Case Report

Two cases of bacteremia due to an unusual pathogen, *Comamonas testosteroni* in Iran and a review literature

Shohreh Farshad[1]*, Fatemeh Norouzi[1]*, Maneli Aminshahidi[1]*, Behzad Heidari[2]*, Abdolvahab Alborzi[1]*

[1]*Medical Microbiology, Professor Alborzi Clinical Microbiology Research Center, Shiraz University of Medical Sciences, Namazi Hospital, Shiraz 71937-11351, Iran*
[2]*Clinical Laboratory Research of Pediatric Allergy and Immunology, Shiraz University of Medical Sciences, Namazi Hospital, Shiraz 71937-11351, Iran*

*These authors contributed equally to this work.

Abstract
Here we describe two cases of bacteremia caused by *Comamonas testosteroni* in two malignant patients, a 10-year-old boy with brain medulloblastoma and a 19-year-old girl with osteosarcoma admitted in the same hospital at short intervals. This is the first report in Iran on this low inherent virulence organism as a human pathogen.

Key words: *Comamonas testosteroni* bacteremia; Iran; case report

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Introduction

Comamonas testosteroni is characterized as a Gram-negative, aerobic, motile and non-spore forming bacterium belonging to the Comamonadacae family. Their arrangements on Gram staining usually are in singles or pairs [1]. The organism has been isolated from a wide range of natural habitats such as water, soil, and plants, so it is recognized as an environmental organism. In spite of its uncommon pathogenesis, there are a few reports on the aggressive manner of it as an opportunistic pathogen.

We isolated this organism in a short time from the blood cultures of two patients with malignancy that presented with fever and neutropenia. The first one was diagnosed with brain medulloblastoma and the other with osteosarcoma.

Case reports

The first case was a 10-year-old boy who was hospitalized in the hematological ward of Amir Oncology Hospital, Shiraz, Iran, in September 2010. He had been diagnosed one year previously with brain medulloblastoma and had received six courses of chemotherapy after surgery. He was in good health without any serious condition until November 2010, when he was found febrile (38.5ºC) on examination. Subsequently, blood and urine cultures were taken. Wide-spectrum antibiotics, ciprofloxacin (10 mg/kg/day for 21 days) and amikacin (15 mg/kg/day for 21 days), were also received intravenously. Laboratory findings were as follows: white blood cell 3700 cell/mm3; hemoglobin 9.1g/dl; platelets 114000 cell/mm3; erythrocyte sedimentation rate 91/h; and c-reactive protein three plus. Lactate dehydrogenase, creatine phosphokinase, calcium, alkaline phosphatase and urine analysis were within normal range. Aspartate aminotransferase was 78 u/l, phosphorous 7.2 mg/dl, and urine culture showed no growth but blood culture was positive. During this hospital stay (*i.e.*, September to November) he was placed in different wards.

The second patient was a 19-year-old girl who had been diagnosed with osteosarcoma at the age of 15. She had since then relapsed following surgery and five courses of chemotherapy, and for the past three months she had developed dry cough. Evaluation showed tumor metastasis to the lungs. She was admitted to the emergency ward of Amir Oncology Hospital in November 2010 with septic shock and after two days she was placed in the same room where the first case was hospitalized. On examination she had drowsiness, a bedsore on the buttock, low blood

pressure (60 systolic mm Hg), and high-grade fever (39.8ºC). Blood and urine samples were taken and cultured. Broad-spectrum antibiotics, vancomycin (60 mg/kg/day for 14 days) and imipenem (100 mg/kg/day for 14 days), were taken intravenously, and oral ciprofloxacin (30 mg/kg/day for three weeks) was prescribed upon discharge. She also received granulocyte colony stimulating factor for severe neutropenia. The laboratory data were as follows: white blood cell 300 cell /mm3; hemoglobin 9.1g/dl; platelets 82000 cell/mm3; blood urea nitrogen 13mg/dl; uric acid 5.4mg/dl; lactate dehydrogenase 753u/l. Calcium, phosphorous, sodium, potassium and glucose were in normal range. Both blood cultures were positive for *Comamonas testosteroni*.

The two patients presented here were cured of the bacteremia after appropriate treatment and discharged from hospital with normal white blood cell counts.

Methodology

Sampling

Blood samples (1-3 ml from a 10-year-old boy and 8-10 ml blood from a 19-year-old girl) were inoculated into blood culture bottles (BD BACTEC peds plus/F, BD BACTEC plus + Aerobic/F, Shannon, Ireland). One droplet of the positive growth blood cultures (BD BACTEC 9240 Blood Culture System 02390, Becton, Dickinson and Company Franklin Lakes, NJ, USA) was placed on sheep blood agar, chocolate blood agar and MacConkey agar plates and pricked by a sterile needle. Sheep and chocolate blood agar plates were incubated in micro aerobic conditions prepared by a candle jar at 37ºC. MacConkey agar plates were incubated in aerobic conditions at 37ºC for 24 to 48 hours. Gram staining was performed for both single colonies and patients' blood samples.

