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 nitrativorans 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 bloodstream 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 (CRBSIs) 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

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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 resistant 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.

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.

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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, pipercillin-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 testosterone 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. | 1983 | USA |
| 4 59 years/ Male | No data | No data | No data | Cured | Barbaro et al. | 1983 | USA |
| 5 No data | No data | Abdomen | No data | Cured | Barbaro et al. | 1984 | USA |
| 6 66 years/ Male | No data | Peritoneal fluid | No data | Cured | Barbaro et al. | 1984 | USA |
| 7 14 years/ Male | Appendicitis | Appendix | No data | Cured | Barbaro et al. | 1983 | USA |
| 8 59 years/ Male | No data | No data | No data | Cured | Barbaro et al. | 1984 | USA |
| 9 15 years/ Male | Perforated appendicitis | Abcess | Cefoxitin; drainage; then ampicillin, clindamycin, and gentamicin | Cured | Barbaro et al. | 1987 | USA |
| 10 24 years/ Female | IVDA CSF | Moxalactam and nafcillin | Cured | Barbaro et al. | 1987 | USA |
| 11 31 years/ Male | Alcoholic cirrhosis | Peritoneal fluid | Cefoxitin | Cured | Barbaro et al. | 1987 | USA |
| 12 11 years/ Male | Perforated appendicitis | Peritoneal fluid | Ampicillin, clindamycin, and tobramycin | Cured | Barbaro et al. | 1987 | USA |
| 13 12 years/ Female | Perforated appendicitis | Peritoneal fluid | Cefoxitin | Cured | Barbaro et al. | 1987 | USA |
| 14 21 years/ Female | Perforated appendicitis, pregnancy | Umblical cord-blood | Ceftazidime | Cured | Barbaro et al. | 1987 | USA |
| 15 Stillborn | Maternal IVDA | Umblical cord-blood | Died (Stillbirth) | Cured | Barbaro et al. | 1987 | USA |
| 16 84 years/ Female | CHF Urine | Ampicillin | Cured | Barbaro et al. | 1987 | USA |
| 17 24 years/ Male | Appendicitis | Peritoneal fluid | Cefoxitin | Cured | Barbaro et al. | 1987 | USA |
| 18 Female/NB | Maternal IVDA + prematurity | Blood | Ampicillin, amikacin | Died in 24 hr | Barbaro et al. | 1987 | USA |
| 19 No data | AIDS | Respiratory secretions | Ceftazidime | Cured | Franzetti et al. | 1992 | Italy |
| 20 35 years/ Male | Zoonotic infection | Animal bite tissue | Ceftazidime, gentamicin | Cured | Isolato et al. | 2000 | Canada |
| 21 75 years/ Male | Breast carcinoma (CRBSI) | Blood and CVC | Ceftazidime, gentamicin | Cured | Le Moal et al. | 2001 | France |
| 22 89 years/ Male | Tropical fish exposure | Blood | Levofoxacin | Cured | Smith et al. | 2003 | USA |
| 23 50 years/ Male | Cholesteatoma | CSF | Meropenem | Cured | Arda et al. | 2003 | Turkey |
| 24 49 years/ Male | Infective endocarditis | Blood and mitral valve | Cefpime + gentamicin, then ampicillin; surgery | Cured | Cooper et al. | 2005 | USA |
| 25 54 years/ female | Esophageal cancer with metastases (CRBSI) | Blood | Cefepime, ciprofloxacin, drotrecogin alfa | Cured | Abraham et al. | 2007 | USA |
| 26 22 years/ Male | Perforated appendicitis | Peritoneal fluid, blood | Cefazolin | Cured | Gul M et al. | 2007 | Turkey |
| 27 54 years/ Male | Chronic alcoholic, car accident | Cerebrospinal fluid | No data | Died | Jin et al. | 2008 | USA |
| 28 82 years/ Male | Endophthalmitis (diabetes) | Vitreous biopsy | Ceftazidime (IV and topical) | Cured | Reddy et al. | 2009 | India |
| 29 83 Years/ Male | Ischemic cerebrovascular accident | Blood | Amikacin, piperacillin/tazobactam | Cured | Katicicoglou et al. | 2010 | Turkey |
| 30 54 years/ Male | Cellulitis (foot injury) | Blood | Oxacillin, ciprofloxacin | Cured | Tsui et al. | 2011 | Taiwan |
| 31 73 years/ Male | Intra-abdominal infection and hepatocellular carcinoma | Blood | Gentamicin, levofloxacin | Cured | Tsui et al. | 2011 | Taiwan |
| 32 63 years/ female | ESKD on hemodialysis (CRBSI) | Blood | Vancomycin, ceftriaxone | Died | Nseir et al. | 2011 | Israel |
| 33 10 years/ Male | Cerebral palsy, tracheostomy | Endotracheal aspirate | Ceftriaxone, clarithromycin | Cured | Ozen et al. | 2011 | Turkey |
| 34 10 years/ Male | Medullablastoma, chemotherapy | Blood | Ciprofloxacin, amikacin | Cured | Farshad et al. | 2012 | Iran |
| 35 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 | Turkey |
| 41 42 years/ female | Septic shock | Blood and urine | Cefazidime and levofloxacin | Cured | Hyun Jung Kim et al. | August | Korea |
| 42 50 years/ Female | Chronic renal disease, gluteal abscess | Blood | Piperacillin-tazobactam then cefoperazone-subactam | Died | B Swain et al. | Dec | India |
| 43 4 years/ Female | ESKD with PD | Peritoneal fluid | Ciprofloxacin (intraperitoneal) | Cured | Parolin M. et al. | 2016 | Italy |
| 44 62 years/ Male | Diabetes, ischemic cerebrovascular accident | Blood | Ceftriaxone | Died | Pekinturk N. | 2016 | Turkey |
| 45 68 years/ male | Lung cancer, adrenal metastasis | Blood | Cefepime and teicoplanin | Died | Yassayancan N. | 2017 | Turkey |
| 46 1 year/ Female | Acute gastroenteritis, sepsis | Blood | Ceftriaxone | Cured | Ruzizaki W. | 2017 | Oman |
| 47 65 years/ female | Gastroenteritis | Stool | Ciprofloxacin and probiotics | Cured | Shaik Farooq et al. | 2017 | India |
| 48 30 years/ Female | Neutropenia | Blood | Moxifloxacin | Cured | Akta et al. | 2018 | Turkey |
| 49 46 years/ female | Might be contaminated food and water (immunocompetent) | Blood and urine | Gentamicin and imipenem | Cured | Shreerkant Tiwari, Monalishah Nanda | 2019 | India |
| 50 4 years old/ Female | Persistent choaca | Urine | Cefazidime, amikacin | Cured | S. Gayenur, Buyukber | 2021 | Turkey |
| 51 No data | Burn wound infection | Burn swab | No data | No data | Janan A. Ghafil, May, T. Bleh | 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.

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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
Unique Identifying number or registration ID: None
Hyperlink to your specific registration (must be publicly accessible and will be checked): None

Guarantor

Maen Al-Aissami

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