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Rhodococcus equi peritonitis in continuous ambulatory peritoneal dialysis: a first in Colombia

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Abstract

Background: In the present report case, we show a peritonitis infection in a continuous ambulatory peritoneal dialysis (CAPD) patient in Colombia. We isolated *Rhodococcus equi* in the peritoneal fluid culture. *Rhodococcus equi* is a rare pathogen in immunocompetent people. Rhodococcal peritonitis complicating CAPD has only been reported in few cases, and experience in its treatment is limited. Antimicrobial treatment is unsuccessful because of the virulence and resistance of the *Rhodococcus equi*. So, the removal of the catheter determines the clinical resolution in most of the cases. In our case, we present the resolution with a combined antibiotic therapy.

Case presentation: We present the case of a 50-year-old female patient with chronic kidney disease secondary to diabetic nephropathy. The patient reported to our unit with abdominal pain 6 months after the start of the treatment with CAPD. An intraperitoneal empirical antibiotic scheme was initiated according to the guidelines of the International Society for Peritoneal Dialysis. Patient denies contact with farm animals in her daily life. After 7 days of treatment, *Rhodococcus equi* was found in the culture. It was decided to extrapolate antibiotic regimen based on the studies of immunocompromised patients suffering from pulmonary infections. The removal of the peritoneal dialysis catheter is decided, but the patient refuses to undertake the procedure. The patient progresses without abdominal pain, and the antibiotic treatment is changed by azithromycin 500 mg daily and performing peritoneal dialysis in CAPD mode.

Conclusions: This case, like the previously published ones, highlights the limitations in the treatment of *Rhodococcus equi* due to the limited number of reported cases of this pathogen and the absence of standard treatment protocols leading to variable response rates. The therapeutic resolution was due to the prolonged use of antibiotic treatment and being aware of the potential increase of the morbidity.

Keywords: *Rhodococcus equi*, CAPD, Peritonitis

Background

Rhodococcus equi is a zoonotic organism that causes rare, potentially fatal several peritoneal infections, and most of the reported cases occurred as pulmonary infections in immunocompromised patients, especially among AIDS patients [1]. *Rhodococcus equi* is a rare pathogen in immunocompetent people, with only about 10–15% of all cases happening in the absence of any known immunocompromise [2]. Rhodococcal peritonitis complicating continuous ambulatory peritoneal dialysis (CAPD) has only been reported in few cases, and experience in its treatment is limited. Combinations of antibiotic regimens are essential to achieve a bacteriological cure. We report a case of Rhodococcal peritonitis in CAPD [3] patient in Colombia.

Rhodococcus equi is a common pathogen in veterinary medicine, but *Rhodococcus* infection recently emerged in the current era as an opportunistic infection in humans, with pulmonary disease being the most common clinical presentation. A recent review of *Rhodococcus equi* infections

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in immunocompetent individuals found no suggestive epidemiological contact in 10 of the 19 patients in the case series [4]. The other published cases of *Rhodococcus equi* infection are evenly distributed among patients with HIV and patients undergoing chronic immunosuppression after transplantation or treatment [5, 6] of other chronic medical disorders. We report a case of *Rhodococcus equi* peritonitis in CAPD patient in Colombia, and we discuss aspects of pathogenesis, clinical presentation, diagnosis, microbiology, and treatment of this disease entity.

Case presentation

We present the case of a 50-year-old female patient with chronic kidney disease secondary to diabetic nephropathy. A peritoneal catheter was placed in the abdomen on May 30, 2015, and the peritoneal dialysis started on June 1, 2015, in continuous ambulatory peritoneal dialysis (CAPD) mode. Was the technique used with four refills per day, using two bags of 1.5% glucose and two bags of 2.3%, intercalated every 6 h? The peritoneal equilibration test (PET) performed at 2 months showed a high average; the patient reported to our unit with abdominal pain 6 months after the start of the treatment.

