A 26 year old pregnant woman with antithrombin III deficiency developed recurrent septicemia with *Serratia marcescens*. In spite of the administration of antibiotics, high grade fever persisted. She subsequently manifested lower abdominal pain, and spontaneous abortion occurred. After the abortion, she became completely afebrile. The amnion was turbid, and microscopic examination of the placenta showed haemorrhage and massive infiltration of neutrophils, suggestive of infectious chorioamnionitis. Pulsed field gel electrophoresis showed that isolates from the blood, urine, and vaginal discharge were genetically identical. Intravenous pyelography revealed that she had a bilateral completed double ureter. It was thought that a urinary tract anomaly caused infection with *S marcescens*, and the pathogen spread to the chorioamnion via the bloodstream. This is the first report of chorioamnionitis caused by *S marcescens* in a non-immunocompromised host. In addition, these findings indicate that the chorioamnion can serve as a site for persistent infection in normal pregnancies.

Several serratia species are widely distributed in nature: in freshwater and saltwater, on leaves, fruits, and vegetables. However, the only serratia species frequently isolated in hospitals is *S marcescens*. This pathogen, which sometimes colonises respiratory and urinary tracts, can be responsible for nosocomial infection, mostly in immunocompromised hosts.1,2

“There have been no reports describing chorioamnionitis caused by *Serratia marcescens*”

Clinically evident intrauterine infection occurs in approximately 2–11% of normal pregnancies.3 Among various pathogens resulting in chorioamnionitis, the most prevalent are *Ureaplasma urealyticum*, *Mycoplasma hominis*, and *Prevotella bivia*.4 However, there have been no reports describing chorioamnionitis caused by *S marcescens*. Here, we present a pregnant woman in whom chorioamnionitis with *S marcescens* caused recurrent septicaemia in spite of treatment with antibiotics. Pathological analyses of the placenta showed that the chorioamnion served as a site for persistent infection in this patient.

CASE REPORT
A 26 year old pregnant woman with no past history was admitted to a local hospital because of gait disturbance on 15 June 2000. Physical examination showed severe tenderness and flaring in the lower left extremity. Ultrasonographic examination revealed the existence of deep vein thrombosis (DVT) from the left common iliac vein to the femoral vein. She was referred to our hospital in the 10th week of pregnancy. Complete blood counts and blood chemistry were normal. Coagulation studies were as follows: prothrombin time, 12.7 seconds (control, 14.1); activated partial thromboplastin time, 38.1 seconds (control, 36.0); fibrinogen, 2430 mg/litre; fibrin degradation products, 293 µg/ml; D-dimer, 1207 ng/ml; protein C activity, 83%; protein S activity, 93%; and antithrombin III (AT III) activity, 52%. Considering her family history, which suggests multiple episodes of DVT, she was diagnosed as having AT III deficiency, and was treated with continuous infusion of heparin.

