

## Original Research Article

## Involvement of *Serratia marcescens* along with *Citrobacter freundii* in causing septic arthritis

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### ABSTRACT

Involvement of *Serratia marcescens* and *Citrobacter freundii* in causing septic arthritis is extremely rare. Here, we report a case of septic arthritis of knee joint following a recent arthroplasty, due to dual infection by *Serratia marcescens* and *Citrobacter freundii* in a diabetic patient. The patient had recent history of undergoing knee arthroplasty for functional and structural restoration of the knee joint injured due to saw injury. *Serratia marcescens* and *Citrobacter freundii* are known as common hospital acquired pathogens but septic arthritis due to these organisms is very rare even in health care settings.

Keywords: *S. Marcescens*, *C.Freundii*, arthritis, co-infection.

### Background:

*Serratia marcescens* is a Gram negative bacillus belonging to the family enterobacteriaceae. It is normal flora of soil and water, and is generally found as a contaminant in ventilation equipments, tracheotomy tubes, peritoneal dialysis fluids, and indwelling catheters [1]. The first case of *S. marcescens* infection was reported in 1951 [2]. Since then, *S. marcescens* has been found to be responsible for many hospital-acquired infections, particularly urinary tract infections, septicemia, meningitis and wound infections. The immunocompromised patients or those with pre-damaged skin are at high risk of infection by this organism [3]. However, *S. marcescens* infections affecting bones and joints are very rare [4].

Septic arthritis can occur following operative procedures including joint arthroplasty and arthroscopy [5]. *Citrobacter freundii* is also a Gram negative Bacillus belonging to the family enterobacteriaceae [6]. *C. freundii* is an opportunistic pathogen responsible for a number of significant infections. It is a well-known cause of nosocomial infections like infections of the respiratory tract, urinary tract, blood, and many other normally sterile sites [7]; but its involvement in causing septic arthritis is very rare [8].

Here, we describe a rare case of septic arthritis due to mixed infection by *S. marcescens* and *C. freundii* following a recent arthroplasty for functional and structural restoration of the knee joint injured due to saw

injury. This is the first case of septic arthritis caused by *S. marcescens* and *C. freundii* reported from Nepal.

### CASE PRESENTATION

A 46-year-old male diabetic patient (diabetes mellitus type 2) was brought to the casualty department of a tertiary care hospital in Kathmandu, Nepal in February 2015 with history of saw injury to knee during wood cutting. The patient had normal C - reactive protein (CRP), normal total and differential leukocyte counts, but higher random glucose level (300 mg/dl). The patient was given diabetic medication. The arthroplasty was performed to restore the structure and function of the knee by using orthopedic implants. The patient was given amoxicillin+clavulanic acid (500 mg twice a day) as prophylaxis and discharged after one week. Around one week later, the patient again attended the hospital with chief complain of swollen knee joint with pain and redness. The patient had high CRP (15mg/dl), leukocytosis (12000/mm<sup>3</sup>) with significant

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neutrophilia (76%). Body temperature was normal (36.7°C). The fluid was aspirated aseptically from the joint.

In Gram stain, there were plenty of pus cells with a few Gram negative bacilli. The total count of the fluid was 9600/mm<sup>3</sup> with 92 % neutrophils, 5% eosinophils and 3% lymphocytes. The blood culture, urine culture and sputum culture were found to be normal and the source of infection was believed to be inoculation through traumatized joint. The patient underwent an emergent arthroscopic washout followed by empirical treatment with intravenous ciprofloxacin (400 mg thrice a day).

The fluid was cultured in Blood Agar (BA) and MacConkey Agar (MA). After overnight incubation at 37°C, two types of colonies were grown (Figure 1). One type of colony was circular, convex with red pigmentation, Gram staining of which revealed the presence of Gram negative bacilli. Based on the colony morphology and biochemical characteristics (Table 1) shown, the organism was identified as *S. marcescens* and another type of colony was non pigmented, circular and convex. In Gram stain, it was also Gram negative bacillus. On the basis of the colony morphology and biochemical characteristics (Table 2) shown, the organism was identified as *C. freundii*.

**Biochemical Properties Results Biochemical Properties Results**

Catalase	+	Catalase	+
Motility	+	Motility	+
Oxidase	-	Oxidase	-
Citrate	+	Citrate	+
Nitrate reductase	+	Nitrate reductase	+
Urease Saccharolytic	-	Urease H <sub>2</sub> S	-
DNase	+	ONPG	+
Gelatinase	+	Indole	+
Indole H <sub>2</sub> S	+	Lactose,	-
Lactose,	-	Malonate &	-
Raffinose	-	adonitol	
Arabinose	-	fermentation	
<b>Table 1: Biochemical characteristics of <i>S. marcescens</i></b>		<b>Table 2: Biochemical characteristics of <i>C. freundii</i></b>	

