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Original Article

Chryseobacterium meningosepticum infection: antibiotic susceptibility and risk factors for mortality

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Background and Purpose: A limited range of antibiotic classes are available for treatment of *Chryseobacterium meningosepticum* infections. Although the role of *C. meningosepticum* in newborn infections and immunocompromised hosts has been recognized, clinical data detailing these infections remain limited. This retrospective study investigated the risk factors for mortality in patients with *C. meningosepticum* infections and the antibiotic susceptibility of clinical isolates.

Methods: Information on demographic characteristics, clinical parameters, antibiotic treatment, and outcomes was collected. Statistical significance of potential prognostic parameters was analyzed by Fisher's exact test. The antimicrobial susceptibility of 19 isolates to seven antibiotics was determined, and susceptibility results were presented as minimal inhibitory concentration (MIC) range, MIC at which 50% of isolates were inhibited (MIC_{50}), and MIC at which 90% of isolates were inhibited (MIC_{90}).

Results: Hypoalbuminemia (<2.5 g/dL) [p=0.02] and increased pulse rate (p=0.008) at the onset of infection, and presence of an indwelling central venous line (p=0.04) were associated with poor outcomes. Use of appropriate antibiotics was not significantly associated with the clinical outcome (p=0.21). MIC values of levofloxacin (MIC_{50}/MIC_{90}, 0.12/2 μg/mL) were lower than those of ciprofloxacin (0.5/4 μg/mL).

Conclusion: Hypoalbuminemia, increased pulse rate at the onset of infection and presence of central venous line infection were associated with a poor outcome in patients with *C. meningosepticum*.

Key words: Antimicrobial susceptibility tests; *Chryseobacterium*; Mortality; Risk factors

Introduction

Chryseobacterium spp. are inhabitants of soil and water, including municipal water supplies despite adequate chlorination. The organisms have been recovered from the hospital environment, and are opportunist human pathogens, causing occasional nosocomial outbreaks. *Chyseobacterium meningosepticum* and *Chryseobacterium indologenes* are two species commonly isolated from clinical specimens. The former, a Gram-negative, oxidase-positive and catalase-positive bacillus, previously named as *Flavobacterium meningosepticum* is an uncommon pathogen causing nosocomial pneumonia and meningitis in newborns.

Clusters of *C. meningosepticum* neonatal meningitis have been linked to many sources, including contaminated lipid stock bottles, contaminated venous catheter lines and nutritional solution, and tap water [1-3]. *C. meningosepticum* infection in adult patients has been found to be hospital acquired, and to occur in immunocompromised hosts. Reviewing 308 reports of positive cultures in the English language literature on *C. meningosepticum*, Bloch et al reported that pneumonia was the most frequent infection among the post neonatal group, accounting for 40% of cases, followed by sepsis (24%), meningitis (18%), endocarditis (3%), cellulitis (3%), abdominal infections (3%), eye infections (3%), and single case reports of sinusitis, bronchitis, and epididymitis [4].

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C. meningosepticum possesses two kinds of beta (β)-lactamases: extended-spectrum β-lactamases, and metallo-β-lactamases; both enable it to develop resistance to antimicrobial agents commonly used to treat Gram-negative bacillary infections. The former confers resistance to all available cephalosporins, including fourth-generation cephalosporins (cefepime and cefpirome). Both cefepime and cefpirome had poor potency against *C. meningosepticum* (minimal inhibitory concentration [MIC] at which 50% of isolates were inhibited [MIC_{50}]/MIC at which 90% of isolates were inhibited [MIC_{90}]: 64/>256 μg/mL and 128/>256 μg/mL for cefepime and cefpirome, respectively) [5]. Additionally, a study reporting the distribution and characterization of metallo-β-lactamase genes suggested that *C. meningosepticum* represents a reservoir of diverse metallo-β-lactamases, which could potentially spread to Gram-negative bacteria of greater clinical significance [6].

Clinically, the disk diffusion method has been notoriously unreliable for antibiotic sensitivity testing in several studies [4,7,8]. Fraser and Jorgensen suggested that the microdilution test rather than the disk diffusion test should be performed to determine the susceptibility of *C. meningosepticum* when testing with vancomycin and piperacillin-tazobactam [9]. Quinolones had been suggested to be the drugs of choice for treatment of *C. meningosepticum* infections [4,7-9]. However, Chang et al indicated a good correlation ($r = -0.90$) of disk diffusion test and microdilution test for ciprofloxacin [7].

