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Postoperative Infant Septicemia Caused by *Pseudomonas luteola* (CDC Group Ve-1) and *Pseudomonas oryzihabitans* (CDC Group Ve-2)

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***Pseudomonas luteola* (CDC group Ve-1) and *Pseudomonas oryzihabitans* (CDC group Ve-2) were both isolated from the same blood culture of a 5-month-old infant, 8 days after open-heart surgery. He quickly responded to appropriate antibiotics. Carbon substrate assimilation tests and fatty acid analysis clearly differentiated these two rarely pathogenic organisms.**

On the basis of their biochemical characteristics, a group of nonfermenting yellow-pigmented rod-shaped bacteria failing to produce cytochrome oxidase, which otherwise resemble *Pseudomonas* spp., were initially classified as *Chromobacterium typhiflavum* by Pickett and Pedersen (16), before being assigned to CDC group Ve-1 and Ve-2 (21). However, because they share features with *Pseudomonas*, *Xanthomonas*, and *Erwinia* spp., their taxonomic position remained uncertain.

Currently, the bacteria of the Ve group are included in the genus *Pseudomonas* (9) and have recently been described as *Pseudomonas luteola* (CDC Ve-1) and *Pseudomonas oryzihabitans* (CDC Ve-2) (14), later designated as, respectively, *Chryseomonas luteola* and *Flavimonas oryzihabitans* (13).

P. luteola and *P. oryzihabitans* have only rarely been reported as pathogenic in humans (9, 18). We describe the first recorded case, to our knowledge, of a septicemia involving both organisms.

Case report. A 5-month-old boy underwent atrial reconstruction (Senning operation) under extracorporeal circulation at the Lyon Cardiological Hospital. This infant had a congenital cardiopathy from transition of the great arteries with intact ventricular septum. Despite atrial sepstostomy (Rashkind operation) carried out on the first day of life, the cyanosis of the infant had grown progressively worse and an auricular reconstruction proved necessary. During the perioperative period, he was given 200 mg of cefazolin and 15 mg of netilmicin every 8 h for 48 h. His immediate postoperative progress was satisfactory but, on day 8, he developed a temperature of 39.8°C. Four blood cultures grew *P. oryzihabitans*, which was accompanied by *P. luteola* in one culture. He was given 250 mg of ceftriaxone and 30 mg of netilmicin daily for 8 days and ceftriaxone alone for a further 6 days. He rapidly became apyrexial and made a good recovery. The patient and his immediate environment were swabbed, but neither of the organisms was recovered. Two months later, however, blood cultures from a patient who had undergone surgery for a valvular replacement on the aorta in the same theater suite yielded the same strain of *P. oryzihabitans*. The evaluation of the equipment used in the operating room did not show bacterial colonization. Neither organism was reisolated during the following 10 months.

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The organisms were first identified by using the API 20 NE and ATB 32 GN galleries (6) (API System, La Balme, France), and their identification was confirmed by the tests and methods of Gilardi (8), Hansen and Yourassowsky (12), Kodama et al. (14), and Watson (23); the culture and identification media used were from Difco Laboratories, Belgium.

Flagella were stained by the method of Rhodes (19). Carbon substrate assimilation tests were done with the API 147 gallery, consisting of 49 carbohydrates, 49 organic acids, and 49 amino acids (7). Cellular fatty acid composition was determined by high-resolution gas-liquid chromatography (5880 A gas chromatograph; Hewlett-Packard Co., Palo Alto, Calif.) with a flame ionization detector and a 25-m fused-silica capillary column (inner diameter, 0.25 mm) coated with RSL 150 (Alltech Associates, Inc., Applied Science Div., State College, Pa.) (24). The preparation of the fatty acids for gas-liquid chromatography analysis was as follows. The strain was inoculated on a plate of tryptic soy agar; after 24 h of incubation at 36°C, the cells were harvested and saponified, and the resulting fatty acids were methylated as described previously (24).

The MICs of 23 antibiotics were determined by a standardized broth microdilution method with *Escherichia coli* ATCC 25922 as the control strain and Mueller-Hinton (Difco) as the dilution medium (22).

Both isolates were small, motile, strictly aerobic gram-negative bacilli. On heart infusion agar (Difco) supplemented with 5% horse blood, *P. luteola* yielded 1-mm-diameter smooth colonies which were yellow and opaque after 24 h of incubation. The wrinkled colonies of *P. oryzihabitans* were less than 0.5 mm in diameter, translucent, and less pigmented. *P. luteola* exhibited a polar tuft of flagella, while *P. oryzihabitans* was monotrichous. Both strains had typical conventional biochemical characteristics (9, 14), except that both acidified sorbitol and not maltose and rhamnose. The tests which differentiated the two species are shown in Table 1.

