

# An Outbreak of Urinary Tract Infections due to Myroides Spp. in Adult Intensive Care Unit: Risk Factors and Control Procedures

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## Erişkin Yoğun Bakım Ünitesinde Myroides Spp'ye Bağlı İdrar Yolu Enfeksiyonu Salgını: Risk Faktörleri ve Kontrol Yöntemleri

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### ABSTRACT

**Objective:** Microorganisms of the Myroides genus are common in the environment, especially in water but rarely seen as an infectious agent in humans. It was described uncommonly in immunocompetent patients. Their treatment is challenging due to their resistance to many antibiotics. Herein, we report the Myroides spp-associated nosocomial urinary tract infection outbreak occurring in tertiary intensive care.

**Methods:** A total of 9 Myroides spp reproductions in 7 patients were included in the study between July 2019 and December 2019.

**Results:** For Myroides species known to have multi-drug resistance, response to the combined treatment of ciprofloxacin and rifampicin was achieved in 5 out of 7 patients.

**Conclusion:** We would like to point out that poorly controlled diabetes can cause outbreaks. Also, ciprofloxacin and rifampicin may be effective options in treatment.

**Keywords:** Myroides, Outbreak, Nosocomial infection, Urinary tract infection, Flavobacterium.

### ÖZ

**Amaç:** Myroides cinsi mikroorganizmalar başlıca su olmak üzere doğal ortamda yaygın olarak bulunur, ama insanda bir enfeksiyon ajanı olarak nadiren görülür. İmmünkompetan hastalarda nadir olarak tanımlanmıştır. Bir çok antibiyotiğe direnç nedeniyle tedavisi zordur. Burada üçüncü basamak yoğun bakımda meydana gelen Myroides spp. ile ilişkili nozokomiyal üriner sistem enfeksiyonu salgını bildirildi.

**Yöntem:** Temmuz 2019 ile Aralık 2019 tarihleri arasında 7 hastada toplam 9 Myroides spp. üremesi çalışmaya dahil edildi.

**Bulgular:** Çoklu ilaca dirençli olduğu bilinen Myroides türleri için, 7 hastanın 5'inde siprofloksasin ve rifampisin kombine tedavisine yanıt alındı.

**Sonuç:** Biz kötü kontrollü diyabetin salgınlara neden olabileceğini saptadık. Ayrıca siprofloksasin ve rifampisin tedavide etkili seçenekler olabileceğini düşünüyoruz.

**Anahtar kelimeler:** Myroides, Salgın, Nozokomiyal enfeksiyon, İdrar yolu enfeksiyonu, Flavobakteri.

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## INTRODUCTION

The Myroides genus (Myroides spp.) are aerobic, yellow-coloured, immobile, non-fermented, gram-negative microorganisms, formerly classified as Flavobacterium odoratum. The most common species are Myroides odoratus and Myroides odoratimimus.

Microorganisms of the Myroides genus are common in the environment, especially in water <sup>[1]</sup>. Although they are common in the environment, they are rarely seen as an infectious agent in humans. It has been reported to cause urinary tract infection, endocarditis, ventriculitis, and cutaneous infections in severely immunocompromised patients as low-grade opportunistic pathogens. Their treatment is challenging due to their resistance to many antibiotics. Only 32 cases have been reported in the literature review conducted in 2010 <sup>[2]</sup>. There has been an increase in case reports in recent years <sup>[3]</sup>.

We aimed to report the Myroides spp.-associated nosocomial urinary tract infection outbreak occurring in tertiary intensive care; and in the light of the literature, to examine this outbreak, which is the fourth outbreak as far as we know.

## MATERIAL and METHOD

The study was conducted after the local ethics committee approval of the hospital was obtained. Our intensive care is a 16-bed tertiary mixed type intensive care. A total of 9 Myroides sp.p strains grown in 7 patients were included in the study conducted between July 24, 2019 and December 28, 2019. All isolates were of urine origin.

All isolates were first identified as Myroides spp. using the VITEK® 2 GN ID cards (BioMérieux, Marcy l'Étoile, France). The initial identification as Myroides spp was performed using a matrix- assisted laser desorption ionization -time of flight mass spectrometry (MALDI-TOF MS) according to the manufacturer's instructions. Antibiotic sensitivity was determined according to EUCAST (European Committee on Antimicrobial Susceptibility Testing) criteria and tested on VITEK 2 (Biomérieux, Marcy-l'Étoile, France) device. Sensitivity to aztreonam,

cefepime, ceftazidime, ciprofloxacin, gentamicin, imipenem, levofloxacin, meropenem, netilmicin, piperacillin, pip-Tazo, tetracycline, amikacin, trimethoprim-sulfamethoxazole, and tobramycin discs was tested. (Table 1)