This study aimed to determine the risk factors for mortality of patients with *C. meningosepticum* infections and to study the antibiotic susceptibility of clinical isolates.

Methods

Microbiology log books were reviewed for *C. meningosepticum* isolated from January 2004 to March 2007. *C. meningosepticum* was identified from bacterial cultures of 79 patients admitted at a teaching hospital. Of these, 34 isolates cultivated on primary cultures from 32 patients showed pure growth of non-fastidious, glucose-non-fermenting bacilli that were oxidase-positive and non-motile. To avoid enrollment of patients with colonization or contamination, isolates from specimens other than blood were enrolled if specimens were obtained by invasive procedures with sterile techniques (e.g., sputum obtained from bronchoscopic washing, rather than expectorated sputum or aspirated sputum; urine obtained from urethral catheterization, rather than midstream voiding). Species identification was made by ID 32 GN automatic identification system (Vitek Systems, bioMérieux Vitek, Inc., Hazelwood, MO, USA).

All bacteremic isolates were available for further susceptibility test by broth dilution method [10]. Standard reference powders of selected drugs, including vancomycin, cefoperazone, cefepime, ciprofloxacin, levofloxacin, minocycline, and piperacillin-tazobactam, were obtained from pharmaceutical suppliers. Stock solutions at 5 mg/mL for each drug were prepared based on the previous National Committee for Clinical Laboratory Standards (NCCLS) recommendations [11] and stored at –70°C before use. Piperacillin-tazobactam (8:1) stock was 5 mg of piperacillin and 0.625 mg of tazobactam per mL. MICs were determined by microdilution method in 96-well plates. Antibiotics were serially diluted two-fold in 50 μL of cation-adjusted Mueller-Hinton broth. The range of antibiotic concentrations was 64 to 0.03 μg/mL. The final well volume was 100 μL after inoculation. The inocula were prepared from actively growing bacteria in 10 mL of cation-adjusted Mueller-Hinton broth re-started with 1 mL of an overnight broth culture. After subculturing, strains were diluted with cation-adjusted Mueller-Hinton broth to a bacterial cell density of 10^6 colony forming units (CFUs)/mL. For a final inoculum of approximately 5×10^4 CFU/well, 50 μL of this dilution was instilled into each well of the 96-well plate. After overnight incubation (18 to 24 h) at 37°C, the MICs were read visually. All MICs were determined in duplicate. Quality control of antibiotic stocks was established using *Pseudomonas aeruginosa* American Type Culture Collection (ATCC) 27853 and *Escherichia coli* ATCC 25922, according to NCCLS guidelines [11].

Medical records of patients with *C. meningosepticum* infections were reviewed. Special attention was paid to demographic data (age, gender, length of stay before infection onset, and hospital stay), clinical manifestations (body temperature, pulse rate, respiratory rate, hypoalbuminemic status at the infection onset), clinical parameters (central venous line placement, white blood cell count, platelet count, and usage of steroids), underlying diseases (autoimmune disease, chronic renal failure, diabetes mellitus, or malignancy), antibiotic treatment, and outcome. Infections were regarded as community-acquired if the patient was admitted with an acute illness and initial cultures at the

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time of presentation yielded a positive result. Infections were considered nosocomial if symptomatic infections developed after the first 72 h of hospitalization.

Definitions

Appropriate antibiotic treatment was defined as antibiotic regimens to which *C. meningosepticum* was susceptible, if susceptibility results were available. If the susceptibility of the organism to any given antibiotic was unknown, treatment was considered inappropriate if the antibiotic was not regarded as a drug of choice for treatment of *C. meningosepticum* infections in the current literature. Usage of steroids was defined as the receipt of any formula and any dose of exogenous steroids prior to the onset of infection. Hypoalbuminemia was defined as a serum albumin level <2.5 g/dL. Central venous line placement referred to the record of its presence within one week before infection onset. Diabetes mellitus was required to be documented either in past history or in relation to the present illness, or by at least two instances of fasting hyperglycemia (>125 mg/dL) during hospitalization. Renal failure was arbitrarily defined as impaired renal function with serum creatinine of >2.0 mg/dL at the infection onset. Abnormal white blood cell counts were defined as white blood cell counts of >12,000/mm^3 or <4000/mm^3 at the onset. Thrombocytopenia was defined as a low platelet count (<100,000/mm^3) at the onset. Fever was defined as a body temperature of >38°C and hypothermia <36°C, according to the methods of measurement at the onset. Increased pulse rate was present if the patient had a pulse rate of >90/min at the onset. Increased respiratory rate was defined as a respiratory rate of >20/min at the onset. All-cause mortality was defined as any death during the hospitalization.