The two strains were positive for the following characteristics: catalase; oxidation of glucose, galactose, mannitol, xylose, levulose, sorbitol, mannose, gluconate, lactose (10%); hydrolysis of amylase; acetate; citrate; growth on MacConkey agar; tributyrine esterase; trypsin; pyrrolidonyl aminopeptidase, γ-glutamyl aminopeptidase; cystine amino-

TABLE 1. The main features differentiating our isolates of *P. luteola* and *P. oryzihabitans*

Characteristic	*P. luteola*	*P. oryzihabitans*
Conventional characteristics		
Flagellar morphology	Multitrichous	Monotrichous
Growth at 42°C	+	−
Urease	+	−
Esculin[a]	+	−
Arginine dihydrolase[a]	+	−
Reduction of nitrates to nitrites[a]	+	−
β-D-Galactosidase (ONPG)[a]	+	−
α-D-Glucosidase	+	−
β-D-Glucosidase	−	+
Alkaline phosphatase	+	−
Carbon substrate assimilation		
D-Fructose	−	+
Sorbitol[b]	−	+
Salicin[b]	+[c]	−
Caprate	+	−
Malonate	−	+
L-Tartrate	−	+
Citraconate	−	+
Itaconate	−	+
Mesaconate	−	+
D-Alanine	−	+
L-Leucine	−	+[c]
L-Isoleucine	−	+[c]
L-Valine	−	+[c]
L-Histidine[b]	−	+[c]
Trigonelline	−	+
2-Aminobenzoate	−	+[c]
Sarcosine	−	+
Ethanolamine	−	+
Diaminobutane	−	+
Glucosamine	+	−
Cellular fatty acid		
Δ-*cis*-11,12-Methylene-octadecanoic acid ($C_{19:0\Delta}$)	+	−

[a] Same results in API 20 NE system.
[b] Tested also in ATB 32 GN system.
[c] After 48 h.

peptidase, valine aminopeptidase; proline aminopeptidase; serine aminopeptidase; and *N*-acetyl-β-D-glucoaminidase. The two strains were negative for the following characteristics: cytochrome oxidase; oxidation of sucrose, rhamnose, and maltose; lysine decarboxylase; ornithine decarboxylase; hydrogen sulfide production; lecithinase; Tween 80 esterase and DNase; gelatinase; acetamide; malonate; phenylalanine deaminase; growth on salmonella-shigella agar; indole; chymotrypsin; α-D-galactosidase; β-xylosidase; α-D-mannosidase; α-L-fucosidase; and β-L-fucosidase and β-D-glucuronidase.

The two strains were also susceptible to polymyxin B and resistant to penicillin G, novobiocin, and the vibriostatic compound O/129.

With the API 147 gallery, the two strains assimilated the following substrates: D-arabinose, L-arabinose, D-xylose, D-ribose, galactose, D-glucose, D-mannose, inositol, mannitol, maltose, trehalose, L-fucose, D-arabitol, gluconate, 2-ketogluconate, 5-ketogluconate, acetate, propionate, heptanoate, caprylate, pelargonate, oxalate, succinate, fumarate, DL-lactate, DL-glycerate, DL-3-hydroxybutyrate, D-malate, L-malate, mesotartrate, pyruvate, 2-ketoglutarate, aconitate, citrate, *para*-hydroxybenzoate, L-alanine, L-serine, L-tyrosine, L-aspartate, L-glutamate, L-proline, betaine, and DL-aminobutyrate. The substrates assimilated by either of the isolates alone are shown in Table 1.

The fatty acid analysis showed that the most abundant acids in these two species were hexadecenoic acid ($C_{16:1}$), hexadecanoic acid ($C_{16:0}$), and octadecenoic acid ($C_{18:1}$). Moderate amounts of 3-hydroxydecanoic acid (3-OH-$C_{10:0}$), dodecanoic acid ($C_{12:0}$), and 2-hydroxydodecanoic acid (2-OH-$C_{12:0}$) were observed while rather small amounts of 3-hydroxydodecanoic acid (3-OH-$C_{12:0}$), tetradecanoic acid ($C_{14:0}$), pentadecanoic acid ($C_{15:0}$), isoheptadecanoic acid ($C_{i17:0}$), heptadecenoic acid ($C_{17:1}$), heptadecanoic acid ($C_{17:0}$), and isooctadecanoic acid ($C_{i18:0}$) were detected. The essential difference between these two species is the fact that moderate amounts of lactobacillic acid (Δ-*cis*-11,12-methylene-octadecanoic acid; $C_{19:0\Delta}$) were detected in *P. luteola* but absent in *P. oryzihabitans*. Our findings are in complete agreement with those of Kodama et al. (14). Contrary to Dees et al. (4), we did not detect Δ-*cis*-9,10-methylene-hexadecanoic acid ($C_{17:0\Delta}$) in our strain of *P. luteola*.

