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Capnocytophaga ochracea Septicemia

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A case report describing *Capnocytophaga ochracea* (*Bacteroides ochraceus*) septicemia in a 21-year-old male patient receiving chemotherapy for acute lymphocytic leukemia is presented. The unusual features of this organism are discussed together with a review of the literature.

Capnocytophaga ochracea (*Bacteroides ochraceus*) is a gram-negative, nonsporeforming capnophilic rod that produces yellow-orange pigmentation and is a part of the normal oral flora in healthy individuals (5). Recently, Forlenza et al. (1) described this organism as a cause of bacteremia in immunocompromised hosts. In this report, we describe the presence of *C. ochracea* septicemia in a patient with acute myelogenous leukemia.

CASE REPORT

A 21-year-old black male was referred to our hospital with a history of anemia, fever of unknown etiology, and lymphadenopathy characterized by enlarged cervical, axillary, and inguinal lymph nodes. A complete blood count performed at admission revealed a leukocyte count of 3,100/mm^3, a hematocrit of 24%, hemoglobin of 7.7 g/dl, and a platelet count of 15,000/mm^3. Examination of a peripheral blood smear revealed a predominance of blast forms. The diagnosis of acute myelogenous leukemia was made subsequently by bone marrow biopsy, and the patient was given chemotherapy which included vincristine, prednisone, cytosine arabinoside, and 6-thioguanine. The patient's disease proved refractory to four separate courses of this treatment during his prolonged hospital stay. Throughout his admission, the patient experienced several febrile episodes which were not found to be of an infectious etiology. At no time during his prolonged hospital course did his leukocyte count exceed 3,500/mm^3.

A blood culture taken on day 71 of the patient's hospital stay yielded a strain of *Escherichia coli* that was resistant to ampicillin, carbenicillin, and tetracycline, but susceptible to cephalothin, gentamicin, and tobramycin. The patient was treated with cefazolin and tobramycin, and blood cultures taken on days 73 and 74 were negative. The patient remained febrile despite antibiotic therapy. Two blood cultures were obtained from the patient on day 77 of hospitalization. On this day it was also noted that the patient's oral hygiene, which had been poor at admission, had deteriorated, and his gums were bleeding. A rectal abscess cultured on day 75 contained a mixture of aerobic, facultative, and anaerobic organisms (*E. coli*, diphtheroids, *Streptococcus faecalis*, *Eubacterium lentum*, and *Peptococcus* sp.) and was considered to be a possible source of the patient's fever. These culture results led to the addition of chloramphenicol to the patient's antibiotic treatment regimen on day 80. On day 85, the laboratory reported the recovery of an unusual yellow-orange, gram-negative rod which was only detected by seventh-day "blind" subculture of the blood cultures collected on day 77.

The patient became afebrile on hospital day 90, and all antibiotics were discontinued 2 days later. The patient was discharged on hospital day 100. The two blood cultures taken on day 77 grew a gram-negative rod identified in our laboratory as *C. ochracea* (*B. ochraceus*).

MATERIALS AND METHODS

Blood specimens were collected and subcultured by methods previously described (4). Each blood specimen was thoroughly mixed and divided equally among four 50-ml blood culture bottles. Two of these contained 50 ml of Columbia broth modified by the addition of L-cysteine to a final concentration of 0.05%. The remaining two bottles also contained the modified medium supplemented with sucrose to a final concentration of 10%. One isotonic and one hypertonic bottle were vented after addition of the blood specimen. All four culture bottles were incubated at 35°C for a period of 7 days.

Biochemical tests employed to characterize our strain of *C. ochracea* were those offered by the Minitek system (BBL Microbiology Systems, Cockeysville, Md.) using the anaerobe inoculation broth. Minitek tests were inoculated in accordance with the manufacturer's recommendation and were incubated at 37°C in a glove box (Coy Manufacturing, Ann Arbor, Mich.) with an atmosphere of 85% N_2, 10% CO_2, and 5% H_2. Gas chromatographic analysis of fermentation products produced by the organism in peptone-yeast-glucose broth after 48 h of anaerobic incubation were conducted by methods previously described (2). Other biochemical and physiological tests were those described previously in the Virginia Polytechnic Institute *Anaerobe Laboratory Manual* (2). The susceptibility

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of the bacterium to antimicrobial agents was determined by the microtiter broth dilution method of Thornsberry and Swenson (9).

RESULTS AND DISCUSSION

The organism recovered from our patient's blood cultures was detected by a subculture of culture bottles after 7 days of incubation and not by macroscopic evidence of growth. The bacterium grew on sheep blood agar (BBL) when incubated at 35°C in either an anaerobic environment or a capneic (5% CO_2) atmosphere. Colonies that developed on sheep blood agar were flat and exhibited a spreading border and a yellow-orange pigment. Gram stains of the colonies revealed the organism to be a thin, nonsporeforming, gram-negative rod. The bacterium produced acetic and succinic acids in peptone-yeast-glucose broth and demonstrated the biochemical reactions shown in Table 1. Included as references in Table 1 are characteristics previously reported for *Capnocytophaga* sp. by Socransky et al. (8). Our isolate hydrolyzed esculin and starch and fermented glucose, lactose, maltose, sucrose, and trehalose. The organism was catalase and oxidase negative and failed to produce indole, to reduce nitrates, and to ferment arabinose, glycerol, mannitol, and salicin. These results agreed well with characteristics described previously by Socransky et al. (8).

