

## Two Cases of *Chromobacterium violaceum* Infection after Injury in a Subtropical Region

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***Chromobacterium violaceum* is a gram-negative rod and is isolated from soil and water in tropical and subtropical regions. The species have pigmented and nonpigmented colony types. Infections caused by nonpigmented strains are rare. We report on two cases of infection caused by both pigmented and nonpigmented strains of *C. violaceum*. Two 24-year-old Korea Airline stewardesses were admitted to Inha University Hospital, Incheon, South Korea, on 9 August 1997, 3 days after an airplane accident in Guam. Both had multiple lacerations on exposed parts of their bodies. There was swelling, tenderness, and pus discharge. The wounds contained many small fragments of stones and weeds. A pigmented strain was isolated from the left hand and a nonpigmented strain was isolated from the left knee of one patient. For the other patient only a nonpigmented strain was isolated from a foot wound. The nonpigmented colonies from the left-knee and the left-foot wounds did not produce any pigment even after an extended period of incubation. The biochemical characteristics were the same for each strain except for oxidase and indole reactions. The pigmented strain was oxidase negative and indole positive, whereas the nonpigmented strains were oxidase positive and indole negative. The patients were successfully treated by debridement and with appropriate antibiotics.**

*Chromobacterium violaceum* is a gram-negative rod which is found in the soil and water of tropical and subtropical areas (8–10, 15, 18). Both pigmented and nonpigmented strains exist, although the nonpigmented strains are rare. Although infections caused by *C. violaceum* are rare among mammals, Woley et al. reported on a case of *C. violaceum* infection in buffaloes in 1905 (11), and the first human infection caused by the organism was reported in Malaysia in 1927 (17).

We recently had an opportunity to see two patients with *C. violaceum* infections. One patient was infected with both pigmented and nonpigmented strains, and the other patient was infected with only a nonpigmented strain. These are the first two cases of *C. violaceum* infection reported in Korea. Two 24-year-old Korean Airline stewardesses who received multiple lacerations and abrasions at the time of a jetliner crash were transferred from Guam to Inha University Hospital in Incheon, South Korea, 3 days after the accident. They received emergency treatment while at a hospital in Guam. At the time of admission to our hospital the laboratory results for both patients were not remarkable. The colonies that grew from a sample from the left-hand wound from patient 1 were deep purple, round, and slightly raised on blood agar and MacConkey agar plates. A sample taken from the left-knee wound from the same patient was cultured and grew nonpigmented colonies on both blood agar and MacConkey agar plates, showing beta-hemolysis on the blood agar plate. Both showed gram-negative rods on Gram-stained smears. A bacterial culture of a sample taken from the left-foot wound of patient 2 grew beta-hemolytic, colorless colonies on a blood agar plate and colorless colonies on a MacConkey agar plate in 10 days. All of these isolates were identified as *C. violaceum* by

conventional biochemical reactions (with published reactions [21]) and with the API 20 NE system (Table 1). Antibiotic susceptibility tests were performed by the disk diffusion method, and these results are presented in Table 2. Empiric treatment with cefpiramide and pefloxacin was started before identification and susceptibility testing of the isolates. Antimicrobial susceptibility testing showed that all of the isolates were susceptible to ciprofloxacin; therefore, we considered that they should be susceptible to pefloxacin as well. One of the isolates was resistant to cefotaxime, but the empirically selected regimen was continued for 10 days because the wound was showing signs of healing. Later, the wounds were closed surgically. The patients improved after 10 days of treatments, with complete healing.

Although the infectivity of *C. violaceum* is low, there have been reports of human infections resulting in septicemia and skin, pulmonary, and liver abscesses in Vietnam, Taiwan, Malaysia, the United States, Australia, and Senegal, among other places (2, 4, 7, 12, 13, 19, 20). In the majority of patients with *C. violaceum* infection, the skin is the port of entry for organisms found in contaminated soil and water. It is even possible to be infected via the oral route (14). *C. violaceum* can be an opportunistic pathogen and may cause diseases in immunocompromised individuals. The case fatality rate may be as high as 57%, according to a report from the United States. Macher et al. (11) reported on 12 cases of *C. violaceum* infection in patients with chronic granulomatous disease, and 7 of these patients died between 7 days and 15 months after initial infection. Because the culture of a specimen from the left hand of the first patient grew pigmented *C. violaceum* along with *Serratia marcescens*, the pathogenic role of *C. violaceum* in this infection is not clear. However, the only organism isolated from the lesions of the left knee of patient 1 and the left foot of patient 2 was nonpigmented *C. violaceum*, suggesting that *C. violaceum* was the causative agent of these infections. About 9% of *C. violaceum* strains are reported to be nonpigmented.