Routine laboratory tests were conducted with hematocrit 27.7%; hemoglobin 8.79 g/dl; white blood cells 10,100 cells/mm3 (neutrophils 70.4%, lymphocytes 2.1%, monocytes 0.46%, eosinophils 0.31%, basophils 0.12%), pre-dialysis urea 72.76 mg/dL, creatinine 10.6 mg/dL, sodium 127 meq/L, potassium 2.9 meq/L, serum calcium; 8.32 mg/dL; phosphorus 6.75 mg/dL; PTH 247.1 pg/mL; ferritin 1527 ng/ml; transferrin 1.42 g/L; TSAT 32%; GOT 14 IU/L; GPT 23 IU/L; alkaline phosphatase 86 IU/L; albumin 3.06 g/dL; HBs Ac 2 IU/L; HbsAg, negative; Ac ANTIHVC, negative; and Ac ANTIHIV negative. Peritoneal fluid is sampled with cloudy appearance, initial white blood cell count of 8100 cells/mm3 (97% polymorphonuclear); no organism was identified in gram stain, and direct KOH study was negative. No changes in chest X-ray.

An intraperitoneal empirical antibiotic treatment with cefazolin 1 g daily plus amikacyn 2 mg/kg was initiated according to the guidelines of the International Society for Peritoneal Dialysis. The patient denies contact with horses or farm animals in her daily life. The therapeutic protocol of local peritonitis was partially responsive. After 72 h, the peritoneal fluid is reevaluated, obtaining a clear-looking liquid, white cells of 427 cells/mm3 (95% polymorphonuclear), the culture reported gram-positive non-branched bacilli. It was decided to continue with the same course of antibiotics regimen. Blood cultures were performed without any microbiological isolation. After 7 days of treatment, *Rhodococcus equi* was found in the culture. It was decided to extrapolate the intraperitoneal vancomycin and meropenem antibiotic regimen based on studies of immunocompromised patients suffering from pulmonary infections by *Rhodococcus equi*.

The patient presents tachycardia with other vital signs in normal parameters, persistent abdominal, oral route intolerance, diffuse abdominal pain of moderate intensity, chills, isolated episodes of vomiting, and no response to antiemetics (metoclopramide). A new collection of peritoneal fluid is performed with white cells of 60 cells/mm3 (50% polymorphonuclear). The removal of the peritoneal dialysis catheter is decided, but the patient refuses to undertake the procedure. The patient is hospitalized, and a tomography of the abdomen and pelvis with oral and intravenous contrast is performed without evidence of collections and without the involvement of other parenchymas. Blood and urine routine tests and culture are done are normal. The patient progresses without abdominal pain, and the antibiotic treatment is changed by azithromycin 500 mg daily for 3 weeks, currently in its 16th week of treatment after asymptomatic peritonitis and performing peritoneal dialysis in CAPD mode. The patient did not present respiratory symptoms during the course of the clinical follow-up.

Methods

From the bag containing the peritoneal fluid, two aliquots of 50 ml are extracted, one to be processed and the other to be stored as a counter sample. In addition, two small tubes are removed for cytochemical examination. Initially, pretreatment of samples larger than 1 ml was performed in the test tubes with a differential centrifuge at 2500 rpm for 15 min according to the Recommendations of the Spanish Society of Infectious Diseases and Clinical Microbiology without obtaining microbiological development. It was decided to gradually increase the parameters of low speed centrifugation until obtaining microbiological development with 6000 rpm for 30 min (it is interpreted or concluded from this maneuver that the antibiotic did not allow the microbial development in the cultures, and that the method of differential centrifugation kept the contact of the bacteria with the antimicrobial) [7]. 30 mL of the supernatant is discarded, and the sediment is resuspended. Ten milliliters of this sediment is inoculated into a blood culture bottle and seeded in blood agar, MacConkey Agar, and chocolate agar, which are incubated at 35–37 °C for up to 72 h, with growth review every 24 h. The blood culture bottle is left to incubate for up to 7 days. If the growth is observed in the agars or if the bottle is detected positive, the isolated microorganism is identified by the WalkAway equipment of Beckman Coulter (see Fig. 1).

