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Case Report and Review of Septicemia Due to *Serratia ficaria*

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***Serratia ficaria* was first described in 1979 as part of the fig tree ecosystem (P. A. D. Grimont, F. Grimont, and M. P. Starr, Curr. Microbiol. 2:277–282, 1979). Since then, it has been isolated from clinical specimens from a few human patients (C. Bollet, J. Freney, P. de Micco, F. Grimont, and P. A. D. Grimont, Méd. Mal. Infect. 20:97–100, 1990; J. A. Brouillard, W. Hansen, and A. Compere, J. Clin. Microbiol. 19:902–904, 1984; H. Darbas, H. Jean-Pierre, G. Boyer, and M. Riviere, Méd. Mal. Infect. 23:269–270, 1993; V. J. Gill, J. J. Farmer, III, P. A. D. Grimont, M. A. Asbury, and C. L. McIntosh, J. Clin. Microbiol. 14:234–236, 1981; F. D. Pien and J. J. Farmer III, South. Med. J. 76:1591–1592, 1983; C. Richard, J. de Coquet, and C. Suc, Méd. Mal. Infect. 19:45–47, 1989), but the pathogenicity of *S. ficaria* was always questionable. We are reporting the case of an aged cancer patient who developed *S. ficaria* septicemia. The habitat of this organism and its potential role as a pathogen are discussed.**

Serratia ficaria was first described in 1979 by Grimont et al. (8). This bacterium was found in figs and in the specific fig pollinator *Blastophaga psenes* (member of the order *Hymenoptera*) (8) but has been isolated from human clinical specimens in a few cases (2, 3, 6, 11, 12). Up to now, its role as a pathogen was always questionable. In 1993, we published a report on a case of gallbladder empyema due to *S. ficaria*, representing the first isolation from deep pus (4). Here we report the first case (to our knowledge) of septicemia due to *S. ficaria*.

An 83-year-old man underwent surgery on 15 July 1993 for an adenocarcinoma of the pyloric antrum without metastasis in the lymph nodes. The operation consisted of an antrectomy with Finsterer repair (anastomosis between remaining stomach and first jejunal loop). During the anesthetic induction, cefazolin (1 g) was administered. Postoperatively, from 17 to 20 July, the patient had febrile peaks (39°C) and chills with mottling of the skin and cyanosis. He was confused and developed hypotension (90 mm Hg) and tachycardia (160/min). On 19 July, the leukocyte count was 19,500/mm^3. No bacterial growth was obtained from a urine sample taken on 20 July. One blood culture was taken on 17 July, and three more were taken the next day. All four blood cultures were positive for *S. ficaria* on 19 July. On this day, antibiotic treatment combining amikacin (500 mg twice daily) and imipenem (500 mg four times per day) was started. The patient's temperature returned to normal on 22 July, and amikacin was stopped. Imipenem was continued for 3 more days. The patient was discharged 2 days later. Stool cultures for *S. ficaria* have not been done.

The blood was cultured in the Septicheck blood culture system (Becton Dickinson, Pont-de-Claix, France). Following incubation for 48 h at 37°C, a gram-negative rod was isolated from all samples on MacConkey medium and on chocolate agar slides of the blood culture system. The biochemical characteristics of the strain tested on the API 20E system (bioMérieux, Marcy l'Etoile, France) resulted in the code number 1206763. Possible identifications suggested in the code book were *Serratia plymuthica* and *S. ficaria*. The colonies gave off a strong potato-like odor which was suggestive of *S. ficaria*. This diagnosis was confirmed by the Institut Pasteur of Paris (Unite des Entérobactéries) by a carbon source utilization study with Biotype 99 carbon source strips (bioMérieux). Table 1 gives biochemical characteristics of the principal species of *Serratia*. Antibiotic susceptibility was tested by the disk diffusion method. According to the standards of the French Antibiogram Committee (1), the results were as follows: resistance to cephalothin, cefoxitin, and colistin; intermediate susceptibility to amoxicillin, amoxicillin plus clavulanic acid, moxalactam, and rifampin; and susceptibility to ticarcillin, piperacillin, imipenem, cefotaxim, ceftazidime, aztreonam, aminoglycosides, chloramphenicol, tetracycline, nalidixic acid and fluoroquinolones, fosfomycin, and trimethoprim-sulfamethoxazole.

