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CASE REPORT

Serratia marcescens Necrotizing Fasciitis Presenting as Bilateral Breast Necrosis

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***Serratia marcescens* is an extremely rare cause of necrotizing fasciitis. We report the first case of necrotizing fasciitis of the chest wall due to infection with *S. marcescens* that initially manifested as bilateral breast necrosis. The patient had a fulminant course leading to death within 72 h of presentation. Literature pertinent to *S. marcescens*-mediated necrotizing fasciitis is also reviewed.**

CASE REPORT

A 54-year-old woman with a history of lupus and end-stage renal disease requiring long-term dialysis presented with the chief complaint of bilateral mastalgia for 4 days. Eighteen months prior to presentation, the patient developed central venous catheter-related superior vena cava (SVC) stenosis that proved refractory to angioplastic interventions. The subsequent clinical course was marked by progressive symmetric enlargement of her breasts from cup size B at baseline to larger than DD. A high-output left upper extremity arteriovenous (AV) fistula—originally created to provide hemodialysis access—appeared to be contributing to central venous congestion and breast engorgement. Five days prior to presentation, the AV fistula was ligated. The following day, the patient developed severe pain in both her breasts. There was no report of fever or chills. Home medications included 10 mg prednisone per day for immune thrombocytopenic purpura. The patient denied prior or current alcohol or intravenous drug use.

Initial vital signs were as follows: temperature, 97.9°F; blood pressure, 81/58 mm Hg; heart rate, 114 beats per minute; respiratory rate, 22 breaths per minute; and arterial oxygen saturation, 96% while breathing room air. The general assessment was remarkable for facial plethora and bilateral upper extremity swelling. There was massive enlargement of both breasts with hyperpigmentation of overlying skin. The breasts were warm, tender, and edematous, without any palpable masses or a nipple discharge. The AV fistula ligation appeared uninfected. The patient was noted to have no indwelling vascular access catheters.

On laboratory workup, a complete blood count revealed leukopenia with left shift (white blood cells, 2.5×10^3 per mm^3; segmented neutrophils, 74%; bands, 9%; metamyelocytes, 5%; myelocytes, 3%; lymphocytes, 5%; monocytes, 5%; and eosinophils, 1%) and thrombocytopenia (52,000 per mm^3). A chemistry panel showed a metabolic acidosis with an elevated lactic acid level (4 mmol/liter). A test for human immunodeficiency virus (HIV) was negative.

The patient was diagnosed with severe sepsis. Management was initiated in accordance with the institution's severe sepsis and septic shock protocol. Two sets of blood cultures were obtained using separate venipuncture sites, and an empirical antibiotic regimen comprising vancomycin, piperacillin-tazobactam, and ciprofloxacin was instituted. Blood culture bottles (BD Bactec Plus Aerobic/F and BD Bactec Lytic/10 Anaerobic/F, 2 sets each) were incubated in the BD Bactec FX blood culture system. Fourteen hours later, the cultures turned positive. Gram staining revealed the presence of a Gram-negative rod in 3 of 4 culture bottles. Selective media were inoculated, with the following results: MacConkey agar showed the growth of a lactose nonfermenting organism; triple sugar iron (TSI) agar showed an alkaline/acid reaction without gas formation; and phenylethyl alcohol (PEA) blood agar showed no growth. Subsequent identification and antimicrobial susceptibility testing were carried out using the automated Siemens MicroScan WalkAway96 system. The organism was finally identified to the species level as *Serratia marcescens*, with the susceptibility profile shown in Table 1.

With worsening breast examination and rising lactic acid levels, the patient was taken to the operating room, where both breasts were confirmed to be nonviable and were removed. The chest wall underneath the breasts demonstrated evidence of necrotizing fasciitis and pectoral myonecrosis. A radical chest wall debridement that included the pectoral fascia and the bulk of the pectoralis major and pectoralis minor muscles bilaterally was performed. Intraoperative cultures from the deep pectoral fascia also grew back *S. marcescens* with a susceptibility profile similar to that of the organism growing from the blood (Table 1). The antibiotic regimen was modified to doripenem to cover multidrug resistance. However, the patient continued to deteriorate clinically and, despite maximal supportive care, died of overwhelming septic shock.

