as well as from various clinical samples and the hospital environment where it can stay for a long period [3]. However, C. testosteroni is not usually detected in healthy humans [4]. It gained its clinical importance after 1987 when it was isolated in multiple cases with pneumonia, meningitis, endocarditis, endophthalmitis, tenosynovitis, cellulitis, and peritonitis [5]. Originally, the genus Comamonas comprised the following species, Comamonas terrigena, Comamonas testosteroni, Comamonas denitrificans, Comamonas nitratorvorans and Comamonas kerstersii. Now, it contains 17 species [6].

Skin is the first immune defense mechanism that functions as a

barrier against invading microorganisms. Infections can be a significant hazard once this barrier is compromised by burns or open wounds. According to the U.S. National Burn Repository, the four leading causes of burn morbidity are pneumonia, cellulitis, urinary tract infections, and burn wound infections. In addition, they are also the main factors contributing to mortality, accounting for 51% of deaths in burn patients [7]. Catheters have also become a primary source of infection and sepsis in the burn patient, with rates of infection sometimes exceeding 20 catheter-related blood stream infections per 1000 catheter days, as defined by the CDC and the National Nosocomial Infection Surveillance System [8]. Not to mention that catheter-related bloodstream infections (CRBSI) are much more common in burn units than other ICU units [8, 9]. Therefore, CV lines and catheters are considered the main suspects when trying to investigate the source of such severe nosocomial infections especially in burns units [10]. Australian Commission on Safety and Quality in Health Care defines CRBSI as a laboratory-confirmed bloodstream infection in a patient where the central line was in place for >48 hours on the date of the event [11]. Also, central line tips in

Abbreviations: CRBSI, Catheter related blood stream infection.

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conjunction with percutaneous/peripheral blood cultures are necessary to meet the gold standard definition for CRBSI [12]. We report a case of a 16 years old burned male patient who developed a central venous line related *C. testosteroni* sepsis which was reluctant to all empirical antibiotics and responded only to colistin.

This case report has been reported in line with the SCARE Criteria [13].

2. Case report

A 16 years old male presented to the emergency department of Al-Mouwasat University Hospital with a flame burn. The medical history, drug history, family history, and psychosocial history were irrelevant. By inspection, the burned area was 30% of total body surface area (TBSA) estimated according to Lund and Browder chart [14]. The burned area is centered in the lower extremities and distributed into deep partial thickness and full thickness burned areas according to the latest American Burn Association white paper [15]. He was admitted to the burn intensive care unit (BICU). A central venous line catheter was inserted far from the wound for resuscitation, along with urinary catheter for urinary output monitoring in line with global acute burns care guidelines [16–18]. On the fourth day of admission, a decision was made to perform an early burn excision without auto grafting as he didn't have a suitable wound bed [19]. Instead, burn wounds were covered by allografts following excision to establish a biological bandage [20]. Swab cultures were taken before surgery from both the burned area and the allograft and results were nonspecific.

After three days of surgery (seventh day since admission), the patient developed continuous peaks of fever of 104 °F (40 °C) with shivering along with tachycardia, tachypnea, blood pressure of (120/70 mmHg), and oxygen saturation of 96% while breathing ambient air, these findings raised our suspicion of sepsis [21]. Immediate action was taken to change the CV line [17]. Cultures specimens were taken from the burn wound, allograft, CV catheter tip, blood and urine following universal guidelines of sterilization and according to UK standard for microbiology investigations [22]. The Department of Infectious Diseases was consulted along with following the guidelines from the French Society for Burn Injuries (SFETB) and empirical broad-spectrum antibacterial therapy was started (Cefazolin and Ceftriaxone) [23]. Nonetheless, the fever persisted and no improvement was noted through the following days.

On the 14th day of admission, the decision was made to perform another surgical procedure where the allograft was removed and dead tissues were debrided.

CV catheter and blood cultures results were identical, *Comamonas testosteroni*, which according to the sensitivity tests was reluctant to all in vitro applied antibiotics and only sensitive to colistin. The patient's antibiotic regimen was promptly altered to (colistin-amikacin) for 14 days and marked early improvement was noted with fever resolving after 5 days. All signs and symptoms of sepsis resolved gradually. Later, the patient underwent skin autografting successfully. All skin defects were completely healed, and the patient was discharged to our outpatient care and long-term care ward for rehabilitation. The patient and his parents were satisfied with the results and discharged from hospital to maintain a scheduled follow-up visit. All the procedures were done by the author and his colleagues under supervision of Prof. Maen Al-Aissami.