In addition, a gram stain of the sample is performed by placing a smear on a lamina and it is colored as follows: 60 s with methyl violet then washed with water; 60 s with gram Lugol then washed with water; alcohol and acetone for 30 s then washed with water and finally colored with gram fuscine for 60 s; and a final wash is performed again

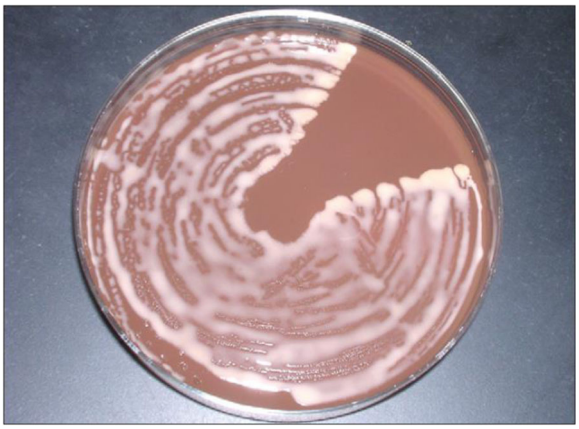

Fig. 1 Colonies of coalescing, mucoid, and pink *Rhodococcus equi* on chocolate agar plate [17]

with water. The smear is left to dry and then examined under a microscope, and the observation is reported.

Discussion

Rhodococcus equi is a well-known cause of pneumonia in horses and immunocompromised human beings [8]. It is a rare disease, and there has been a variable success in the treatment of *Rhodococcus equi* infections, both in pulmonary and extrapulmonary diseases in immunosuppressed patients, particularly those with HIV. The first case of human *Rhodococcus equi* infection was reported in 1967 in a patient with autoimmune hepatitis and under a high-dose steroid treatment. Since then, there have been rare cases reported in patients with HIV and solid organ transplantation where the major involvement is cavitating [9–11] pneumonia. The introduction of highly active antiretroviral therapy (HAART) is one of the main determining factors in the survival of these patients, for whom the mortality rate was 80% [12].

There are very few cases reported in the literature of *Rhodococcus equi* peritonitis, most of which are found in Hong Kong [13]; the presumption is that there is a direct inoculation through contact contamination of the peritoneal dialysis catheter. Antimicrobial treatment is unsuccessful because of the virulence and resistance of the *Rhodococcus equi*, so the removal of the catheter determines the clinical resolution in most of the cases [14].

Rhodococcus equi is a soil-inhabited organism transported in the intestine of many herbivores and widespread in its environment. The patient denied direct contact with livestock, does not work in the agricultural sector, and lives in a rural area. The presentation of this case was presented to our department probably due to the contamination during manual exchanges. This is a global distribution environmental pathogen found in air, water, and land. It colonizes the intestines of omnivores and herbivores, especially horses; direct contact with animals, their excrements, and the manure can be the source of infection, and as all intracellular microorganisms, the infection is difficult to eradicate. The estimated mortality is 11% for immunocompetent patients and 55% for patients with AIDS; for peritoneal dialysis related to peritonitis, the mortality and morbidity are difficult to estimate because there are very few cases. Table 1 shows its classification, possibility of isolation in humans, and some of the synonyms found in the literature.

The red pigment known as *Rhodococcus* = red coconut is not usually appreciated in cultures with less than 4 days; after this time, the colonies may appear salmon-colored, slightly red, pale yellow, or even fall short of pigment or in pink aspect, as shown in Fig. 1. In old cultures, the colonies may appear to be dry, rough, and red-orange colored, reverting to its original aspect when performing a new subculture.

In our case, the incomplete response to the antimicrobial treatment on the fifth day would lead to the extraction of the peritoneal dialysis catheter to reduce the patient's chances of morbidity and preserve the peritoneal membrane. The results of the peritoneal fluid culture were obtained on the eighth day of therapy. At that time, the removal of the catheter was considered, and a review of the literature on pulmonary infections triggered a change in antimicrobial scheme with intraperitoneal vancomycin as follows for 10 days oral azithromycin was added for 3 weeks. The patient has been responding favorably to this treatment for 16 weeks [15].

