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Case report

Myroides bacteremia: A case report and concise review

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ABSTRACT

Myroides species are bacteria found commonly in environmental sources, such as water and soil. Despite this, they are historically uncommon pathogens, tending to affect primarily immunocompromised hosts. Based on a review of the current cases listed in the U.S. National Institutes of Health's National Library of Medicine (Table 1), there have been 48 reported cases of infection to date, one third of which have been reported in only the last seven years. This report outlines a case of bacteremia caused by *Myroides* species occurring in a diabetic male on chemotherapy for Merkel cell cancer. *Myroides* species can be difficult to treat, many strains are resistant to several antibacterial classes, this patient was treated successfully with meropenem.

Introduction

Infections caused by *Myroides* species are exceptionally uncommon, even though the bacteria are ubiquitous in the environment. A 2010 review of the literature revealed only thirty two reported cases [1]. Over the last seven years sixteen more cases have been reported in a variety of clinical settings (Table 1). The bacteria are notoriously resistant to many antibacterials. Given the relative increase in reported infections caused by *Myroides* species and the potential difficulties with effective treatment, clinicians should be alert to the possibility of this organism becoming a more prominent pathogen, especially to the immunocompromised population.

Case

A 64 year old male with multiple medical comorbidities presented to the hospital with rigors. His past medical history was significant for diabetes mellitus, complicated by prior diabetic foot infections with bilateral toe amputations and chronic lower extremity edema. He was also recently diagnosed with Merkel cell carcinoma and received a dose of chemotherapy (Carboplatin/Etoposide) one day prior to this presentation. He complained of subjective fever, malaise and generalized body aches but denied any significant localizing symptoms suggestive of a source of infection.

His initial vital signs were notable for sinus tachycardia in the emergency room. Physical examination was significant for healed surgical scars in his right groin (status post lymph node excision for treatment of his cancer). He was also noted to have a clean left chest wall port site without erythema nor discharge. His lower extremity exam was consistent with chronic edema on the right with stasis dermatitis on that leg, and modest erythema on the posterior aspect of the calf.

The patient's white blood cell count was initially 30×10^9/L and serum lactic acid was found to be correspondingly elevated at 3.68 mmol/L. His hemoglobin was consistent with his chronic anemia and other laboratory parameters including renal and liver function were unremarkable. Initial chest x ray and urinalysis also did not assist in localizing his infection. He was subsequently started on vancomycin and zosyn.

On hospital day 2, blood cultures taken from a peripheral access as well as from his port were both positive for gram negative rods. After CT scan of the abdomen and pelvis failed to reveal occult intra abdominal infection, his port was removed. The final report on both of his blood cultures revealed growth of *Myroides* species. These were performed using a Beckman Coulter MicroScan Panel. In other reports, subspeciation was achieved using 16S rRNA sequencing that was unfortunately not available at the time [1,6]. Cultures of the tip of his port were negative.

Upon further questioning, our patient recalled walking outside his home through slushy puddles of melted snow approximately ten days prior to presentation. He was at the time awaiting replacement specially sized orthotic wear for his chronically swollen right foot and so ran a short errand barefooted. In retrospect, this history appears to explain the portal of entry of his profoundly uncommon pathogen. Conceivably, the chronically

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Table 1
Reported cases of *Myroides* spp. infection as found in the United States' National Institutes of Health's National Library of Medicine (Pubmed) database as of 2/11/2017.