The association between clinical parameters and clinical outcome was analyzed by Fisher's exact test. A two-tailed test was used and a p value <0.05 was considered to be significant.

Results

During the 39-month study period, 32 patients (34 bacterial isolates) with *C. meningosepticum* infections were identified. Of the 32 patients, 23 patients had *C. meningosepticum* bacteremia. Thirty patients had a single infecting strain, and 2 patients had 2 isolates each (Table 1).

Eleven patients, 9 males and 2 females, acquired *C. meningosepticum* infections in the community. The mean age of adult patients was 71.2 years (excluding two pediatric patients — cases 12 and 22). Pneumonia (5 cases, 45%) and cellulitis (3 cases, 27%) were the major diagnoses. Osteomyelitis (case 15), central nervous system (CNS) infection (case 22), and continuous ambulatory peritoneal dialysis peritonitis (case 32) were the remaining diagnoses. Only one patient (case 4) died of bacteremic pneumonia. This patient had coronary artery disease, chronic obstructive pulmonary disease and diabetes mellitus. The mortality rate of patients with community-acquired *C. meningosepticum* infections was 9.1%. Excluding a patient with two episodes of infection, the mean hospital stay was 31.0 days. One patient (case 17) who had *C. meningosepticum* cellulitis and bacteremia had two strains of *C. meningosepticum* cultivated on blood cultures (different antibiogram patterns).

Twenty two patients, 17 males and 5 females, acquired *C. meningosepticum* infection in the hospital. Their mean age was 70.1 years (excluding case 20). Pneumonia (13 cases, 59%) was the major diagnosis. Biliary tract infection (2 cases) and catheter-related infection (2 cases) were the minor diagnoses. Wound infection (1 case), urinary tract infection (1), cellulitis (1), bacteremia with unknown primary source (1), and CNS infection (1) were the remaining diagnoses. Nine patients (42.9%) died in the hospital. The mean time to onset after hospitalization was 40.2 days. Patients with nosocomial infections had a mean hospital stay of 67.5 days, over 2-fold longer than that of community-acquired infections.

Overall, pneumonia was the major diagnosis (6 cases, 60%) of 10 fatal cases. Two pediatric patients, both full-term babies, survived. The mean age of fatal adult cases was 74.2 years and that of adult survivors was 68.6 years (20 adults) [Table 1].

Fifty three percent of patients had changes in white blood cell counts; 32% had low platelet counts, and 68% changes in temperature (either above 38°C or below 36°C) or pulse rate (>90/min) at the onset of infection. Pulse rate increased in all fatal patients, and body temperature and respiratory rate changes occurred in 80% of fatal cases. A lower incidence of constitutional symptoms (changes in body temperature, 63%; changes in pulse rate, 54%; changes in respiratory rate, 50%) was noted in the survivors.

Fourteen patients had underlying diseases, including cardiopulmonary diseases, malignancy, and autoimmune diseases. In patients with fatal outcomes, 5 (50%) had cardiopulmonary diseases. Among patients

Table 1. Demographic data of 32 patients with *Chryseobacterium meningosepticum* infections

