Bacteriemia por *Raoultella planticola*: descripción de un caso y revisión de la literatura

Raoultella planticola bacteraemia: a case report and review of the literature

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ABSTRACT

Raoultella planticola (R. planticola) is an anaerobic gram-negative bacillus implicated in urinary, intra-abdominal, skin and soft tissue infections, pneumonia and bacteraemia. We depict here the clinical case of a 74-year-old woman, medicated lifelong with phenytoin, with bacteraemia caused by R. planticola, successfully treated with ceftriaxone. To date, a comprehensive literature review, revealed 52 published clinical cases (between 2007-2019), thirteen of which due to bacteraemia.

Keywords: *Raoultella planticola*, bacteraemia.

RESUMEN

Raoultella planticola (R. planticola) es un bacilo anaerobio Gram negativo implicado en infecciones de partes blandas, urinarias, intra-abdominales, neumonías y episodios de bacteriemia. Presentamos el caso de una mujer de 74 años, tratada con fenitoína de forma crónica, con bacteriemia por R. planticola tratada de forma exitosa con ceftriaxona. Hasta la fecha, tras realizar una revisión de la literatura, se han descrito 52 casos entre 2007 y 2019, trece de los cuales presentaron bacteriemia.

Palabras clave: *Raoultella planticola*, bacteriemia.

INTRODUCTION

Raoultella planticola (*R. planticola*) is an immobile, encapsulated, anaerobic gram-negative bacillus, belonging to the *Enterobacteriaceae* family, genus *Klebsiella*[1-3]. Increasingly recognized as a clinically significant entity, *R. planticola* is often implicated in urinary, intra-abdominal, skin and soft tissue infections, as well as pneumonia and bacteraemia[4-6]. In this article we describe another case of *R. planticola* bacteraemia.

CASE REPORT

We report a case of a 74-year-old fragile woman with low functional status (Katz 2/6), with known comorbidities of dementia, epilepsy (chronically medicated with phenytoin), obesity, hypertension, dyslipidemia, colonic diverticular disease and a previous history of alcohol abuse (accordingly to family, abstinent for 7 years). Patient was admitted to the emergency department due to generalized tonic-clonic seizures, witnessed by her family, during mealtime. The patient presented signs of respiratory distress and depressed level of consciousness (Glasgow coma scale 8) but hemodynamically stable and afebrile. A fragment of meat was identified in the oropharynx and removed. Patient evaluation performed at admission revealed: chest X-ray with a heterogeneous hypotransparency in the right lower lobe and cranial computed tomography with no signs of acute vascular lesions or space-occupying lesions. Laboratory tests revealed increased inflammatory parameters, signs rhabdomyolysis, acute kidney injury (AKI) (serum creatinine 1.91 mg/dL), and infra-therapeutic levels of phenytoin. Arterial blood gas showed hypoxemic respiratory failure. Thus, patient was admitted in the Internal Medicine ward under the assumption of diagnosis of pneumonitis/aspiration pneumonia. Prior to initiation of empirical antimicrobial therapy with amoxicillin/clavulanate, blood cultures were obtained.

The first days after hospitalization, patient was febrile and presented a slight degree of prostration, with no focal neurological deficits. No cardiac murmurs, palpable adenomegalies, organomegaly or masses, as well as changes in the integument were identified. AKI progressed to a maximum creatinine value of 6.63 mg/dL and gradually resolved to previous values. On the fifth day of hospitalization, blood cultures were positive for gram-negative bacillus, and antibiotic therapy was escalated to piperacillin/tazobactam. One day later, *R. planticola* was isolated in one of the blood cultures, resistant to ampicillin and sensitive to gentamicin, amoxicillin/clavulanate, cefuroxime sodium and clotrimazole. In this context, antimicrobial therapy was adapted to ceftriaxone, during the next 7 days. Follow-up blood cultures persisted sterile. Echocardiography was requested, which excluded vegetations, destructive lesions and abscess formation. Complete blood count and clinical chemistry showed normocytic and normochromic anemia with stable hemoglobin (10 g/dL) paired with iron and B12 deficiencies, promptly treated (no blood loss documented); serum proteinogram showed no relevant deviations, no hypercalcemia, normal thyroid-stimulating hormone, non-reactive serologies for human immunodeficiency virus and hepatitis B and C, non-reactive VDRL, normal angiotensin converting enzyme, a negative summary autoimmune panel with increased immunoglobulin (Ig) A and IgG (508 and 1753 mg/dL, respectively) and increased erythrocyte sedimentation rate (97 mm/h). *Mycobacterium tuberculosis* infection was excluded. Chest, abdomen and pelvis computed tomography found signs of recent pulmonary thromboembolism at the level of the left upper and lower lobar branch, right interlobar branch and right segmental branches of the lower lobe, associated with signs of thrombosis of the portal vein, in a context of slightly lobulated contours enlarged liver. Anticoagulant treatment with apixaban was decided.