**Table 1. In vitro susceptibility testing of the isolates of Myroides spp.**

Antibiotic	MIC value	Interpretation S,I,R
Aztreonam	>=64.0	R
Cefepim	>=32.0	R
Ceftazidime	>=64.0	R
Ciprofloxacin	>=4.0	R
Gentamicin	>=16.0	R
Imipenem	>=16.0	R
Levofloxacin	>=8.0	R
Meropenem	>=16.0	R
Netilmicin	>=32.0	R
Piperacillin	>=128.0	R
Piperacillin/ Tazobactam	>=128.0	R
Tetracycline	>=16.0	R
Amikacin	>=64.0	R
Trimethoprim/ Sulfamethoxazole	>=320.0	R
Tobramycin	>=16.0	R

I: Intermediate, MIC: Minimum inhibitory concentration, R: Resistant, S: susceptible

The demographic data, underlying diseases, hospitalization periods, and antibiotic treatment of all patients who had myroides spp reproduction in their urine culture were recorded.

## RESULTS

Nine *Myroides* spp. isolates were detected in urine samples for a total of 3 months. Pyuria accompanied 7 of the nine isolates. 2 isolates were considered as colonization. The patients' demographic data and clinical characteristics are shown in Table 2. Six (86%) patients were male, and one (14%) was female. The mean age of the patients was 77 years (age range 69-83). All patients had 4 to 6 comorbidities.

The mean hospitalization period of the patients was 80 days (min-max 29-139 days), the average hospitalization period before isolation was 48 days (min-max 13-97 days). All patients used up to 1 to 4 antibiotics before bacterial isolation was made (Table 2).

All patients had normal complete urine analysis findings upon hospitalization. For all patients, a Foley catheter was used for urinary catheterization. All cases had hospital-acquired urinary tract infections. For *Myroides* spp. known to have multi-drug resistance, response to the combined treatment of ciprofloxacin and rifampicin was achieved in 5 out of 7 patients. Treatment was not initiated for two patients who were considered as having bacterial colonization.

## DISCUSSION

*Myroides* spp. are low-grade opportunistic pathogens that are not found in normal human microflora but are mostly present in the environment. *Myroides* spp. have been reported as the cause of opportunistic infections in severely immunosuppressed patients [1,4-6]. It was described rarely in immunocompetent patients [2,7]

As per our literature information, three outbreaks caused by *Myroides* spp. have been reported so far (Table 2). Our study is the fourth outbreak. In the first outbreak reported by Yağcı et al., 9 of the cases had urinary stones, and 4 had urinary neoplasms [8]. In the second outbreak reported by Ktari et al., 6 of the 7 cases with urinary tract infection caused by *M. odoratimimus* had urinary calculus, and one patient had bladder cancer. [9] Besides, the cases had

a long-term hospitalization and a history of endourological intervention in all except for one case. Licker et al. reported that all patients had a permanent urinary catheter in the UTI outbreak due to *m. odoratimimus* (Table 3). [10] All except one of their patients required long-term hospitalization. [10] As well as the underlying comorbidities, we think that prolonged urinary catheterization will pose a severe risk due to the morbidities caused by this bacterium.

Diabetes mellitus affects the immune system, leads to development of infections, and most importantly, predisposes to opportunistic pathogens. Therefore, one of the significant risk factors of *Myroides* spp. in UTI is diabetes mellitus (DM). However, only a limited number of UTI cases due to *Myroides* spp. in diabetic patients have been reported. As far as we know, 7 cases have been reported in the literature so far. All of our patients had DM for a long time, and their HbA1C levels were high, which led us to think that the uncontrolled diabetes of our patients was a serious risk factor for these infections.

However, nonfermenting gram-negative bacilli (NFGNB) can be easily identified at the species level by using the automatic identification system such as VITEK 2 Compact and MALDI-TOF today. It was noted that with these systems, NFGNB is increasingly isolated in major cases of bacteriuria. [11,12] We used the MALDI-TOF identification system in our cases.

It was reported that *Myroides* spp. mostly have multi-drug resistance properties and pan-resistance properties in some cases. However, the antibiotic resistance mechanism of *Myroides* spp. has not been fully explained. The treatment of infections caused by *Myroides* spp. is also of great importance because of its potential to cause serious nosocomial infections and its multi-drug resistance. Mammari et al. reported an intrinsic resistance to B lactams in *M. odoratus* and *M. odoratimimus*, due to chromosome-encoded B lactamases (MUS-1 and TUS-1). [12]

Many strains have been recognized as resistant to beta-lactams, monobactams, and carbapenems, while variable sensitivity to aminoglycosides, quinolones and trimethoprim/sulfamethoxazole has been demonstrated. [2,7,9]