Biochemical methods

The isolated bacteria were tested by catalase and oxidase reactions. Motility and potency of the bacterium for indole and hydrogen sulfate production were checked on sulfur-indole-motility agar. Because no acid production occurred in the OF-glucose medium, complementary identical tests were performed using an api 20 NE identical kit (Biomérieux, Marcy l'Etoile, France), according to the manufacturer's instructions.

Antimicrobial tests

Antimicrobial susceptibility tests were performed based on the Kirby Bauer disk-diffusion method on Mueller Hinton agar plates (Merck, Darmstadt, Germany). Antibiotic disks (Mast Diagnostics Co, Merseyside, United Kingdom) were selected on the basis of United States Federal Drug Administration approved antimicrobial agents that should be considered for routine testing and reporting on non-fastidious organisms.

Results

For both cases pink pigmented colonies with a mucoid and bulgy surface and without hemolysis appeared on the blood and chocolate blood agar plates after 48 hours of incubation at 37ºC. Bacteria also grew on MacConkey agar plates.

Gram staining indicated dumpy Gram negative bacilli mostly revealed in pair arrangement. Catalase and oxidase reactions were negative and positive, respectively. This bacterium was motile and able to reduce nitrate. Due to its disability for glucose fermentation OF-glucose media, complementary diagnostic tests were done using an api 20 NE identical kit (Biomérieux, Marcy l'Etoile, France), according to the manufacture's protocol. Finally, this strain was identified as *Comamonas testosteroni* with high certainty.

The isolated organism exhibited wide-spectrum sensitivity to a large group of antibiotics. Both strains were sensitive to ampicillin, ceftazidime, ceftriaxone, cefuroxime, gentamicin, amikacin, cephalexin, ciprofloxacin, imipenem, meropenem, tobramycin, aztreonam, ticarcillin, tetracycline and piperacillin-tazobactam.

Discussion

In 1987, Tamaoka *et al*. replaced the name of Pseudomonas testosteroni with a new genus known as *Comamonas testosteroni* [2]. This genus is a motile bacterium by a polar tuft of up to six distinctive and long wavelength flagella [3]. Its name is derived due to its ability to decompose testosterone as the carbon source [4,5]. *Comamonas testosteroni*, referred to as an environmental organism, is a commensal microorganism that prefers niches, including soil and water. There are some reports indicating its isolation from activated sludge [6]. In spite of its wide environmental distributions, there are a few reports on its involvement in human infections. Copper *et al*. (2005) suggested that the organism survives for extended periods of time with diverse nosocominal environments, and most of the reported infections by this organism are community acquired [7]. It has also been isolated from some hospital devices such as intravenous lines and water contained in the

Table 1. Summary of reported cases of infection by *Comamonas testosteroni*

Author	Age[y]/Sex*	Site of infection	Outcome	Predisposing factors	Antibiotic treatment
Barbaro *et al* (1987)[17]	31/M	abdominal abscess	cured	perforated appendix	cefoxitin, drainage then ampicillin, gentamicin, clindamycin
Barbaro *et al* (1987)[17]	24/F	cerebrospinal fluid	cured	intravenous drug abuse	Moxalactam ,naficillin
Barbaro *et al* (1987)[17]	59/F	peritoneum	cured	alcoholic cirrhosis	cefoxitin
Barbaro *et al* (1987)[17]	11/M	peritoneum	cured	perforated appendix	ampicillin, clindamycin, tobramycin
Barbaro *et al* (1987)[17]	12/F	peritoneum	cured	perforated appendix	cefoxitin
Barbaro *et al* (1987)[17]	21/F	peritoneum	cured	pregnancy, perforated appendix	cefoxitin
Barbaro *et al* (1987)[17]	Still born	cord	died	maternal intravenous drug abuse	None
Barbaro *et al* (1987)[17]	84/F	urine	cured	congestive heart failure	ampicillin
Barbaro *et al* (1987)[17]	newborn	blood	died	maternal intravenous drug abuse	ampicillin
Barbaro *et al* (1987)[17]	17/F	peritoneum	cured	appendicitis	NR[b]
Barbaro *et al* (1987)[17]	59/M	NR	cured	NR	NR
Barbaro *et al* (1987)[17]	66/M	peritoneum	cured	NR	NR
Barbaro *et al* (1987)[17]	14/M	appendix	cured	appendicitis	NR
Barbaro *et al* (1987)[17]	15/M	peritoneum	cured	NR	NR
Barbaro *et al* (1987)[17]	4/ M	blood	cured	NR	NR
Barbaro *et al* (1987)[17]	28/M	blood	cured	NR	NR
Barbaro *et al* (1987)[17]	24/M	peritoneum	cured	perforated appendix	cefoxitin
Franzetti *et al* (1992)[20]	unknown	lung/pneumonia	cured	AIDS-related complex	ceftazidime
Isotalo *et al* 2000) [21]	35/M	animal bite	cured	zoonotic infection	ceftazidime, gentamicin
Le Moal *et al* (2001)[22]	75/F	central venous catheter/blood	cured	central venous catheter, cancer	ceftazidime, gentamicin
Smith *et al* (2003)[23]	89/M	blood	cured	environmental exposure	levofloxacin
Arda *et al* (2003)[24]	50/M	cerebrospinal fluid	cured	cholesteatoma	meropenem
Cooper *et al* (2005)[7]	49/M	miteral valve, blood	cured	infective endocarditis	cefepime, gentamicin then ampicillin
Gul *et al* (2007)[8]	22/M	blood	cured	perforated appendicitis	cefazolin
Abraham *et al* (2007)[25]	54/F	blood	cured	chemotherapy, central venous catheter	cefepime, ciprofloxacin