Necrotizing fasciitis is an uncommon life-threatening soft tissue infection (7). The clinical syndrome is characterized by widespread subcutaneous fascial and fat necrosis associated with severe systemic toxicity. Early debridement, intravenous antibiotics, and supportive care are the cornerstones of therapy (12, 17). A variety of microorganisms—Gram-positive cocci, Gram-negative rods,

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TABLE 1 Antimicrobial susceptibility profile of *S. marcescens* isolates from blood and breast tissue

Antibiotic	MIC (μg/ml)[a]	
	Isolate from blood	Isolate from breast
Amikacin	≤4 (S)	≤16 (S)
Amoxicillin/K clavulanate		>16/8 (R)
Ampicillin	16 (I)	>16 (R)
Ampicillin/sulbactam	16/8 (I)	16/8 (I)
Aztreonam	≤8 (S)	≤8 (S)
Cefotaxime	>32 (R)	≤2 (S)
Cefotaxime/K clavulanate	>4	4
Ceftazidime	4 (S)	≤1 (S)
Ceftazidime/K clavulanate	>2	≤0.25
Ceftriaxone	>32 (R)	≤8 (S)
Cefuroxime	>16 (R)	>16 (R)
Ciprofloxacin	≤1 (S)	≤1 (S)
Ertapenem		≤2 (S)
Gentamicin	2 (S)	≤4 (S)
Imipenem	2 (S)	≤4 (S)
Levofloxacin	≤2 (S)	≤2 (S)
Meropenem	≤4 (S)	≤4 (S)
Moxifloxacin	≤2 (S)	≤2 (S)
Tetracycline		8 (I)
Ticarcillin/K clavulanate	≤16 (S)	≤16 (S)
Tobramycin	4 (S)	≤4 (S)
Trimethoprim-sulfamethoxazole	≤2/38 (S)	≤2/38 (S)

[a] S, susceptible; I, intermediate; R, resistant. MICs were determined with the use of the Siemens MicroScan system using the Gram-negative NC44 tray for the isolate from blood and NBPC34 tray for the isolate from breast tissue. Formal testing for extended-spectrum β-lactamase production was not performed.

and anaerobes—have been implicated as etiologic agents. *S. marcescens* is an extremely rare cause of necrotizing fasciitis.

S. marcescens is a Gram-negative aerobic bacillus belonging to the family *Enterobacteriaceae*. *Serratia* species are widely distributed in nature and in hospitals and may even be found as commensals in the human gut microbiota. In recent years, *S. marcescens* has been increasingly recognized as an important and frequent opportunistic pathogen. *Serratia* species rank among the 10 most common causes of bacteremia (3) and skin and soft tissue infections (13), accounting for 1.4% and 2.0% of cases, respectively. Epidemiologic studies have shown an incidence rate of 1.3 cases of *Serratia* bacteremia per a population of 100,000 (6). A substantial proportion (47%) of these events originates in the community. Thus, *Serratia* is not a strict nosocomial pathogen and frequently causes disease in nonhospital settings. Around a third of patients with *Serratia* bacteremia are not alive 6 months after diagnosis (6). While non-*marcescens Serratia* species may be pathogenic, more than 90% of isolates in humans are *S. marcescens* (9). A high rate of antimicrobial resistance has not been shown in epidemiologic studies, though a few reports do indicate the presence of multidrug-resistant strains (1, 6, 9).

The exact mechanisms underlying the virulence of *S. marcescens* in humans are not completely known. Culture filtrates prepared from *S. marcescens* are toxic to mammalian cells (4), including human fibroblasts (14). *S. marcescens* secretes a broad array of factors, including a hemolysin, a nuclease, a metalloprotease, serine proteases, siderophores, and lipases (1). Molecular studies have shown a secreted 56-kDa metalloprotease (common to all *S. marcescens* strains) to be a critical mediator of cytotoxicity *in vitro* (11). Whether neutralization of this metalloprotease *in vivo* has any therapeutic utility remains to be explored.

To identify previously reported cases of *S. marcescens*-mediated necrotizing fasciitis, a Medline search was performed using the search terms necrotizing fasciitis, *Serratia*, and *Serratia marcescens*. The search was limited to the English language literature published between January 1966 and September 2011. Reference lists of identified reports were also reviewed to find additional cases of *S. marcescens* necrotizing fasciitis. As a result, 9 previously reported cases were identified (Table 2) (2, 5, 8, 10, 15, 16, 19, 21). Overall, a lower extremity was the most common site of infection, being involved in 7 out of 10 (70%) patients. The present case constitutes the first report of *S. marcescens* causing necrotizing fasciitis of the chest wall.