Case report/year/reference	No. Of cases	Organism	Reported clinical setting
Holmes et al/1979/ [15]	5	*F. odoratum*	Ischemic lower limb disease, foot gangrene, bladder carcinoma, syringomyelia, chronic renal impairment (1 patient in each category)
Davis et al/1979/[16]	1	*F. odoratum*	Infection of amputation stump
MacFarlane et al/1985/[17]	1	*F. odoratum*	Ventriculitis, bacteremia
Prieur et al/1988/[18]	1	*F. odoratum*	Bacteremia and cellulitis
Hsueh et al/1995/[19]	1	*F. odoratum*	Necrotizing fasciitis
Ferrer et al/1995/[20]	1	*F. odoratum*	Endocarditis, graft infection
Bachman et al/1996/[21]	1	*F. odoratum*	Bacteremia, recurrent cellulitis
Spanik et al/1998/[22]	4	*F. odoratum*	Bacteremia, infected central venous catheter
Yagci et al/2000/[23]	13	*M. odoratimimus*	Pyuria
Green et al/2001/[24]	1	*M. odoratus*	Bacteremia and cellulitis
Motwani et al/2004/[25]	1	*M. odoratus*	Bacteremia and cellulitis
Thomas et al/2007/[26]	1	*Myroides* spp.	Acalculous cholecystitis
Bachmeyer et al/2008/[27]	1	*M. odoratimimus*	Bacteremia and cellulitis
Benedetti et al/2011/ [1]	1	*M. odoratimimus*	Septic shock, pneumonia, soft tissue infection
Ktari et al/2011/ [2]	4	*M. odoratimimus*	UTI
Maraki et al/2012/ [3]	1	*M. odoratimimus*	Cellulitis
Deepa et al/2014/ [4]	1	*M. odoratus*	Pneumonia (secondary)
Crum-cianflone et al./2014/ [5]	1	*M. odoratus*	Necrotizing fasciitis
Endicott-Yazdani et al./ 2015/ [6]	1	*M. odoratimimus*	Bacteremia (source thought to be from a foot ulcer)
Prateek et al./2015/ [7]	1	*M. odoratus*	Pericardial effusion
Ali et al./2015/ [8]	1	*Myroides* spp.	Canaliculitis (chronic)
Lahmer et al./2016/ [9]	1	*M. odoratus*	Necrotizing pancreatitis
Jover-Saenz et al./2016/ [10]	1	*M. odoratimimus*	Prosthetic joint infection
Belloir et al./2016 [11]	1	*M. odoratimimus*	Bacteremia
Willems et al./2016/ [12]	1	*M. odoratimimus*	Erysipelas and sepsis
This case/2017	1	*Myroides* spp.	Bacteremia and cellulitis

disrupted skin barrier on his bare foot may have been further compromised by neuropathy and the extremes of temperature, resulting in his calf erythema and subsequent bacteremia, given his immunocompromised state.

Discussion

Organisms of the genus Flavobacterium were first isolated in 1923. *F. odoratum* are aerobic, yellow-pigmented, non-motile, non-fermenting gram-negative rods that derive their name from a characteristic fruity odor. Given several demonstrated distinctive features of *F. odoratum*, in 1996, the new genus *Myroides* was created (of taxonomic interest, the greek noun Myron means sweet oil or perfume). It initially consisted of two species, *M. odoratus*, formerly *F. odoratum* and *M. odoratimimus* [1,2,3]. More recently, *M. pelagicus*, *M. profundi*, and *M. marinus* were isolated from seawater [1] and *M. indicus* and *M. xuanwuensis* have been found in soil [13,14].

Myroides species are not known to be normal components of the human microflora, rather they are often found in environmental sources such as soil and water. They most often behave as low grade opportunistic pathogens, affecting immunocompromised hosts such as those with liver cirrhosis, diabetes mellitus, and chronic obstructive pulmonary disease (COPD) on long-term corticosteroid treatment [1–3]. To date only two cases have been described in immunocompetent hosts, out of a total of 48 (including this one) reported cases of infection found in the literature (as outlined in Table 1).

Based on a review of the current cases listed in the U.S. National Institutes of Health's National Library of Medicine, this case is the eleventh reported case of soft tissue infection caused by *Myroides* spp. (Table 1). The genus has been reported as an etiologic agent most commonly in cases of cellulitis and necrotizing fasciitis and urinary tract infections. Two nosocomial outbreaks have been reported among urologic patients, all of whom (except one) underwent endourologic operations and were hospitalized for a prolonged period. All of these patients also had urinary stones or urinary neoplasms [2]. There have also been (very few) reported cases of surgical wound infection, ventriculitis, endocarditis, prosthetic joint infection and necrotizing pancreatitis. It should also be noted that the invasive potential of the species has been demonstrated in several reported cases of bacteremia [1] (Table 1).

Antimicrobial treatment of *Myroides* infection can be quite difficult. The production of chromosome-encoded metallo-beta-lactamases has also been documented both in *M. odoratus* (TUS-1) and in M. odoratimimus (MUS-1). Many strains have thus been recognized as resistant to beta lactams, monobactams and carbapenems, they exhibit variable susceptibility to aminoglycosides, quinolones and trimethoprim/sulfamethoxazole [1–3].

Our patient's specimen was resistant to cephalosporins and aminoglycosides, of intermediate resistance to ciprofloxacin and piperacillin/tazobactam and sensitive to meropenem and

trimethoprim/sulfamethoxazole. He ultimately responded well to treatment with meropenem.

Conclusion

Myroides remains an uncommon pathogen that is ubiquitous in the environment. Nevertheless it is being increasingly reported in a variety of clinical settings. Clinicians should remain alert to the possibility of this pathogen as an etiologic agent for invasive infection, especially in the immunocompromised or when there is a lack of response from routine treatment.

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