On the 17th day of treatment, she suddenly became feverish (38.6°C) and was empirically treated with cefotiam, 1 g every 12 hours for five days, which completely resolved the symptoms. Although blood culture revealed bacteraemia with *S marcescens* determined by Gram stain and VITEC 2 Gram negative identification cards (Japan bioMedieux, Tokyo, Japan), the focus of the infection was not determined by cultures of her urine, vaginal discharge, or heparin preparation. The minimum inhibitory concentrations (MICs) of this organism were < 0.5 mg/litre for both ceftazidine (CAZ) and imipenem/cilastatin (IPM/CS). On the 30th hospital day, she had a repeated feverish episode. She was treated with CAZ, 1 g every 12 hours, which soon relieved the fever. However, she again had high grade fever on the 38th hospital day, in spite of the continued administration of CAZ. She was then treated with IPM/CS, 0.5 g every 12 hours for four days, which brought a resolution of the fever, and the antibiotic was administered for eight additional days. In both of these episodes, *S marcescens* was isolated from her blood cultures, which showed MICs < 0.5 mg/litre for both CAZ and IPM/CS. After 12 days cessation of IPM/CS, she was discharged without fever. However, nine days later, she was readmitted because of fever and lower abdominal pain, with a small amount of genital bleeding. Ultrasonography of the abdomen showed no abnormality in the fetus. All of the cultures obtained from her blood, urine, and vaginal discharge on admission revealed infection with *S marcescens*, with MICs < 0.5 mg/litre for both CAZ and IPM/CS. Although she was treated with ceftriaxone (1.0 g intravenously, once a day) and subsequently with IPM/CS (0.5 g intravenously, every 12 hours), amniorrhexis and spontaneous abortion occurred. After the abortion, she became completely afebrile. The amnion was turbid, and microscopic examination of the placenta showed haemorrhage and massive infiltration of neutrophils, suggestive of infectious chorioamnionitis. After the event, *S marcescens* was not isolated from her urine or genital discharge. Pulsed field gel electrophoresis (PFGE) showed that isolates from the blood, urine, and vaginal discharge were genetically identical. Intravenous pyelography showed that she had a bilateral completed double ureter. It was thought that a urinary tract anomaly caused infection with *S marcescens*, and the pathogen spread to the chorioamnion via the bloodstream. This is the first report of chorioamnionitis caused by *S marcescens* in a non-immunocompromised host. In addition, these findings indicate that the chorioamnion can serve as a site for persistent infection in normal pregnancies.

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Abbreviations: AT III, antithrombin III; CAZ, ceftazidime; DVD, deep vein thrombosis; IPM/CS, imipenem/cilastatin; MIC, minimum inhibitory concentration; PFGE, pulsed field gel electrophoresis
discharge were identical (fig 1). Intravenous pyelography was performed to clarify the route of infection, which showed a bilateral completed double ureter. The administration of IPM/CS was stopped on the seventh day after abortion.

DISCUSSION

Because *S. marcescens* is a pathogen that sometimes causes nosocomial infection, we first suspected that the pathogen had been transmitted via the intravenous route of medication in our present patient. However, this possibility was excluded, because none of the cultures of the heparin preparations administered to this patient showed contamination with *S. marcescens*. It is well known that *S. marcescens* can occasionally be found on the skin of healthy persons. Because our present patient was a non-immunocompromised woman with a urinary tract anomaly, the original site of infection with *S. marcescens* may have been the urethra. Based on the results of PFGE analysis (fig 1), we further speculated that infection with *S. marcescens* spread from the urinary tract to the chorioamnion via the bloodstream.

‘‘It is noteworthy that treatment with imipenem/cilastatin could not eradicate *Serratia marcescens* in spite of its susceptibility to this antibiotic’’

Thus, we think that *S. marcescens* survived in the chorioamnion, and resulted in recurrent septicemia, in spite of intensive intravenous administration of antibiotics. Although *S. marcescens* is a well known pathogen that frequently develops multidrug resistance, it usually retains in vitro susceptibility to IPM/CS. Indeed, *S. marcescens* isolated from our present patient showed a low MIC for IPM/CS. It is noteworthy that treatment with IPM/CS could not eradicate *S. marcescens* in spite of its susceptibility to this antibiotic, resulting in repeated febrile episodes and septicemia. Our findings indicate that *S. marcescens* causes chorioamnionitis even in non-immunocompromised hosts, and once the infection occurs, the chorioamnion may serve as a site for persistent infection. To our knowledge, this is the first report describing chorioamnionitis caused by *S. marcescens* in a normal pregnancy.

**Take home messages**

- We describe a 26 year old pregnant woman who developed recurrent septicemia with *Serratia marcescens*. 
- Despite the administration of antibiotics, high grade fever persisted and spontaneous abortion occurred, probably as a result of infectious chorioamnionitis.
- This patient had a bilateral completed double ureter, and this anomaly may have caused infection with *S. marcescens*, which spread to the chorioamnion via the bloodstream.
- This is the first report of chorioamnionitis caused by *S. marcescens* in a non-immunocompromised host.
- The chorioamnion may serve as a site for persistent infection in normal pregnancies.

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**REFERENCES**

Chorioamnionitis caused by *Serratia marcescens* in a non-immunocompromised host

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