Case no.[a]	Age (years)	Gender	Mode of infection	Onset (days)[b]	Hospital stay (days)	Specimen	Underlying disease	Infectious diagnosis
1	66	M	H	87	81	Blood	CAD, COPD, DM	Wound infection
2	90	F	H	14	24	Blood	CHF	Biliary tract infection
3	83	M	H	87	129	Blood	DM	Pneumonia
4	63	M	C	0	5	Blood	CAD, COPD, DM	Pneumonia
5	67	F	H	59	66	Blood	Breast cancer	Catheter-related infection
6	60	M	H	20	52	Blood	Esophageal cancer	Pneumonia
7	82	M	H	20	40	Bronchial washing	Interstitial lung disease	Pneumonia
8	80	M	H	257	276	Blood, CVP catheter tip	CAD, CHF	Pneumonia
9	79	M	H	27	41	Bronchial washing	DM	Pneumonia
10	72	M	H	8	9	Urine	Rheumatoid arthritis	Urinary tract infection
11	85	M	C	0	184	Blood	COPD	Pneumonia
12	2	M	C	1	4	Blood	None	Cellulitis
13	52	M	C	0	9	Blood	Progressive systemic sclerosis	Pneumonia
14	79	M	H	15	59	Blood	COPD	Pneumonia
15	68	M	C	0	15	Blood	Traumatic fracture of tibia	Osteomyelitis
16	29	M	H	7	26	Blood	T-cell lymphoma	Pneumonia
17	72	M	C	0	21	Blood	CHF	Cellulitis
17	72	M	C	0	21	Blood	CHF	Cellulitis
18	40	F	H	9	19	Blood	Cirrhosis of liver, DM, SLE	Catheter-related infection
19	76	M	H	17	38	Blood	None	Ventilator-associated pneumonia
20	90	F	C	0	47	Blood	Asthma, CVID	Cellulitis
20	90	F	H	17	47	Blood	Anal squamous cell carcinoma	Cellulitis
21	66	F	H	33	83	Blood	CAD, DM	Biliary tract infection
22	0.05	M	C	2	27	Blood, CSF	Patent ductus arteriosus	CNS infection
23	58	M	H	65	113	Blood, pleural fluid, pus	CAD, CHF, DM	Unknown primary source
24	63	M	H	9	94	Blood, sputum	Alcoholism, cirrhosis of liver	Pneumonia
25	83	F	C	2	23	Bronchial washing	DM, NHL, prostate cancer	Ventilator-associated pneumonia
26	50	M	C	1	13	Bronchial washing	Interstitial lung disease	Pneumonia
27	76	M	H	30	53	Pleural fluid	Prostate cancer	Pneumonia
28	81	M	H	73	92	Bronchial washing	CAD, DM	Pneumonia
29	77	M	H	15	28	Bronchial washing	Uremia	Ventilator-associated pneumonia
30	87	M	H	6	39	Bronchial washing	Asthma	Pneumonia
31	62	M	H	10	76	CSF	ICH, VP shunt placement	CNS infection
32	78	M	C	1	9	Ascites	None	CAPD peritonitis

Abbreviations: M = male; F = female; H = hospital-acquired; C = community-acquired; CVP = central venous pressure; CSF = cerebrospinal fluid; CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease; DM = diabetes mellitus; CHF = congestive heart failure; SLE = systemic lupus erythematosus; CVID = common variable immunodeficiency; NHL = non-Hodgkin's lymphoma; ICH = intracranial hemorrhage; VP shunt = ventriculoperitoneal shunt; CNS = central nervous system; CAPD = continuous ambulatory peritoneal dialysis

[a]Cases 1-10.

[b]Length of stay before the onset of infection.

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with cardiopulmonary diseases, 5 patients (36%) died, whereas the death rate was 28% among patients without cardiopulmonary diseases.

Antibiotic regimens used in individual patients are presented in Table 2, and the results of testing for association with clinical parameters are shown in Table 3. Increased pulse rate (p=0.008), hypoalbuminemic status (p=0.024), or placement of central venous line (p=0.038) at the infection onset were associated with a poor outcome. Usage of appropriate antibiotic regimens had no statistically significant effect on the outcome (p=0.210).

The susceptibility patterns of *C. meningosepticum* isolates studied generally corresponded to those previously described [7,12-13], i.e., resistance to cefoperazone and cefepime. The isolates in our hospital were susceptible to piperacillin-tazobactam (MIC_{50}, 8 μg/mL; MIC_{90}, 16 μg/mL). The MIC_{50} and MIC_{90} of vancomycin was 16 and 64 μg/mL, respectively. MICs of levofloxacin (MIC_{50}, 0.12 μg/mL; MIC_{90}, 2 μg/mL) were lower than those of ciprofloxacin (MIC_{50}, 0.5 μg/mL; MIC_{90}, 4 μg/mL) (Table 4).