Progressive clinical improvement was observed during hospitalization, registering a full recovery at discharge.

LITERATURE REVIEW AND DISCUSSION

R. planticola, previously known as *Klebsiella planticola* and *Klebsiella trevisanii*, is a bacterium found in water and soil. Despite of its increasing clinical relevance, it remains a rare cause of infection in humans[1-3].

It is thought to have a virulence capacity similar to that of *Klebsiella pneumoniae*[7], presenting with lipopolysaccharides, fimbriae, toxins and biofilm formation[8], and it is estimated that approximately 9 to 18% of humans are colonized by *R. planticola*[4].

Most cases of infection are associated with significant comorbidities, invasive procedures or previous trauma[9], but the main

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Author	Year	Clinical manifestation	Culture site	Risk factors	Age/Gender	Treatment	Outcome
Pacilli, M.; Nataraja R.M.	2019	Peritonitis	Peritoneal fluid	Meckel diverticulum	8 years/ Female	Trimethoprim-sulfamethoxazole (10 days)	Stable at 6 months of follow-up
Branco, J. C. et al	2019	Peritonitis	Peritoneal fluid	Alcoholic liver cirrhosis, diabetes mellitus (DM)	76 years/ Male	Ceftriaxone (7 days)	Deceased
Harmon, S.L; Nadeem I.	2019	Cystitis	Urine	Transplant, DM	40 years/ Female	Amoxicillin/clavulanate (5 days)	3 month following treatment new RP infection
Fager, C.; Yurteri-Kaplan, L	2019	Cystitis	Urine	Postoperative, peripheral neuropathy	50 years/ Female	Nitrofurantoin	Stable at 1 month of follow-up
AlSweed A. et al	2018	Endocarditis	Blood	Gastroesophageal reflux disease (GERD), hiatus hernia, methicillin-resistant Staphylococcus aureus (MRSA)	4 years/Male	Initially vancomycin + ceftazidime. After antimicrobial susceptibility testing ceftriaxone + gentamicin	?
Al-Sawaf, O. et al	2019	Cellulitis	Blood	Cancer	38 years/ Male	Piperacillin/tazobactam (12 days)	?
Fager C.; Yurteri-Kaplan L.	2018	Cystitis	Urine	Lupus treated with methotrexate, postoperative	50 years/ Female	Nitrofurantoin	Stable at 1 month of follow-up
Gonzales Zamora, J.A. et al	2018	Bacteremia	Blood	Burns	85 years/ Female	Initially Cefepime. After antimicrobial susceptibility testing ceftazidime/avibactam + polymyxin (15 days)	?
Mehmood H. et al	2018	Pyelonephritis	Urine	Immunoglobulin A nephropathy	65 years/ Male	During hospitalization ceftriaxone (3 days). After discharge ciprofloxacin (4 days)	Stable at 2 weeks of follow-up
Yumoto, T. et al	2018	Bacteremia	Blood	Burns	79 years/ Male	Initially piperacillin/tazobactam (9 days), then Meropenem (3 days)	Deceased
Naganathan, G.; Amin, N.K.	2018	Necrotizing appendicitis	Blood	Colitis, GERD, proton-pump inhibitor (PPI), asthma, postoperative	63 years/ Female	Initially ceftriaxone (1 day). Then amoxicillin/clavulanate (14 days)	Stable at 5 weeks of follow-up
Yamamoto, S. et al	2018	Bacteremia	Blood	Cancer	81 years/ Male	Initially ampicillin 3 days. After antimicrobial susceptibility testing, ceftriaxone (11 days)	?
Atici, S. et al	2018	Bacteremia	Blood	Pre-term newborn	Newborn with 28 weeks of gestation	Initially netilmicin, then piperacillin/tazobactam	Deceased
Kalaria, S.S. et al	2017	Skin infection	Pus	Trauma (animal bite), PPI	73 years/ Female	Levofloxacin	Stable at 4 months of follow-up
Casarsa, C., Mearelli, F., Biolo, G.	2017	Bacteremia	Blood	Sjögren syndrome, cancer, post endoscopic retrograde cholangiopancreatography (ERCP)	55 years/ Female	Ceftriaxone (14 days)	?
Yoshida, N.; Tsuchida, Y.	2017	Palmar atheroma infection	Pus	Cancer	74 years/ Male	Initially ceftriaxone (4 days), then levofloxacin (21 days)	?