In the present case, clinical pathogenicity of the organism was clear because the patient developed signs of septic shock with increased leukocyte count, and all four blood cultures were positive for *S. ficaria* in pure culture. Therefore, *S. ficaria* is able to cause severe infections (septicemia) or deep suppurations such as gallbladder empyema (4). The other reported cases (2, 3, 6, 11, 12) represented rather mild infections or colonization. All the patients with age reported were elderly and/or suffering from serious underlying diseases (Table 2 summarizes major data regarding reported clinical cases). Thus, *S. ficaria* is an opportunistic pathogen responsible for colonization or serious infections in compromised patients. But its pathogenicity seems low: in this case of septicemia, as in the prior case of gallbladder empyema (4), the course was uncomplicated and the recovery was speedy.

S. ficaria is usually susceptible to numerous antibiotics but always resistant to cephalothin (cefazolin was the prophylactic antibiotic in the present case). The susceptibility to aminopenicillins, chloramphenicol, colistin, rifampin, and tetracycline varies in different reports (details in Table 3).

For the understanding of what follows, we must give some details about the fig tree. The fig tree (*Ficus carica*) is a dioecious species which depends on a specific hymenopteran (*B. psenes*) for pollination. The male tree yields unedible figs in which *B. psenes* breeds. Over 1 year, there are usually two generations of *B. psenes*, in May and in July-August-September. In July, the *B. psenes* insects leave the male figs carrying pollen and pollinate female figs on female trees. These figs turn ripe and edible in October: they contain seeds which will germinate, about 50% of which will be female trees and 50% of

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TABLE 1. Differentiation of *Serratia* species[a] (5–9)

Characteristic	*S. ficaria*	*S. marcescens*	*S. liquefaciens* group[b]	*S. plymuthica*	*S. marinorubra* (synonym *rubidaea*)	*S. odorifera*
Growth on						
Adonitol	+	+	d	0	+	+
L-Arabinose	+	0	+	+	+	+
D-Arabitol	+	0	0	0	+	0
Benzoate	+	d	d	(v)	(+)	0
Betaine	0	0	0	v	+	0
D-Cellobiose	+	0	(+)	+	+	+
meso-Erythritol	+	d	d	0	+	d
D-Melibiose	+	0	+	+	+	+
α Methylglucoside	+	0	(+)	(v)	+	0
Mucate	+	0	0	v	+	+
Nicotinate	+	(+)	+	(+)	0	+
Quinate	+	d	d	+	(+)	0
L-Rhamnose	+	0	d	0	0	+
D-Sorbitol	+	+	+	d	0	+
D-Tartrate	0	0	0	0	v	(+)
Trigonelline	+	d	0	0	+	+
Utilization of						
Malonate	0	0	0	0	+	0
Simmons' citrate	+	d	+	v	+	+
Prodigiosin formed	0	d	0	v	+	0
Potato-like odor	+	0	0	0	v	+
Growth at 4°C	+	0	+	+	0	+
Tetrathionate reduced	0	d	+	0	0	0
Lysine decarboxylase	0	+	+	0	d	+
Ornithine decarboxylase	0	+	+	0	0	d
Tween 80 hydrolyzed	+	+	+	+	+	0
Chitin hydrolyzed	+	+	+	+	0	0
Gas from glucose	0	0	+	v	0	0
Acid from						
Adonitol	(+)	v	0	0	+	(v)
L-Arabinose	+	0	+	+	+	+
D-Arabitol	+	0	0	0	+	0
D-Melibiose	+	0	+	+	+	+
α-Methylglucoside	+	0	v	v	v	0
Rhamnose	+	0	d	0	0	+
D-Sorbitol	+	+	+	d	0	+
Xylose	+	0	+	+	+	+

[a] Symbols: +, positive for 90% or more of the strains; 0, negative for 90% or more of the strains; v, positive for 10 to 89% of the strains; d, either + or 0, a test used to differentiate biotypes; ( ), delayed reaction.

[b] The *S. liquefaciens* group consists of *S. liquefaciens* sensu stricto, *S. proteamaculans*, and "*S. grimesii*."

which will be male trees. Such is the life cycle of wild *F. carica*. There are two kinds of cultured *F. carica*. One kind (for example, the Smyrna variety, equivalent to Calimyrna in California), like the wild type, yields figs requiring pollination in order to ripen and become edible. Another kind yields parthenocarpic figs which ripen and become edible without pollination. To give two crops of figs, one in July and another in October, is the major feature of these cultivars, which are cultured in southern France both in home gardens and for commercial production. The unpollinated fig is bacteriologically sterile (8). To explain the colonization or contamination of their patients, some authors (3, 6, 11, 12) looked for consumption of fresh figs, but only one patient had a history of fig consumption (6). In the present case, it was not possible to ask the patient about fig consumption; however, in July, the edible figs are usually parthenocarpic. We think that the fig plays a secondary role in human colonization. The major source would be *B. psenes*. Except for two Belgian cases dated January (3), all isolates occurred between May and October (activity period of *B. psenes*). In our region of France, customarily the most important activity of *B. psenes* is in July (10), and the present case happened in July. Furthermore, the clinical isolates described in France are located in the south. *B. psenes* is not found in northern France. During July and August, about 6,000 or 7,000 *B. psenes* insects per day emerge from one middle-sized male tree (9a). The *B. psenes* flies around and between fig trees would create a bacterial aerosol responsible for an extended bacterial spreading. Grimont and Deval isolated *S. ficaria* from figs, fig leaf, and *B. psenes* and also from common grass, market mushrooms, and ants (7). Thus, from the fig tree ecosystem, the bacterium may be spread by insects, such as *B. psenes* and ants, visiting figs. This environmental spreading might explain the human isolates from respiratory specimens (2, 3, 6) or from leg wounds (11, 12) and possible oral contamination. In the cases of septicemia and gallbladder empyema, the source of infection is obviously the gut bacterial flora. This implies that *S. ficaria* could be a part (at least transiently) of human intestinal flora. This point needs further