Table 1. (continued)

Jin *et al* (2008) [18]	54/M	cerebrospinal fluid	died	environmental exposure, struck by car	NAD[c]
Reddy *et al* (2009)[26]	82/F	eye	cured	advanced age, diabetes, surface disorder in the eye	ceftazidime, ciprofloxacin
Nseir *et al* (2011)[27]	64/F	blood	cured	catheter used in hemodialyse	NAD
Tsui *et al* (2011)[28]	54/M	blood	cured	environmental exposure	oxacillin, flomoxef, and then ciprofloxacin
Tsui *et al* (2011)[28]	73/M	blood	cured	Chronic hepatitis B, hepatocellular carcinoma	metacin gentamicin and then levofloxacin
Present case	10/M	blood	cured	Medulloblastoma, chemotherapy	ciprofloxacin, amikacin
Present case	19/F	blood	cured	osteosarcoma	imipenem, vancomycin, ciprofloxacin

a Y, year
* M, male; F, female
b NR, Not reported
c NAD, Not accessible data

humidifier reservoirs used in respiratory treatment [8]. There was only one report of the infective role of *Pseudomonas testosteroni* in a human until 1987 [9].

Here we collected all the sites of infection related to *Comamonas testosteroni* from 1987 up to date (Table 1).The collected data are divided on the basis of the patient's age, sex, and sites of infection, predisposing factors, antibiotic treatment, and outcome. Considering the low virulence potency of *Comamonas* spp., the majority of the reported literature focused on two species, *Comamonas acidovorans* and *Comamonas testosteroni*. Most *Comamonas acidovorans* strains were isolated from ocular sites [10-12] , followed by urinary track, central venous catheter, indwelling catheter, tricuspid valve in a case of endocarditis, and acute suppurative otitis draining pus [13-17]. However, in 33 reported cases of *Comamonas testosteroni* including the two present cases, the most common isolation sites were the bloodstream in 13 cases, followed by the abdominal cavity in 10 cases mainly due to secondary dissemination after perforated appendix or other anatomic abnormalities in the gastrointestinal tract; three cases from cerebrospinal fluids; one case of the organism isolated from the embryonic cord of a stillborn infant of an intravenous drug abuse mother; one isolation from an ocular site; one from urine; one from a patient with immunodeficiency syndrome as an agent of pneumonia; and one from the infection site of an animal bite. The infection site of one last case is missing (Table 1). All were responsive to antibacterial treatment except for the three cases consisting of two newborn and stillborn infants and a case of meningitis in a homeless man, [18, 19]. Taking into account the reported studies, it seems that the strains of *Comamonas testosteroni* show more sensitivity to common antibiotics than *Comamonas acidovorans*.

The two present cases are the first reports of the role of *Comamonas testosteroni* in bacteremia in Iran. Therefore, our two cases are the 32nd and 33rd reported cases on the infection since then. Having detected two positive blood cultures in a two-day interval with an uncommon pathogen microorganism, we became suspicious of a probable common source and consequently investigations found a direct contact between the two patients who were admitted for a few hours at the same time in the same room. On the basis of the two patients' histories and presentation of infections, it seems that the possible source and predisposing factor in the osteosarcoma case might be acquired *Comamonas* bacteremia from the environment with unknown origin, due to neutropenia. As for the case with brain medulloblastoma, probably inhalation in the same room where the other case with dry cough was hospitalized was responsible. Unfortunately, we could not find any source, and air contact such as respiratory inhalation or through air conditioners, which might have been the source of the infections. Further investigations should be conducted to confirm and consolidate the findings. Finally, we informed the Infection Control Committee of the hospital to take proper disinfecting measures,

including isolation of such cases, educating the health staff, and using effective antiseptic methods.

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Corresponding author

Maneli Aminshahidi
MSc of Medical Microbiology
Professor Alborzi Clinical Microbiology Research Center
Shiraz University of Medical Sciences
Namazi Hospital, Shiraz 71937-11351, Iran
Telephone: +98-711-6474304; Fax: +98-711-6474303
Email: Maneli1969@yahoo.com

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