Discussion

Because of the multiresistant nature of the organism, clinical experience in choosing optimal therapeutic regimens for treating *C. meningosepticum* infections is

Table 2. Treatment of 32 patients with *Chryseobacterium meningosepticum* infection

Case no.	Diagnosis	Antibiotic regimens	Appropriate treatment	Outcome
1	Wound infection	Cefazolin	No	Died
2	Biliary tract infection	Ciprofloxacin	Yes	Died
3	Pneumonia	Piperacillin	Yes	Died
4	Pneumonia	None	No	Died
5	Catheter-related infection	Ticarcillin-clavulanate	No	Died
6	Pneumonia	Ticarcillin-clavulanate + amikacin	No	Died
7	Pneumonia	Ciprofloxacin + vancomycin	Yes	Died
8	Pneumonia	Cefepime	No	Died
9	Pneumonia	Ticarcillin-clavulanate	No	Died
10	Urinary tract infection	Ceftriaxone	No	Died
11	Pneumonia	Piperacillin-tazobactam	Yes	Survived
12	Cellulitis	Gentamicin	No	Survived
13	Pneumonia	Levofloxacin	Yes	Survived
14	Pneumonia	Trimethoprim-sulfamethoxazole	Yes	Survived
15	Osteomyelitis	Vancomycin	No	Survived
16	Pneumonia	Piperacillin-tazobactam + amikacin	Yes	Survived
17	Cellulitis	Piperacillin-tazobactam	Yes	Survived
17	Cellulitis	Vancomycin	No	Survived
18	Catheter-related infection	Cefazolin + gentamicin	No	Survived
19	Ventilator-associated pneumonia	Piperacillin-tazobactam + amikacin	No	Survived
20	Cellulitis	Levofloxacin	Yes	Survived
20	Cellulitis	Cefepime	Yes	Survived
21	Biliary tract infection	Ciprofloxacin	Yes	Survived
22	CNS infection	Vancomycin + rifampin	No	Survived
23	Unknown source	Levofloxacin + rifampin	Yes	Survived
24	Pneumonia	Trimethoprim-sulfamethoxazole	No	Survived
25	Ventilator-associated pneumonia	Cefpirome	No	Survived
26	Pneumonia	Levofloxacin	No	Survived
27	Pneumonia	Vancomycin	No	Survived
28	Pneumonia	Vancomycin	No	Survived
29	Ventilator-associated pneumonia	Ciprofloxacin	Yes	Survived
30	Pneumonia	Ciprofloxacin	Yes	Survived
31	CNS infection	Trimethoprim-sulfamethoxazole	Yes	Survived
32	CAPD peritonitis	Ciprofloxacin + rifampin	Yes	Survived

Abbreviations: CNS = central nervous system; CAPD = continuous ambulatory peritoneal dialysis

Table 3. Clinical variables and outcomes of patients with *Chryseobacterium meningosepticum* infection

Variable	Dead (n = 10) No. (%)	Survived (n = 24) No. (%)	*p*
Antibiotic treatment			0.210
Appropriate	7 (70)	9 (37.5)	
Inappropriate	3 (30)	15 (62.5)	
White blood cell count at infection onset			0.210
>12,000/mm^3 or <4000/mm^3	3 (30)	15 (62.5)	
4000-12,000/mm^3	7 (70)	9 (37.5)	
Platelet count at infection onset			0.165
<100,000/mm^3	5 (50)	6 (25.0)	
≥100,000/mm^3	5 (50)	18 (75.0)	
Body temperature at infection onset			0.335
>38.0°C or <36.0°C	8 (80)	15 (62.5)	
36 to 38°C	2 (20)	9 (37.5)	
Pulse rate at infection onset			0.008
>90/min	10 (100)	13 (54.2)	
≤90/min	0 (0)	11 (45.8)	
Respiratory rate at infection onset			0.112
>20/min	8 (80)	12 (50.0)	
≤20/min	2 (20)	12 (50.0)	
Usage of steroids			0.553
Yes	4 (40)	7 (29.2)	
No	6 (60)	17 (70.8)	
Serum albumin level at infection onset			0.024
<2.5 g/dL	8 (80)	9 (37.5)	
≥2.5 g/dL	2 (20)	15 (62.5)	
Central venous line placement			0.038
Yes	10 (100)	16 (66.7)	
No	0 (0)	8 (33.3)	
Comorbidity of diabetes mellitus			0.262
Yes	4 (40)	5 (20.8)	
No	6 (60)	19 (79.2)	
Status of renal function			0.097
Serum creatinine >2.0 mg/dL	6 (60)	7 (29.2)	
Serum creatinine ≤2.0 mg/dL	4 (40)	17 (70.8)	
Gender			0.958
Male	8 (80)	19 (79.2)	
Female	2 (20)	5 (20.8)	
Pneumonia			0.531
With bacteremia	4 (67)	6 (50)	
Without bacteremia	2 (33)	6 (50)	