The antimicrobial susceptibility testing was performed for both the organisms by Kirby-Bauer disc diffusion technique by using Mueller Hinton Agar (MHA). The *S. marcescens* was found to be susceptible toward tigecycline (15mcg), gentamicin (10mcg), ciprofloxacin (5mcg), cefixime (5mcg), cefepime (30mcg), imipenem

(10mcg), chloramphenicol (30mcg), erythromycin (15mcg) and resistant toward cefazoline (30mcg), and amoxicillin+clavulanic acid (20/10mcg). Similarly *C. freundii* was susceptible toward tigecycline (15mcg), gentamicin (10mcg), ciprofloxacin (5mcg), cefixime (5mcg), cefepime (30mcg), imipenem (10mcg), chloramphenicol (30mcg) and resistant toward cefazoline (30mcg), erythromycin (15mcg), and amoxicillin+clavulanic acid (20/10mcg). Since the organisms were found to be susceptible toward ciprofloxacin; when the patient improved clinically after getting treatment with intravenous antibiotic for one week, he was discharged with a further six weeks course of oral ciprofloxacin (750 mg twice a day). On his 6 weeks follow up, the patient was improving significantly with no signs of any systemic or localized infection and the complete recovery with absence of infection was ensured by normal CRP level (4mg/dl) along with the return of normal function of the joint.



Figure 1: Mixed growth of *S. marcescens* (red colored colony) and *C. freundii* (white colored colony) on MacConkey agar after overnight aerobic incubation at 37° C.

**DISCUSSION**

We report a rare event of septic arthritis caused due to dual infection by *S. marcescens* and *C. freundii* following arthroplasty for functional and structural restoration of the knee joint injured due to saw injury. The *S. marcescens* was identified with the help of the biochemical properties shown by it, as presented in table 1, along with the red pigmentation shown by the bacteria (in MHA and MA). And, *C. freundii* was identified with the help of the biochemical properties shown by it, as in table 2.

Major joint infections with *S. marcescens* are rare. They have been sporadically reported, in the world literature [9]. As far as we are aware, no cases of postoperative *S. marcescens* joint infection have been reported from Nepal. *S. marcescens* is an opportunistic Gram-negative *Bacillus* [10]. It is a common pathogen isolated in health-care associated infections of the respiratory and urinary tracts [1]. However, community-acquired infections may also occur in patients with risk factors such as trauma, renal failure, diabetes, and chronic leg ulceration [11]. In our case, the patient was diabetic and had saw injury. *S. marcescens* is considered intrinsically resistant to cephalosporins [5]. In this case, also the *S. marcescens* was found to be resistant toward cefazoline and according to the culture and AST report, the patient was treated with ciprofloxacin. The antibiotic of choice for *S. marcescens* infection is amikacin, meropenem and ciprofloxacin [12, 13]. The majority of cases of septic arthritis are caused by haematogenous spread, direct inoculation or local extension [5]. In our case, the septic arthritis may have been caused due to direct inoculation of the bacteria through traumatized joint. Involvement of *C. freundii* in causing septic arthritis has been reported in a previously healthy five-year-old boy as coinfection with *Haemophilus influenzae* type b. And it was concluded that when *Citrobacter spp.* is isolated, coinfection with other bacterial pathogens should be considered [14]. In our case, also *C. freundii* along with *S. marcescens* were found to be responsible for causing septic arthritis. Another case of septic arthritis by *C. freundii* has been reported by Bruehl and Listernick in an eight-month-old infant [8]. Except from these two pediatric cases in which the *C. freundii* was involved in causing septic arthritis, we could not find any literature describing *C. freundii* as causative agent of septic arthritis in adults. Common organisms implicated in septic arthritis include *Staphylococcus aureus*, *Haemophilus influenzae* and *Neisseria gonorrhoeae* [5]. Septic arthritis is considered as a medical emergency. If left untreated, it may destroy the joint in a period of days. The infection may also spread to other parts of the body. Early diagnosis and proper treatment is very necessary to avoid the complications and the fatal outcome. In our case, the patient got well without any complications due to early diagnosis and proper antimicrobial therapy as suggested by the fluid culture and sensitivity report.

## CONCLUSION

*S. marcescens* and *C. freundii* were isolated from a case of septic arthritis. The patient was treated with ciprofloxacin as suggested by culture and sensitivity report. *S. marcescens* being the normal flora of soil and water, it is considered as saprophytic organism and may be disregarded as possible contaminant, even if it is grown in the clinical samples. Septic arthritis is a medical emergency and treatment should be started promptly to avoid any possible complications.

## LIST OF ABBREVIATIONS USED

MA-MacConkey Agar, BA-Blood Agar, MHA-Mueller Hinton Agar, SIM- Sulfide Indole Motility medium, TSITriple Sugar Iron Agar, ONPG- Ortho-NitroPhenylGalactopyranoside, CRP- C-Reactive Protein

## STATEMENT REGARDING PATIENT CONSENT

Written informed consent was obtained from the patient for publication of this case report.

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