3. Clinical discussion

Burns can be a life-threatening injury as many pathophysiologies of burns-related morbidity and mortality have been implicated, nosocomial infections originating from different sites in such vulnerable patients are still by far the most relevant mechanism [24,25]. Unfortunately, the involved pathogens are usually resistant to various antibiotics and are getting more virulent day by day. Many pathogens of

different species were isolated. In our case, blood and CV-line cultures were identical and conclusive, confirming a *C. testosteroni* infection.

C. testosteroni species have a wide range of natural habitats including water, soil, and plants as well as some hospital equipment, such as intravenous lines and the water reservoir in the humidifiers of respiratory therapy equipment [6].

By reviewing the literature regarding *C. testosteroni* in general, we found that it is rarely recognized as a human pathogen [4]. But it has been more frequently encountered (till now around 51 cases) (Table 1). In the reported cases *C. testosteroni* is mostly responsive to various antibiotics. Unfortunately, there are no sufficient data available about *C. testosteroni* infections in burn patients.

Comamonas species are usually susceptible to aminoglycosides, fluoroquinolones, carbapenems, piperacillin-tazobactam, trimethoprim-sulfamethoxazole, and cephalosporins [6]. However, no response was noted in our patient to empirical 1st and 3rd generation cephalosporins, which was confirmed by sensitivity tests on the cultured specimens. Those tests also showed that the pathogen was resistant to various antibiotics and only responsive in vitro to Colistin.

Additionally, the most common infections by *C. testosteroni* are intra-abdominal infections, specifically after perforated appendicitis [26]. There were three cases of bacteremia due to *C. testosteroni* infection related to using CV line (CRBSI), the first in a female patient with breast cancer [27], the second in a patient with end stage kidney disease on hemodialysis [28], the third in a female patient with esophageal cancer on chemotherapy [29]. To the best of our knowledge, our case is the first reported case of *C. testosteroni* CRBSI in a burned patient. However, another case regarding burns was published in Indian Journal of Forensic Medicine & Toxicology in 2021 which reported a 2.2% isolation of *C. testosteroni* burn wound infection among 120 contaminated burn patients and revealed that *C. testosteroni* had the highest percentage of antibiotic resistance among other isolated pathogens [30]. The majority of reported infections are community-acquired rather than nosocomial [31]. Most of the previously reported patients had some degree of immunosuppression due to malignancy, chronic liver disease and end-stage renal disease on hemodialysis [28,31]. Therefore, this could be explained by a strong correlation between *C. testosteroni* infection and the immunologic status of the patient, and this needs more evidence to be proven. As burn patients are considered immunocompromised [21,32], this case can be included in that category. 7 out of 51 reported cases in literature were fatal, the majority might be related to a polymicrobial infection and/or an underlying disease.

Since this pathogen has been more frequently encountered, we hope that this case report would be beneficial for clinicians and laboratory physicians when making their diagnosis and clinical approach by taking such rare pathogens into consideration. However, more research must be done to explore and understand the pathogenicity, virulence mechanism, and increased antibiotic resistance of *C. testosteroni*.

4. Conclusion

Burn patients are more susceptible to unusual pathogens, therefore, a lower threshold for taking samples and culturing is critical for early diagnosis and better prognosis.

Developing virulence and resistance of rare pathogens against conventional antibiotics are universal alarming subjects which need great united efforts to deal with. Constantly reporting such cases can help raise awareness toward this huge problem.

Ethics approval

None.

Table 1
Comamonas testosteroni infections in the medical literature.