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TABLE 1. Growth and biochemical characteristics of *Chromobacterium violaceum* isolates<sup>a</sup>

Test	% of isolates positive <sup>b</sup>	Reaction of isolates		
		Patient 1		Patient 2, left foot
		Left knee	Left hand	
Gas from glucose	0	-	-	-
Violet pigmentation	91	-	+	-
Acid from:				
D-Glucose	100	+	+	+
D-Mannitol	0	-	-	-
D-Xylose	0	-	-	-
Lactose	0	-	-	-
Maltose	0	-	-	-
Sucrose	20	-	-	-
Catalase reaction	97	+	+	+
Oxidase reaction	67	+	-	+
Growth on:				
MacConkey agar	100	+	+	+
Salmonella-shigella agar	71	+	+	+
Simmons citrate reaction	68	+	+	+
Urea hydrolysis	5	-	-	-
Nitrate reduction	97	+	+	+
Indole production	21	-	+	-
Triple sugar iron slant, acid	8	-	-	-
Triple sugar iron butt, acid	94	+	+	+
H <sub>2</sub> S production	0	-	-	-
Methyl red reaction	37	-	-	-
Voges-Proskauer reaction	0	-	-	-
Gelatin hydrolysis	86	-	-	-
Growth at:				
25°C	100	+	+	+
42°C	85	-	-	-
Esculin hydrolysis	5	-	-	-
Lysine decarboxylase	0	-	-	-
Arginine dihydrolase	100	+	+	+
Ornithine decarboxylase	0	-	-	-
Growth in nutrient broth:				
0% NaCl	100	+	+	+
6% NaCl	0	-	-	-
API 20 NE no.		5150555	4150555	5150555

<sup>a</sup> On Gram staining all isolates were gram-negative rods, and all isolates were fermentative.

<sup>b</sup> Data are from Weyant et al. (21).

Although there has been debate regarding the pathogenicities of nonpigmented strains, it has been shown that in rats the infectivities of both pigmented and nonpigmented strains of *C. violaceum* are comparable (16).

Samples from our patients grew both pigmented and nonpigmented strains of *C. violaceum*. The pigmented strain developed a faint violet color after 1 day of incubation on a blood agar plate, and the color became deeper in subsequent days. The nonpigmented strain did not develop pigment even after a

TABLE 2. Antibiotic susceptibilities of *Chromobacterium violaceum* isolates

Antimicrobial agent	Susceptibility of isolates <sup>a</sup>		
	Patient 1		Patient 2, left foot
	Left knee	Left hand	
Ampicillin-sulbactam	R	R	S
Piperacillin	S	S	S
Ticarcillin-clavulanic acid	S	S	S
Cephalothin	R	R	R
Cefotaxime	S	R	S
Ceftazidime	S	S	S
Cefoperazone-sulbactam	S	S	S
Cefotetan	S	S	S
Aztreonam	S	S	S
Imipenem	S	S	S
Amikacin	R	S	S
Gentamicin	S	S	S
Isepamicin	R	S	R
Netilmicin	S	S	S
Tobramycin	I	S	S
Ciprofloxacin	S	S	S

<sup>a</sup> R, resistant; S, susceptible; I, intermediate.

week of incubation. Most *C. violaceum* isolates produce oxidase and catalase but are negative for Voges-Proskauer reaction and esculin. At times it may be difficult to perform the oxidase test due to pigmentation. Therefore, we used both fresh aerobically grown colonies with mild pigmentation and anaerobically grown colonies without pigmentation when we performed the oxidase test, as recommended by Silvendra et al. (15). About 21% of *C. violaceum* isolates are reported to be indole positive (3, 5, 15). In contrast to previously reported findings that most nonpigmented strains of *C. violaceum* are indole positive, our pigmented strain was indole positive and our nonpigmented strains were indole negative.

Oxidase-negative nonpigmented strains of *C. violaceum* may be difficult to differentiate from *Haemophilus aphrophilus* or *Pasteurella*. However, the *C. violaceum* isolates were differentiated by their ability to grow on a salmonella-shigella agar plate and by their arginine dihydrolase activity.

Oxidase-positive, nonpigmented strains may be confused with *Vibrio* or *Aeromonas* (11, 15). These may be differentiated by their ability to grow in a nutrient broth with 0% NaCl, their fermentation of D-glucose, mannitol, and maltose, and their lysine decarboxylase and ornithine decarboxylase activities.

*C. violaceum* is usually susceptible to aminoglycosides, chloramphenicol, and tetracycline but is resistant to penicillins and cephalosporins (1, 6, 15). Some *C. violaceum* strains have been reported to be resistant to the broad-spectrum cephalosporins (1). At their last visits, 6 months after the accident, both patients were free of infection.

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