**Table 2. Clinical characteristics and treatment of the seven cases of UTIs due to Myroides species**

Case No, Gender/ Age (years)	Department admitted to	Admission date	Sample Collection date	Days of hospitalization	Comorbidities	HbA1c	Prior antibiotic treatment	Type of infection	Treatment for Myroides UTIs	Outcome
C1 M/77	Intensive care,	.07.22.2019	09.02. 2019	97 days	HT, DM, AF,CHF, Aspiration Pneumonia,, AVR, CVD	6,9	teicoplanin, Meropenem	UTI	Rifampicin+ ciprofloxacin	Failure
C2 M/81	Intensive care,	08.20. 2019 09.17..2019	09.02. 2019	83 days	DM, BPH Parkinson's Disease, Chronic Subdural Hematoma Aspiration Pneumonia	7,2	Meropenem cmlistin	UTI	No treatment	Cured
C3 M/76	Intensive care,	08.26 .2019 10.02. 2019	09.07. 2019	56 days	DM, CAD, Hypoxic Ischemic Encephalopathy	6,8	Teicoplanin, Meropenem	UTI	No treatment	Cured
C4 M/83	Intensive care,	07.24. 2019	09..10. 2019	64 days	CVD, ARF Pneumonia	7,8	Meropenem	UTI	Rifampicin+ ciprofloxacin	Failure
C5 F/83	Intensive care,	07.24. 2019	1- 10.07. 2019 2- 11.18. 2019	139 days	HT, DM, Epilepsy Intracranial mass	5,9	1-Meropenem 2-Meropenem, Amikacin	UTI	Rifampicin+ ciprofloxacin	Cured
C6 M/69	Intensive care,	07.24. 2019 12.02. 2019	28.10.2019	132 days	CVD, Monier Chon sendromu, Aspiration Pneumonia	6,1	Imipenem, sulfamethoxazole and trimethoprim colistin tigecycline	UTI	Rifampicin+ ciprofloxacin	Cured
C7 M/73	Intensive care,	10.15. 2019	1-11.26. 2019 2-12.02. 2019	70 days	DM,HT ,CAD,ABY, Ludwig's Angin	7,1	1-Linezolid, sulfamethoxazole and trimethoprim, colistin	UTI	Rifampicin+ ciprofloxacin	Cured

HT:Hypertension; DM:Diabetes mellitus; AF:Atrial fibrillation; CHF:Congestive Heart Failure; AVR:AorticVvalve Replacement; CVH:cerebrovascular disease; BPH:Benign Prostatic Hyperplasia ;CAD: Coronary Artery Disease; ARD: Acute Renal Failure

**Table 3. Comparison of outbreaks reported so far**

Study	Number of Cases	Age (Year/Gender)	Underlying Conditions of Infections	Infection	Culture	Treatment	Outcome
Yağcı et al. 2000	13	Not reported	Urinary neoplasm (4 patients) and urinary stones (9 patients)	pyuria	Urine	Not reported	Not reported
Ktari et al. 2012	7	Range 44-80/ all M	6 patients with urinary calculi, 1 patient with bladder cancer	Group A: Urinary tract infection Group B: Bladder colonization Group C: Urinary tract infection	Urine	3 patients were successfully treated with ciprofloxacin (Group A) 3 patients without treatment (Group B) 1 patient was treated with imipenem+ colistin (Group C)	Group A: Cured Group B: Favourable Group C: Failure
Licker at al	4	Range 36-72/3M,1F	3 patients with urethro-vesical catheterization 1 patient with bilateral cutaneous ureterostomy	Group A: Urinary tract infection Group B: Urinary tract infection Group B: Bladder colonization	Urine	1 patient was treated with imipenem+ colistin+ amikacin (Group A) 2 patients were successfully treated with Tigecycline (Group B) 1 patients without treatment (Group C)	Group A: Cured Group B: Good clinical response Group C: Favourable

In the case series reported by Ktari et al. three patients with UTI caused by *Myroides* spp. were given ciprofloxacin and rifampicin combination treatment, and treatment response was achieved.<sup>[9]</sup> Our patients had resistance to all laboratory tested antibiotics. In 5 of our patients, we changed Foley catheters and started ciprofloxacin and rifampicin combination treatment empirically, and we achieved treatment response. Therefore, we think that ciprofloxacin and rifampicin combination may be an appropriate and effective combination for the treatment of infections caused by *Myroides* spp..

During the period when *Myroides* sp.p isolates were

detected, it was determined that new personnel (nurse, patient care staff) started to work in our intensive care unit. When the anamnesis of these employees was examined, it was found that they did not have intensive care experience and their working experience in the health sector was inadequate. Periodic training was given to these employees about hand washing, urinary catheter care, and patient care. No *Myroides* spp reproduction was detected in the following months. Our most important limitation of this study was that environmental cultures had not been taken. Another limitation was also the inability to perform statistics due to the small size of the patient group.

## CONCLUSION

In this study, we wanted to show that *Myroides* spp., which is difficult to treat due to multi-drug resistance, can cause an outbreak of nosocomial urinary tract infection with long-term urinary catheterization in intensive care patients with uncontrolled DM, even if there is no urinary system pathology and to emphasize the importance of staff training and increasing compliance with infection control measures in outbreak control.

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