Author	Year	Clinical manifestation	Culture site	Risk factors	Age/Gender	Treatment	Outcome
Povlow, M.R.; Carrizosa, J.; Jones, A.	2017	Bacteremia	Blood	Alcoholic liver cirrhosis, seafood consumption	66 years/ Male	Initially piperacillin/ tazobactam. After antimicrobial susceptibility testing, ceftriaxone	?
Subedi, R. et al	2017	Bacteremia	Blood	DM, hypertension, dyslipidemia	63 years/ Male	Piperacillin/tazobactam for 6 weeks + levofloxacin for 2 weeks	Stable
Ulkent, S.C. et al	2017	Cholecystitis	Pus	No relevant medical history	71 years/ Female	Ampicillin (10 days)	Stable at 3 months of follow-up
Howell, C.; Fakhoury, J.	2017	Cystitis	Urine	Neonatal hyperbilirrubinemia	2 months/ Female	Initially ceftriaxone (1 dose), then cefalexin (10 days)	?
Westerveld, D. et al	2017	Pneumonia	Sputum	Cancer	36 years/ Female	Initially ceftriaxone, after exacerbation piperacillin/ tazobactam	?
Bardellini, E. et al	2017	Mucositis	Pus	Cancer	16 years/ Male	Amikacin + Ceftazidime (8 days)	Stable at 12 months of follow-up
Adjodah, C. et al	2017	Cardiac device implantation site	Pus	Rheumatoid arthritis treated with methotrexate	79 years/ Male	Initially oxacillin. After antimicrobial susceptibility testing ciprofloxacin (15 days)	Stable at 5 years of follow-up
Bonnet, E. et al	2017	Joint infection	Synovial fluid	Arthroscopy	46 years/ Male	Initially vancomycin. After antimicrobial susceptibility testing amoxicillin/clavulanate (8 days) + levofloxacin (4 weeks)	Stable at 18 months of follow-up
Skelton W.P. 4th; Taylor, Z.; Hsu, J.	2017	Pyelonephritis	Urine	Cancer	73 years/ Female	Initially cefalexin. After antimicrobial susceptibility testing nitrofurantoin (7 days)	?
Merino, R. E.; Rebolledo O.S; Miquel, P.J.	2017	Pancreatitis Cholangitis	Blood	Rheumatic valvulopathy	55 years/ Female	Piperacillin/tazobactam	?
Tugcu, M. et al	2017	Pyelonephritis	Urine	Urodynamic study, peritoneal dialysis (PD)	57 years/ Male	Ceftriaxone (7 days)	Stable at 1 month of follow-up
Pan, Z. et al	2017	Pneumonia	Sputum	Peritonitis, perforated duodenal ulcer	74 years/ Male	Initially piperacillin/ tazobactam. After exacerbation levofloxacin + tigecycline (7 days)	Stable at 2 weeks of follow-up
Sia, C.S. et al	2016	Peritonitis	Peritoneal fluid	Human immunodeficiency vírus (CD4 122), chronic kidney disease (CKD)	56 years/ Female	Initially cefazoline + gentamicin (6 days). After exacerbation ceftriaxone (15 days)	?
De Campos, F.P; Guimarães, T.B.; Lovisolo, S.M.	2016	Pancreatic pseudocyst	Peritoneal fluid	CKD, chronic pancreatitis	52 years/ Male	?	Deceased
Sitaula, S. et al	2016	Hepatic abscess	Pus	DM, benign prostatic hyperplasia (BPH)	62 years/ Male	Initially piperacillin/ tazobactam. After antimicrobial susceptibility testing ceftriaxone (15 days) + ciprofloxacin (28 days)	Stable at 2 months of follow-up