The MICs of the antibiotics tested are shown in Table 2.

Discussion. The normal habitat of *P. luteola* (*Chryseomonas luteola*) and *P. oryzihabitans* (*Flavimonas oryzihabitans*) is unclear, although they belong to a group of bacteria normally found in water, soil, and other damp environments (20). They are rare human pathogens, occasionally isolated from pus and wounds (10) and implicated in a handful of reported cases of septicemia (2, 11, 15, 17, 18; B. Shaw and V. Baselski, Clin. Microbiol. Newsl. **4**:87, 1982) and peritonitis (1, 3, 20), usually in association with indwelling catheters or prostheses. However, this is apparently the first report of the simultaneous isolation of both species from the blood of a septicemic patient.

P. luteola and *P. oryzihabitans* can be distinguished from most other motile, yellow-pigmented nonfermenters by their negative oxidase reaction, and from the pigmented enterobacteria by their strictly aerobic character. The two species can be readily differentiated by either conventional tests or, as here, carbon substrate assimilation tests (Table 1) and

TABLE 2. MICs of 23 antibiotics against the two isolates

Antibiotic	MIC (mg/liter) for:	
	P. luteola	*P. oryzihabitans*
Ampicillin	4	16
Ticarcillin	4	32
Mezlocillin	2	8
Azlocillin	≤1	4
Piperacillin	≤1	2
Aztreonam	4	32
Cephalothin	>32	>32
Cefoxitin	16	>32
Cefotaxime	1	4
Moxalactam	>32	>32
Cefamandole	>32	>32
Amdinocillin	32	32
Ceftriaxone	1	2
Ceftazidime	≤0.25	0.5
Gentamicin	≤0.06	0.12
Tobramycin	≤0.06	0.12
Netilmicin	≤0.06	≤0.06
Amikacin	≤0.25	0.5
Chloramphenicol	4	16
Fosfomycin	>128	16
Pefloxacin	1	0.5
Trimethoprim-sulfamethoxazole	8	>128
Tetracyclines	2	4

cellular fatty acid analysis, where our results were similar to those reported elsewhere (14).

Both isolates showed a typical pattern of antibiotic susceptibilities for the species with resistance to cephalothin, cefamandole, and cefoxitin (5). Unusually, however, both were also resistant to latamoxef (moxalactam). It is notable that, in the present case, the infant had been given perioperative cefazolin. This antibiotic has a spectrum of activity very similar to that of cephalothin with which patients in several other reported cases had been treated before the onset of infection (1, 3, 20).