TABLE 1. *Biochemical characteristics of C. ochracea*

Biochemical test	Current isolate	*C. ochracea*[a] (27)	*C. sputigena*[a] (6)	*C. gingivalis*[a] (25)
Catalase	−	0	0	0
Oxidase	−	0	0	0
Esculin hydrolysis	+	96	83	75
Indole	−	0	0	0
Nitrate reduction	−	8	83	4
Fermentation of:				
Arabinose	−	4	0	0
Glucose	+	100	100	100
Glycerol	−	NT	NT	NT
Lactose	+	92	40	8
Maltose	+	100	100	100
Mannitol	−	0	0	0
Salicin	−	11	0	0
Sucrose	+	100	100	100
Trehalose	+	9	0	0
Starch hydrolysis	+	77	0	0
Urease	−	14	0	12

[a] Data reported by Socransky et al. (8). Numbers within parentheses indicate the number of strains. Results are expressed as percentage of positive strains. NT, Not tested.

Minimal inhibitory concentrations determined for our isolate were (in micrograms per milliliter): penicillin, 2.0; carbenicillin, 1.0; cephalothin, 2.0; erythromycin, 0.12; clindamycin, 0.12; chloramphenicol, 2.0; and tetracycline, 8.0.

Leadbetter and co-workers (3) proposed that the genus and species designation *C. ochracea* be used in place of *B. ochraceus* because the organism requires increased carbon dioxide tension for growth (capnophilic) and exhibits gliding motility as do members of the genus *Cytophaga*. Thus the genus designation *Capnocytophaga* describes the unique characteristics of the organism which are not shared by members of the genus *Bacteroides*.

The new genus is distinct from other genera of gliding bacteria (*Cytophaga* and *Flexibacter*) in that *Capnocytophaga* is catalase and oxidase negative, strictly fermentative, requires carbon dioxide, and fails to produce lactic, propionic, and butyric acids as products of fermentation (3, 8). Three species of the new genus have been proposed: *C. ochracea, C. gingivalis,* and *C. sputigena*. Williams and co-workers (11) have recently reported that seven of the eight strains identified as Center for Disease Control group DF-1 (10) exhibited a high degree of deoxyribonucleic acid relatedness with *C. ochracea*, as did four isolates previously identified as *B. ochraceus*. Identical conclusions were obtained in a collaborative study of 21 isolates initially characterized as DF-1, *B. ochraceus,* or *Capnocytophaga* sp. (6). This collaborative study, like that of Williams and colleagues, found a high degree of deoxyribonucleic acid relatedness among the organisms studied and concluded that the genus *Capnocytophaga* was an appropriate designation for the organism.

The spreading colonial morphology observed by us was noted by Leadbetter and co-workers to depend on the medium employed (3). These investigators observed the spreading morphology on sheep blood agar manufactured by BBL, but not on that produced by other manufacturers. We also employed the medium manufactured by BBL. Further investigation by Leadbetter and colleagues revealed that the spreading morphology occurred on media that contained at least 2% agar, but not on media with lower agar content (3).

C. ochracea and other members of the genus are found in the gingival sulci of humans and are also found in periodontal pockets in patients suffering from periodontal disease (5). The relative quantity and predominance of *Capnocy-*

tophaga spp. has been reported to be increased in patients with advanced forms of periodontal disease (5).

Aside from our report, there are only four other reports which document the recovery of *C. ochracea* in blood cultures. No clinical history is available for two patients whose blood cultures yielded *Capnocytophaga* strains included in the taxonomic study of Williams and co-workers (11). Six other clinical isolates cited in the study of Newman and co-workers (6) also lack clinical description of the patients involved. Shurin and co-workers (7) described the alteration of polymorphonuclear leukocyte function and morphology in two patients with dental disease associated with *Capnocytophaga* spp. One of these patients had multiple myeloma and evidence of destructive dental disease, and *C. ochracea* was recovered from blood cultures obtained 3 days apart.

Forlenza and colleagues have described six patients who experienced 10 episodes of sepsis caused by *Capnocytophaga* sp. (1). Five of the six patients were less than 16 years of age. The five children had either myeloblastic leukemia or acute lymphocytic leukemia, whereas the single adult patient had adenocarcinoma. Each of the patients was granulocytopenic, and 7 of the 10 episodes occurred while the patient was receiving antimicrobial therapy. All patients had ulcerations of their oral mucosa, and 8 of the 10 had bleeding gums. The patient that we describe is similar to the six patients described by Forlenza et al. (1) in that he was severely leukopenic, had bleeding gums, and developed septicemia while he was receiving antimicrobial therapy.

Clinical microbiologists should be aware of *Capnocytophaga* sp. and its unusual cultural and biochemical characteristics. Its association with septicemia in the leukopenic patient and its role in periodontal disease require further study.

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