Author	Year	Clinical manifestation	Culture site	Risk factors	Age/Gender	Treatment	Outcome
Gian, J.; Cunha, B.A.	2016	Prostatitis	Urine	BPH, post transurethral resection of the prostate	53 years/ Male	Fosfomycin (3 months)	Stable at 3 months of follow-up
Tug´cu M., et al.	2016	Pyelonephritis	Urine	PD, DM, urodynamic study	57 years/ Male	Ceftriaxone (7 days)	Stable at 1 month of follow-up
Cho, Y.J. et al	2016	Pneumonia	Sputum	Smoking	58 years/ Male	Initially levofloxacilin + piperacillin/tazobactam (7 days). After antimicrobial susceptibility testing, piperacillin/tazobactam (4 weeks)	Stable at 3 weeks of follow-up
Vassalo, J. et al	2016	Conjunctivitis	Pus	No relevant medical history	88 years/ Female	Initially topical gentamicin (8 days). After exacerbation topical ciprofloxacin (3 weeks)	?
Vassalo, J. et al	2016	Conjunctivitis	Pus	?	71 years/ Male	Topical gentamicin	?
Vassalo, J. et al	2016	Conjunctivitis	Pus	?	15 years/ Female	?	?
Vassalo, J. et al	2016	Conjunctivitis	Pus	Postoperative	69 years/ Female	?	Recurrent conjunctivitis
Yoon, J.H. et al	2015	Cystitis	Urine	Cancer	16 months/ Male	Initially cefotaxime + ampicillin (6 days), then cefpodoxime (4 days)	Stable at 2 years of follow-up
Kim, S.W. et al	2015	Peritonitis	Peritoneal fluid	PD	65 years/ Male	Initially cefazoline + ceftazidime (6 days). After antimicrobial susceptibility testing, ciprofloxacin + ceftazidime (17 days)	Stable at 5 months of follow-up
Gangcuangco, L.M.; Saul, Z.K.	2015	Cystitis	Urine	Dementia	92 years/ Female	Ceftriaxone (7 days)	?
González-González, L. et al	2015	Bacteremia	Blood	DM	82 years/ Female	Initially ceftriaxone. After antimicrobial susceptibility testing, ciprofloxacin	?
Xu, M. et al	2015	Pneumonia	Sputum	Cancer	60 years/ Male	Tigecycline + levofloxacin	Deceased
Lam, P.W.; Salit, I.E.	2014	Bacteremia	Blood	Cancer, PPI, seafood consumption	56 years/ Female	Initially ceftriaxone + metronidazole. After antimicrobial susceptibility testing, ceftriaxone (3 days) + ciprofloxacin (7 days)	?
Ershadi, A. et al	2014	Cholecystitis	Biliary fluid	Alcoholic liver cirrhosis, DM	49 years/ Male	Initially piperacillin/ tazobactam + vancomycin. Then tigecycline (14 days)	?
Zuberbuhler, B.; Abedin, A.; Roudsari, A.	2014	Conjunctivitis	Pus	?	58 years/ Female	Topical chloramphenicol	Stable at 2 weeks of follow-up
Koukoulalki, M. et al	2014	Prostatitis	Urine	Transplant	67 years/ Male	Ciprofloxacin (4 weeks)	Stable at 6 months of follow-up

Author	Year	Clinical manifestation	Culture site	Risk factors	Age/Gender	Treatment	Outcome
Salmaggi, C. et al	2014	Bacteremia	Blood	Chronic obstructive pulmonary disease, bronchiectasis, cancer	70 years/ Male	Initially ciprofloxacin + metronidazole. After antimicrobial susceptibility testing, ciprofloxacin (2 weeks)	Stable at 19 days of follow-up
Puerta-Fernandez, S. et al	2013	Bacteremia	Blood	Pituitary adenoma (treated with radiotherapy), BPH, fish consumption	63 years/ Male	Initially piperacillin/ tazobactam. After antimicrobial susceptibility testing, cefotaxime (10 days)	?
Olson, D.S. et al	2013	Pyelonephritis	Urine	Coronary disease, heart failure, CKD	89 years/ Male	Initially ceftriaxone. After antimicrobial susceptibility testing, ciprofloxacin (14 days)	?
Hu, A.Y. et al	2012	Bacteremia	Blood	Cancer, Post-ERCP	59 years/ Male	Piperacillin/tazobactam (14 days)	?
Teo, I. et al	2012	Cholecystitis	Biliary fluid	Celiac disease, irritable bowel syndrome, PPI	62 years/ Female	Amoxicillin/clavulanate (7 days)	Stable at 3 months of follow-up
Kim, S. H. et al	2012	Necrotizing fasciitis	Pus	Heart disease, DM, trauma	66 years/ Male	Initially cefazolin + clindamycin. After antimicrobial susceptibility testing, ceftriaxone	Stable at 4 weeks of follow-up
Yokota, K. et al	2012	Bacteremia	Blood	Cancer	65 years/ Male	Initially cefoperazone, then meropenem + piperacillin/tazobactam (9 days)	?
O´Connel, K.; Kelly, J.; Niriain, U.	2010	Cellulitis	Pus	Trauma	30 years/ Male	Initially benzylpenicillin + flucloxacillin + clindamycin. After antimicrobial susceptibility testing, ciprofloxacin added (2 weeks)	?
Alves, M.S.; Riley, L. W.; Moreira, B.M.	2007	Pancreatitis	Peritoneal fluid	Alcohol use disorder	45 years/ Male	Initially ciprofloxacin + metronidazole. Then imipenem + amikacin (15 days)	?