The intracellular pathogen condition confers *Rhodococcus equi* special characteristics regarding the sensitivity studies and the choice of antibiotic treatment. In this case, in vitro sensitivity is not always correlated with in vivo efficacy. On the other hand, the success of the treatment depends on the use of lipophilic antibiotics that can penetrate the macrophages-neutrophils and be active in an environment with low oxygen concentrations and an acid pH where the organism survives. In vitro studies have shown the activity of different antimicrobial agents, as summarized in Table 2.

Table 1 *Rhodococcus* genus classification, isolated from human beings and previous taxonomic references [18, 19]

Specie	Isolated from humans	Previous references
Rhodococcus coprophilus	DNF	DNF
Rhodococcus equi	+	*Corynebacterium equi* *Nocardia restricta*
Rhodococcus erythropolis	+	*Corynebacterium aurantiacum*
Rhodococcus fascians	+	*Rhodococcus luteus*
Rhodococcus rhodochrous	+	*Rhodococcus roseus*
Rhodococcus ruber	DNF	*Streptothrix rubra*
Rhodococcus marinonascens	DNF	*Rhodococcus marininascens*

DNF data not found; + published references

Table 2 *Rhodococcus equi* in vitro sensibility [19]

Good	Variable	Resistant
Carbapenems	Aminoglucosides	Penicillins
Glycopeptides	Clindamycin	Aminopenicillins
Quinolones	Tetracyclines	Cephalosporins
Macrolides	Clindamycin	
Rifampin		

Conclusions

This case, like the previously published ones, highlights the limitations in the treatment of *Rhodococcus equi* due to the limited number of reported cases of this pathogen and the absence of standard treatment protocols leading to variable response rates. In our experience, the infection was treated adequately without the removal of the PD catheter. A thorough bibliographical search was performed, and there is no theoretical evidence to maintain the catheter. In our case, it was decided by the patient's request to maintain such access with an appropriate subsequent evolution. In summary, given the rather unpredictable response to the different treatments and considering the standard recommendations made by the International Society for Peritoneal Dialysis (ISPD), the extraction of the PD catheter would be indicated when there is refractory peritonitis defined as an effluent failure after the fifth day of appropriate antibiotic treatment [16].

In this case, the therapeutic resolution was due to the prolonged use of antibiotic treatment and being aware of the potential increase of the morbidity and compromise of the integrity of the peritoneal membrane.

This case highlights the success of the management of peritoneal dialysis with secondary peritonitis. In rare cases, the delay in the isolation of *Rhodococcus equi* jeopardizes the continuity of the dialysis leading to catheter removal and the passage to hemodialysis based on the recommendations of the International Society for Peritoneal Dialysis (ISPD). Prolonged antimicrobial therapy has shown variable rates of success in the few cases reported to date and with variable results despite preserving the catheter and continuing in such kidney replacement therapy.

Abbreviations

AIDS: Acquired immune deficiency syndrome; CAPD: Continuous ambulatory peritoneal dialysis; DNF: Data not found; HAART: Highly active antiretroviral therapy; ISPD: International Society for Peritoneal Dialysis; PD: Peritoneal dialysis; PET: The peritoneal equilibration test

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Availability of data and materials

The data and materials were all included in the manuscript.

Authors' contributions

JLD and YDLC are responsible for the writing of the manuscript. JLD and YDLC performed the acquisition and interpretation of data and drafted and revised the manuscript. VB helped to draft the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Written informed consent was obtained from the patient for publication of this case report, and the accompanying images were additioned at the bibliographic references. This study/report was approved by the Ethical Committee of the Hospital de Clínicas José de San Martín (approval number: HCJSM12/16) and was conducted in accordance with the National Law on the protection of personal data No 25.326 and the Declaration of Helsinki (Last version, Fortaleza 2013).

Consent for publication

Written informed consent was obtained from the patient for publication of this case report, and the accompanying images were additioned at the bibliographic references.

Competing interests

The authors declare that they have no competing interests.

Publisher's Note

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