	Age/sex	Underlying disease	Sample	Therapy	Outcome	Author	Year	Place
1	71 years/ Female	Rheumatic heart disease	Blood	Penicillin	Cured	Sonnenwirth	1970	USA
2	31 years/ female	Rheumatic heart disease	Bone marrow	Kanamycin, tetracycline	Cured	Atkinson et al.	1975	USA
3	17 years/ Female	Appendicitis	Peritoneal fluid	no data	Cured	Barbaro et al.	19-July 1983	USA
4	59 years/ Male	No data	No data	No data	Cured	Barbaro et al.	26-July 1983	USA
5	No data	No data	Abdomen	No data	Cured	Barbaro et al.	12-Aug 1983	USA
6	66 years/ Male	No data	Peritoneal fluid	No data	Cured	Barbaro et al.	13-Sep 1984	USA
7	14 years/ Male	Appendicitis	Appendix	No data	Cured	Barbaro et al.	26-Oct 1984	USA
8	4 years/ Male	No data	Blood	No data	Cured	Barbaro et al.	15-Jan 1985	USA
9	28 years/ Female	No data	Blood	No data	Cured	Barbaro et al.	11-Jun 1985	USA
10	15 years/ Male	No data	Peritoneal fluid	No data	Cured	Barbaro et al.	16-July 1985	USA
11	31 years/ male	Perforated appendicitis	Abscess	Cefoxitin; drainage; then ampicillin, clindamycin, and gentamicin	Cured	Barbaro et al.	1987	USA
12	24 years/ female	IVDA	CSF	Moxalactam and nafcillin	Cured	Barbaro et al.	1987	USA
13	59 year/ female	Alcoholic cirrhosis	Peritoneal fluid	Cefoxitin	Cured	Barbaro et al.	1987	USA
14	11 years/ male	Perforated appendicitis	Peritoneal fluid	Ampicillin, clindamycin, and tobramycin	Cured	Barbaro et al.	1987	USA
15	12 years/ female	Perforated appendicitis	Peritoneal fluid	Cefoxitin	Cured	Barbaro et al.	1987	USA
16	21 years/ female	Perforated appendicitis, pregnancy	Peritoneal fluid	Cefoxitin	Cured	Barbaro et al.	1987	USA
17	Stillborn	Maternal IVDA	Umbilical cord- blood	-	Died (Stillbirth)	Barbaro et al.	1987	USA
18	84 years/ female	CHF	Urine	Ampicillin	Cured	Barbaro et al.	1987	USA
19	24 years/ male	Appendicitis	Peritoneal fluid	Cefoxitin	Cured	Barbaro et al.	1987	USA
20	Female/NB	Maternal IVDA + prematurity	Blood	Ampicillin, amikacin	Died in 24 hr	Barbaro et al.	1987	USA
21	No data	AIDS	Respiratory secretions	Ceftazidime	Cured	Franzetti et al.	1992	Italy
22	35 years/ Male	Zoonotic infection	Animal bite tissue	Ceftazidime, gentamicin	Cured	Isolato et al.	2000	Canada
23	75 years/ female	Breast carcinoma (CRBSI)	Blood and CVC	Ceftazidime, gentamicin	Cured	Le Moal et al.	2001	France
24	89 years/ Male	Tropical fish exposure	Blood	Levofloxacin	Cured	Smith et al.	2003	USA
25	50 years/ male	Cholesteatoma	CSF	Meropenem	Cured	Arda et al.	2003	Turkey
26	49 years/ male	Infective endocarditis	Blood and mitral valve	Cefipime + gentamicin, then ampicillin; surgery	Cured	Cooper et al.	2005	USA
27	54 years/ female	Esophageal cancer with metastases (CRBSI)	Blood	Cefepime, ciprofloxacin, drotrecogin alfa	Cured	Abraham et al.	July 2007	USA
28	22 years/ male	Perforated appendicitis	Peritoneal fluid, blood	Cefazolin	Cured	Gul M et al.	Sep 2007	Turkey
29	54 years/ Male	Chronic alcoholic, car accident	Cerebrospinal fluid	No data	Died	Jin et al.	2008	USA
30	82 years/ female	Endophthalmitis (diabetes)	Vitreous biopsy	Ceftazidime (IV and topical)	Cured	Reddy et al.	2009	India
31	83 Years/ Male	Ischemic cerebrovascular accident	Blood	Amikacin, piperacillin/tazobactam	Cured	Katircioglu et al.	2010	Turkey
32	54 years/ male	Cellulitis (foot injury)	Blood	Oxacillin, ciprofloxacin	Cured	Tsui et al.	Feb 2011	Taiwan
33	73 years/ male	Intra-abdominal infection and hepatocellular carcinoma	Blood	Gentamicin, levofloxacin	Cured	Tsui et al.	Feb 2011	Taiwan
34	63 years/ female	ESKD on hemodialysis (CRBSI)	Blood	Vancomycin, ceftriaxone	Died	Nseir et al.	Apr 2011	Israel
35	10 years/ Male	Cerebral palsy, tracheostomy	Endotracheal aspirate	Ceftriaxone, clarithromycin	Cured	Ozden et al.	2011	Turkey
36	10 years/ male	Medullablastoma, chemotherapy	Blood	Ciprofloxacin, amikacin	Cured	Farshad et al.	2012	Iran
37	19 years/ female	Osteosarcoma	Blood	Ciprofloxacin, vancomycin, imipenem	Cured	Farshad et al.	2012	Iran