limited. Vancomycin has been previously recommended as the drug of choice for the treatment of neonatal meningitis due to *C. meningosepticum* [14]. Its efficacy varied from 65% [4] to nearly 0% [7]. Furthermore, high MICs (≥16 μg/mL) of vancomycin for the organism, as demonstrated in this work as well as those of others [7,12], indicate that vancomycin should not be considered for treating severe *C. meningosepticum* infections, especially meningitis. On the other hand, this work further confirms the acceptable efficacy of ciprofloxacin against the organism, as has been noted in previous reports [7,12,15]. In addition, we found that levofloxacin may be superior to ciprofloxacin in this setting; however, the use of levofloxacin to treat *C. meningosepticum* infections needs further clinical evaluation.

Lin et al [12] conducted a 24-month surveillance of bloodstream infections caused by *C. meningosepticum* in non-neonatal patients and found a 54.5% (6 in 11 patients) community-acquired infection rate, with prolonged hospital stay (mean, 32 days; range, 13 to 99 days) prior to the onset of bacteremia in rest hospital-acquired cases.

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Table 4. In vitro activities of selected antibiotics against 19 clinical isolates of *Chryseobacterium meningosepticum*

Antibiotic	MIC (μg/mL)		
	Range	MIC_{50}	MIC_{90}
Vancomycin	16->64	16	64
Cefoperazone	16->64	64	>64
Cefepime	0.5->64	32	>64
Ciprofloxacin	0.06-32	0.5	4
Levofloxacin	0.03-8	0.12	2
Minocycline	0.03-1	0.03	1
Piperacillin-tazobactam	0.12->64	8	16

Abbreviations: MIC = minimal inhibitory concentration; MIC_{50} = MIC at which 50% of isolates were inhibited; MIC_{90} = MIC at which 90% of isolates were inhibited

In our study, the mean hospital stay before the onset of infection in the hospital-acquired group was 40.2 days and the mean hospital stay was 67.5 days (range, 9 to 276 days). In the literature [4], infections with *C. meningosepticum* were generally associated with a poor outcome, with a cumulative mortality of 33% among post-neonates. Our study, in accordance with the previous report, showed that a high mortality rate (42.9%) of *C. meningosepticum* infections in patients with hospital-acquired infections. On the other hand, our finding of a lower mortality rate (9.1%) in those with community-acquired infections was in accordance with the findings of another series [12].

It appears that the use of appropriate antibiotics did not necessarily correlate with a favorable outcome; host factors, on the other hand, are the critical determinant of outcome in *C. meningosepticum* infections. Although poor cardiopulmonary reserves may be a feature of aged patients, the presence of underlying diseases such as cardiopulmonary diseases (e.g., coronary artery disease, congestive heart failure, obstructive lung diseases, and interstitial lung diseases) probably predispose the patients to poor outcomes. Owing to the limited number of patients in this study, the role of underlying cardiopulmonary diseases is not known. The outcome was not significantly different between pneumonia patients with and without bacteremia (p=0.531) in our study. Whether bacteremia complicating *C. meningosepticum* pneumonia attacts a poorer outcome requires further investigation.

Three patients in our study had community-acquired cellulitis with bacteremia, an unusual clinical setting. A 2-year-old full-term patient (case 12) presented Stevens-Johnson syndrome possibly related to acyclovir prior to *C. meningosepticum* bacteremia complicating cellulitis. A 72-year-old male (case 17) with congestive heart failure, chronic pedal edema and desquamation over his right leg, presented recurrent cellulitis on several admissions. The remaining patient, a 90-year-old female (case 20) with poor condition of colostomy wound due to inappropriate care, presented with cellulitis of the lower abdomen. All three patients had defects in their skin barriers that probably predisposed them to *C. meningosepticum* bacteremia complicating cellulitis. This may reflect the nature and characteristics of the organism, and the importance of intact cutaneous barriers in prevention of invasion by this opportunist pathogen.

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