DM – Diabetes mellitus; GERD - Gastroesophageal reflux disease; MRSA - Methicillin-resistant Staphylococcus aureus; PPI - Proton-pump inhibitor; ERCP - Endoscopic retrograde cholangiopancreatography; PD - Peritoneal dialysis; CKD - Chronic kidney disease; BPH - Benign prostatic hyperplasia

underlying risk factor is cancer[1]. Due to the rare occurrence of *R. planticola* infection in humans, most of the risk factors for this infection are largely deduced from published clinical cases. Immunosuppression, the use of proton pump inhibitors, comorbidities, exposure to soil or aquatic contaminants, invasive procedures, and seafood consumption (due to the ability to convert histidine to histamine) are thought to contribute to infection by *R. planticola*[3, 10-12]. In addition, the most common primary sites of infection appear to be the biliary and urinary tracts[1]. *R. planticola* is generally sensitive to third generation cephalosporins, aminoglycosides, fluoroquinolones and carbapenems, but extensive resistance has been described, most commonly to ampicillin[3] and piperacillin/tazobactam, with some cases of resistance to carbapenems and β-lactamases of broad spectrum reported[7,13].

A comprehensive review of the literature identified 52 clinical cases published from 2007 to 2019 due to *R. planticola* infection in humans, selecting only case reports with full text (Table 1): four cases of pneumonia, one of endocarditis, twelve cases of urinary infection (six of cystitis, four of pyelonephritis and two of prostatitis), thirteen cases of intra-abdominal infection (one of cholangitis, three of cholecystitis, four of peritonitis, two of pancreatitis, one of appendicitis, one liver abscess and one pancreatic pseudocyst), two cases of skin and soft tissue infection (one due to necrotizing fasciitis and two due to cellulitis), thirteen cases of bacteraemia, four cases of conjunctivitis, one case of mucositis, one case of joint infection and one case of infection of the implantation site of a medical device. Within the 52 cases described, five patients died due to infectious complications, two of whom were diagnosed with *R. planticola* bacteraemia.

Only six of the documented cases occurred in patients under the age of 18, with the average age of the reported cases being approximately 60 years and a higher prevalence in males. Approximately 60% of the patients had some degree of immunosuppression due to the underlying disease or treatments, increasing their susceptibility to

opportunistic *R. planticola* infection. In five of the described cases, the risk factor for *R. planticola* infection seemed to be chronic use of PPI.

The majority of reported cases concern urinary tract infections, intra-abdominal infections and bacteraemia, with the number of the latter increasing in recent years. Our case adds another case of bacteraemia to those reported. As mentioned in the literature, the existence of comorbidities can contribute and facilitate infection by *R. planticola*. Our patient had several cardiovascular disease risk factors, chronic liver disease and was under phenytoin treatment, which can be linked to leukopenia, agranulocytosis and granulocytopenia. Regarding the alcohol withdrawal reported in our clinical case, chronic alcohol consumption can also play a capital role, due to cytokines imbalance and bone marrow shock, in increasing the susceptibility to infections, like *R. planticola* infection[14]. As far as we know, our patient had no consumption of shellfish or direct exposure to water or soil contaminants.

CONCLUSIONS

Due to the increasing prevalence and clinical relevance of *R. planticola*, an infection with this pathogen should be considered in patients with immunosuppression, subjected to invasive procedures, with chronic use of PPI, trauma or recent seafood consumption.

Currently, *R. planticola* remains largely susceptible to many antibiotics, but resistance to ampicillin, piperacillin/tazobactam and more recently carbapenems has been reported[11]. The antibiotic sensitivity test should be carried out in all cases to adequate the antibiotic therapy and decrease the likelihood of drug resistance.

CONFLICTO DE INTERESES

The author declares that there is no conflict of interest in this work.

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ASPECTOS ÉTICOS

The author declares that no data that allows identification of the patient appears in this article.

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