A known immunocompromised state was not always identified in previous reports. None of the patients were infected with HIV, even though all cases emerged after 1985. Several comorbidities and risk factors that might have contributed to enhanced susceptibility to infection with *S. marcescens* were noted. Advanced renal disease was present in 4 of 10 patients, with 3 patients receiving scheduled hemodialysis. Corticosteroid use was reported in 3 of 10 patients. Three patients had diabetes mellitus, 2 had lupus, and 1 had received chemotherapy for lung cancer. The antibiotic

TABLE 2 Reported cases of *S. marcescens* necrotizing fasciitis, 1966 to present

Case no.	Reference	Age (yr)/ sex[a]	Comorbidity(ies) and/or risk factor(s)[b]	Site of infection	Initial antibiotic(s)	Outcome
1	Rimailho et al. (1987) (16)	74/M	NSAID	Right leg	Not reported	Died
2	Zipper et al. (1996) (21)	55/F	Diabetes mellitus	Right leg	Ceftizoxime, clindamycin	Survived
3	Huang et al. (1999) (8)	73/M	Nephrotic syndrome, corticosteroid	Right leg	Ciprofloxacin	Died[c]
4	Huang et al. (1999) (8)	40/M	ESRD (hemodialysis), lupus, skin biopsy, corticosteroid	Left leg	Ceftazidime	Survived
5	Liangpunsakul and Pursell (2001) (10)	66/F	None	Left leg	Penicillin G, clindamycin	Died
6	Newton et al. (2002) (15)	2/F	None	Neck	Vancomycin, cefotaxime, amikacin, clindamycin	Died
7	Bachmeyer et al. (2004) (2)	49/M	Lung cancer s/p chemotherapy, ischemic heart disease, diabetes mellitus	Left leg	Piperacillin-tazobactam, amikacin	Died[c]
8	Curtis et al. (2005) (5)	51/M	ESRD (hemodialysis), diabetes mellitus, heart failure	Left leg	Vancomycin, ciprofloxacin, clindamycin	Died
9	Statham et al. (2009) (19)	6/M	Recurrent otitis media, recurrent pharyngitis	Neck	Vancomycin, cefepime, clindamycin	Survived
10	Present case (2011)	43/F	ESRD (hemodialysis), lupus, SVC syndrome, ligation of arteriovenous fistula, corticosteroid	Chest wall	Vancomycin, piperacillin-tazobactam, ciprofloxacin	Died

[a] M, male; F, female.
[b] NSAID, nonsteroidal anti-inflammatory drugs; ESRD, end-stage renal disease; s/p chemotherapy, status postchemotherapy; SVC, superior vena cava.
[c] Death was from aspiration pneumonia and gastrointestinal bleeding (case 3) or metastatic small cell lung cancer (case 7), not necrotizing fasciitis *per se*.

susceptibility profile of the isolated *S. marcescens* was reported only by Curtis et al. (5), who found their isolate to be resistant to ampicillin, cefazolin, and cefuroxime but susceptible to ceftriaxone, cefepime, piperacillin-tazobactam, imipenem, ciprofloxacin, and gentamicin. All patients underwent early surgical debridement; nonetheless, 7 out of 10 patients (70%) had a fatal outcome. Septic shock with multiorgan failure was the most frequent pathophysiological syndrome leading to death.

In our patient, necrotizing fasciitis of the chest wall might have started with direct seeding of the pectoral fascia through a break in the overlying skin. Alternatively, the chest wall fascia might have become secondarily involved due to hematogenous dissemination. Our patient had several predisposing conditions for invasive soft tissue and bloodstream infections. Chronic hemodialysis and corticosteroid use have previously been shown to be risk factors for Gram-negative rod bacteremia (18, 20). Whether prior splenectomy in our patient contributed to infection with *S. marcescens* is not entirely clear. *S. marcescens* is not an encapsulated organism, and splenectomized patients have not been shown to be at increased risk for infections with *Serratia* spp.

In conclusion, we report a case of fulminant necrotizing fasciitis presenting as bilateral breast necrosis. To our knowledge, this is the first reported case of necrotizing pectoral fasciitis due to infection with *S. marcescens*. Despite the unusual presentation, this case illustrates the significant morbidity and mortality that can be associated with *S. marcescens* infections. Moreover, it highlights that in patients with lupus and renal failure presenting with necrotizing fasciitis, the initial antibiotic coverage should be broad enough to cover for multidrug-resistant Gram-negative bacilli such as *S. marcescens*.

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