(continued on next page)

Table 1 (continued)

Age/sex	Underlying disease	Sample	Therapy	Outcome	Author	Year	Place
38 16 years/ Male	Perforated appendicitis	Peritoneal fluid	Amikacin, ampicillin, clindamycin	Cured	Bayhan et al.	2013	Turkey
39 80 years/ female	Diabetes mellitus, rotator cuff tendinitis (not proven)	Blood	Cefazolin and doripenem	Cured	Orsini Jose et al.	2014	USA
40 51 years/ male	Endocarditis	Aortic valve	Ciprofloxacin	Cured	Arzu Duran et al.	1 may 2015	Turkey
41 42 years/ female	Septic shock	Blood and urine	Ceftazidime and levofloxacin	Cured	Hyun Jung Kim et al.	August 2015	Korea
42 50 years/ Female	Chronic renal disease, gluteal abscess	Blood	Piperacillin–tazobactam then cefoperazone-sulbactam	Died	B Swain et al.	Dec 2015	India
43 4 years /Female	ESDK with PD	Peritoneal fluid	Ciprofloxacin (intraperitoneal)	Cured	Parolin M. et al.	2016	Italy
44 62 years/ Male	Diabetes, ischemic cerebrovascular accident	Blood	-	Died	Pekinturk N.	2016	Turkey
45 68 years/ male	Lung cancer, adrenal metastasis	Blood	Cefepime and teicoplanin	Died	Yasayancan N,	2017	Turkey
46 1 year/ Female	Acute gastroenteritis, sepsis	Blood	Ceftriaxone	Cured	Ruziaki W.	2017	Oman
47 65 years/ female	Gastroenteritis	Stool	Ciprofloxacin and probiotics	Cured	Shaika Farooq et al.	2017	India
48 30 years/ Female	Neutropenia	Blood	Moxifloxacin	Cured	Aktar et al.	2018	Turkey
49 46 years/ female	Might be contaminated food and water (immunocompetent)	Blood and urine	Gentamicin and imipenem	Cured	Shreekant Tiwari, Monalisah Nanda	2019	India
50 4 years old/ Female	Persistent cloaca	Urine	Ceftazidime, amikacin	Cured	S. Gayenur Buyukberber	2021	Turkey
51 No data	Burn wound infection	Burn swab	No data	No data	Jenan A. Ghafil May, T. flieh	2021	Iraq
52 16 years old/male	Burn (CRBSI)	Blood and CVC	Colistin-amikacin	Cured	Present case	2022	Syria

CVC=Central venous catheter, CSF=Cerebrospinal fluid, CHF=Congestive heart failure, AIDS = Acquired immune deficiency syndrome, IVDA=Intravenous drug abuse, ESKD = End stage kidney disease, CRBSI=Catheter related blood stream infection, IV=Intra venous abuse, NB=Newborn, PD=Peritoneal dialysis.

Consent

Written informed consent for publication of this case and any accompanying images was obtained from the patient. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and material

Data mentioned in this case report are available to the reviewers if required.

Sources of funding

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Authors contribution

AYHAM SAMMONI: Participated in preparing the manuscript with all its phases.

Ali Abdalah: Collecting data and patient's information.

Maen Al-Aissami: Supervised the previous data and gave the final approval.

Registration of Research Studies

Name of the registry: None

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Guarantor

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Declaration of competing interest

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103371>.

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