TABLE 2. Major data regarding clinical isolates of *S. ficaria*

Reference	Sex[a]	Age (yr)	Geographical location	Isolation date[b]	Source	Associated flora	Underlying disease
6	F	59	Maryland	22 Oct 1979	Expectoration	Alpha-hemolytic *Streptococcus* spp., *Neisseria* spp., *Corynebacterium* spp., *Haemophilus* spp., *Escherichia coli*	Mitral valve xenograft
11	F	44	Hawaii	May 1980	Leg ulcer	*Pseudomonas acidovorans*, *Xanthomonas maltophilia*, *Enterobacter cloacae*	Alcohol-caused cirrhosis
3	M	62	Belgium	5 Jan 1982	Expectoration	*Enterobacter agglomerans*	Pneumoconiosis
3	F	62	Belgium	5 Jan 1982	Tracheal secretions	0	Diabetes, asthma
2	M	74	Southern France	6 Aug 1983	Tracheal, nasal, and buccal secretions	*Proteus mirabilis*	Glioblastoma
12	M	?[c]	Southern France	Jul 1988	Extra-articular wound of knee	0	
4	M	70	Southern France	7 Oct 1990	Bile	0	
Present case	M	83	Southern France	19 Jul 1993	Blood	0	Adenocarcinoma of antrum

[a] F, female; M, male.
[b] Oct, October; Jan, January; Aug, August; Jul, July.
[c] ?, unknown.

TABLE 3. Antibiotic susceptibility of *S. ficaria*

Antibiotic(s)	Susceptibility of strains to antibiotic (no. of strains)[a]							
	14 environmental strains [8][b]	1 patient strain [6]	1 patient strain [11]	2 patient strains [3]	1 patient strain [12]	1 patient strain, 12 environmental strains [2]	1 patient strain [4]	1 patient strain (present case)
Amikacin	S (14)	S	S		S	S (13)	S	S
Amoxicillin				S (2)				I
Amoxicillin + clavulanic acid							S	I
Ampicillin	I (3), R (11)		R	S (2)	R	R (13)	S	
Aztreonam							S	S
Carbenicillin	S (14)	S	S	S (2)	S			
Cefoxitin								R
Cephalothin	R (14)	R	R	R (2)	R		R	R
IIIGC[c]					S	S (13)	S	S
Chloramphenicol	S (14)	MR	S	S (2)	S		S	S
Colistin	S (13), R (1dz)[d]		R	R (2dz)	S	S (10), R (3, 1dz)	S	R (dz)
Furadoin	R (14)				R			
Gentamicin	S (14)	S	S	S (2)	S	S (13)	S	S
Imipenem							S	S
Kanamycin	S (14)	MR	S	S (2)	S	S (13)		
Minocycline	S (12), I (2)			S (2)			S	
Nalidixic acid	S (14)	S	S		S		S	S
Netilmicin					S	S (13)		S
Pefloxacin						S (13)	S	S
Piperacillin							S	S
Rifampin	S (14)				R			I
Streptomycin	S (14)	R	S	S (2)	S	S (13)		
Sulfa drugs	S (14)		S		S			
Tetracycline	S (1), I (12), R (1)		S		R			S
Ticarcillin							S	S
Tobramycin	S (14)	S	S		S	S (13)	S	S
Trimethoprim	S (14)				S			
Trimethoprim-sulfamethoxazole			S	S (2)			S	S

[a] S, susceptible; I, intermediately susceptible; R, resistant; MR, moderately resistant (term used by Gill et al. in their report [6]).
[b] The number in brackets is the reference.
[c] III GC, expanded-spectrum cephalosporins.
[d] dz, double-zone phenomenon.

study. Starr et al. described a selective culture medium which could be used in these investigations (13).

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