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LITERATURE CITED

1. **Amber, I. J., and L. G. Reimer.** 1987. *Pseudomonas* sp. group Ve-2 bacterial peritonitis in a patient on continuous ambulatory peritoneal dialysis. J. Clin. Microbiol. **25**:744–745.
2. **Berger, S. A., Y. Siegman-Igra, J. Stadler, and A. Campus.** 1983. Group Ve-1 septicemia. J. Clin. Microbiol. **17**:926–927.
3. **Connor, B. J., R. T. Kopecky, P. A. Frymoyer, and B. A. Forbes.** 1987. Recurrent *Pseudomonas luteola* (CDC Group Ve-1) peritonitis in a patient undergoing continuous ambulatory peritoneal dialysis. J. Clin. Microbiol. **25**:1113–1114.
4. **Dees, S. B., C. V. Moss, R. E. Weaver, and D. Hollis.** 1979. Cellular fatty acid composition of *Pseudomonas paucimobilis* and groups IIk-2, Ve-1, and Ve-2. J. Clin. Microbiol. **10**:206–209.
5. **Fass, R. J., and J. Barnishan.** 1980. In vitro susceptibilities of nonfermentative Gram-negative bacilli other than *Pseudomonas aeruginosa* to 32 antimicrobial agents. Rev. Infect. Dis. **2**:841–853.
6. **Freney, J., P. Laban, M. Desmonceaux, H. Alexandre, B. Poggi, J. P. Gayral, and J. Fleurette.** 1985. An automatic micromethod for the identification of Gram-negative bacilli by carbon substrate assimilation tests, p. 377–389. *In* K. O. Habermehl (ed.), Rapid methods and automation in microbiology and immunology. Springer-Verlag, Heidelberg, Federal Republic of Germany.
7. **Gavini, F., D. Izard, H. Leclerc, M. Desmonceaux, and J. P. Gayral.** 1980. Carbon sources assimilation tests: comparison between a conventional method and a microtechnique (API) in study of *Enterobacteriaceae*. Zentralbl. Bakteriol. Parasitenkd. Infektionskr. Hyg. Abt. 1 Orig. **1**:182–187.
8. **Gilardi, G. L.** 1978. Identification of *Pseudomonas* and related bacteria, p. 15–44. *In* G. L. Gilardi (ed.), Glucose nonfermenting gram negative bacteria in clinical microbiology. CRC Press, Inc., West Palm Beach, Fla.
9. **Gilardi, G. L.** 1985. *Pseudomonas*, p. 350–372. *In* E. H. Lennette, A. Balows, W. J. Hausler, Jr., and H. J. Shadomy (ed.), Manual of clinical microbiology, 4th ed. American Society for Microbiology, Washington, D.C.
10. **Gilardi, G. L., S. Hirschl, and M. Mandel.** 1975. Characteristics of yellow-pigmented nonfermentative bacilli (groups Ve-1 and Ve-2) encountered in clinical bacteriology. J. Clin. Microbiol. **1**:384–389.
11. **Gomez Garcés, J. L., J. M. Aguado, M. A. Fernández-Clúa, and F. Soriano.** 1986. *Pseudomonas* species Ve-2 septicemia. Eur. J. Clin. Microbiol. **5**:168–169.
12. **Hansen, W., and E. Yourassowsky.** 1983. Recherche de glycosidases chez les *Pseudomonas* du groupe fluorescent: relation entre serogroupe et activités glycosidasiques chez *P. aeruginosa*. Ann. Microbiol. (Paris) **134B**:411–419.
13. **Holmes, B., A. A. Steigerwalt, R. E. Weaver, and D. J. Brenner.** 1987. *Chryseomonas luteola* comb. nov. and *Flavimonas oryzihabitans* gen. nov., comb. nov., *Pseudomonas*-like species from human clinical specimens and formerly known, respectively, as groups Ve-1 and Ve-2. Int. J. Syst. Bacteriol. **37**:245–250.
14. **Kodama, K., N. Kimura, and K. Komagata.** 1985. Two new species of *Pseudomonas*: *P. oryzihabitans* isolated from rice paddy and clinical specimens and *P. luteola* isolated from clinical specimens. Int. J. Syst. Bacteriol. **35**:467–474.
15. **O'Leary, T., and I. W. Fong.** 1984. Prosthetic valve endocarditis caused by group Ve-1 bacteria (*Chromobacterium typhiflavum*). J. Clin. Microbiol. **20**:995.
16. **Pickett, M. J., and M. M. Pedersen.** 1970. Characterization of saccharolytic nonfermentative bacteria associated with man. Can. J. Microbiol. **16**:351–362.
17. **Pien, F. D.** 1977. Group Ve-2 (*Chromobacterium typhiflavum*) bacteremia. J. Clin. Microbiol. **6**:435–436.
18. **Pien, F. D., and Y. S. Chung.** 1986. Group Ve infection: case report of group Ve-2 septicemia and literature review. Diagn. Microbiol. Infect. Dis. **5**:177–180.
19. **Rhodes, M. E.** 1958. The cytology of *Pseudomonas* spp. as revealed by a silver plate staining method. J. Gen. Microbiol. **18**:639–648.
20. **Silver, M. R., T. P. Felegie, and M. I. Sorkin.** 1985. Unusual bacterium, group Ve-2, causing peritonitis in a patient on continuous ambulatory peritoneal dialysis. J. Clin. Microbiol. **21**:838–839.
21. **Tatum, H. W., W. H. Ewing, and R. E. Weaver.** 1974. Miscellaneous gram-negative bacteria, p. 270–294. *In* E. H. Lennette, E. H. Spaulding, and J. P. Truant (ed.), Manual of clinical microbiology, 2nd ed. American Society for Microbiology, Washington, D.C.
22. **Thrupp, L. D.** 1980. Susceptibility testing of antibiotics in liquid media, p. 73–113. *In* V. Lorian (ed.), Antibiotics in laboratory medicine. The Williams & Wilkins Co., Baltimore.
23. **Watson, R. R.** 1976. Substrate specificities of aminopeptidases: a specific method for microbial differentiation, p. 1–14. *In* J. R. Norris (ed.) Methods in microbiology, vol. 9. Academic Press, Inc., New York.
24. **Yabuuchi, E., and C. W. Moss.** 1982. Cellular fatty acid composition of strains of three species of *Sphingobacterium* gen. nov. and *Cytophaga johnsonae*. FEMS Microbiol. Lett. **13**:87–91.