

Serratia Marcescens: A Serious Death Causing Agent for Neonates

SERRATIA MARCESCENS: YENİDOĞAN İÇİN ÖLÜME SEBEBİYET VEREN CİDDİ BİR AJAN

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Summary

Serratia marcescens is a serious death causing agent especially for prematures and low birth weighted neonates, and has become an important cause of nosocomial infection over the last 30 years. In this report, we describe the course of the outbreak we had experienced and the measures taken to control it.

Serratia marcescens was isolated from ten patients (eight from NICU and two from nursery). All isolates were from blood and were sensitive to imipenem, meropenem, amikacin and ciprofloxacin. Except one case again all were sensitive to cephaperazone. Fifty percent (4/8) of newborns were lost. Six of eight neonates were prematures, and three deaths occurred were from these six prematures. Except two neonates, birth weight of all neonates were below 2500 grams. Cultures taken to find out the source of outbreak did not result as a certain one, but positive culture obtained from an aspirator was blamed for the rapid spread of the bacteria.

Serratia marcescens is a serious death causing agent especially for prematures and low birthweighted neonates. Respiratory, gastrointestinal and cardiovascular systems are mostly affected and serious measures including the temporarily closure of units to new admissions should be taken to control the spread.

Key Words: Neonatal intensive care unit,
Neonatal sepsis, Nosocomial infection,
Serratia marcescens

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Serratia marcescens is a motile, non-sporulating gram negative bacillus classified in the family enterobacteriaceae. It was long considered non-pathogenic for human and since 1950, sporadic infections by this microorganism have been described. Over the last 30 years *Serratia* has become an important cause of nosocomial infections (1).

The first description of nosocomial infection caused by *Serratia marcescens* was Wheat et al's report of 11 cases over a six month period in 1951 (2). So far it has been recognized as a cause of hospital acquired infection for last decades.

Recently our Neonatal Intensive Care Unit (NICU) and nursery experienced an outbreak with *Serratia marcescens* that was controlled by serious measures

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Özet

Serratia marcescens özellikle prematür ve düşük doğum ağırlıklı yenidoğanlar için ölüme sebebiyet veren ciddi bir ajandır ve otuz yıldan beridir önemli bir hastane enfeksiyonu etkeni olmuştur. Bu yazıda, tecrübe edilmiş bir salgın ve onu kontrol etmek için alınmış olan tedbirleri tanımladık.

Serratia marcescens on hastada izole edildi (sekizi yenidoğan yoğun bakım ünitesi ve ikisi servisten). Tüm izolasyonlar kandandı ve hepsi imipenem, meropenem, amikasin ve siprofloksasine duyarlıydılar. Yine biri hariç hepsi sefaperazona duyarlıydılar. Yenidoğanların yüzde ellisi (4/8) kaybedildi. Sekiz yenidoğanın altısı prematüre idi ve oluşan ölümlerin üçü bu altı prematüredendi. Salgının kaynağını bulmak için alınan kültürler kesin bir sonuç vermedi, ancak bir aspiratörden alınan pozitif kültür hızlı yayılım için suçlandı.

Serratia marcescens, özellikle prematür ve düşük doğum ağırlıklı yenidoğanlar için ölüme sebep olan ciddi bir ajandır. Solunum, gastrointestinal ve kardiovasküler sistemler en çok etkilenir ve salgını kontrol etmek için üniteyi yeni hasta kabulüne geçici olarak kapamayı da içeren ciddi tedbirler alınmalıdır.

Anahtar Kelimeler: Yenidoğan yoğun bakım ünitesi,
Yenidoğan sepsisi, Hastane enfeksiyonu,
Serratia marcescens

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including the closure of the NICU to new admissions. These measures ultimately limited the outbreak to ten cases. In this report, we describe the course of the outbreak and the measures taken to control it.

Patients and Methods

Our NICU is a department comprising 17 cots with an opening door to nursery. The nursing staff caring for the infants in NICU has no contact with nursery during duty. An isolation room, used for breastfeeding by neonates' mothers, is present between the opening door of NICU and nursery.

The eight patients from NICU and two patients from nursery had infection with *Serratia marcescens*. All

patients were searched for clinical symptoms and signs developed, the course of the sepsis, clinical outcome, features such as birth weight, prematurity and laboratory data including C-reactive protein (CRP), complete blood count (CBC), peripheric blood smear (PS), cultures from blood, cerebrospinal fluid, stool and urine and antibiotic resistance (3). Bactec automatized technique was used for blood cultures. Hypoactivity, hypothermia or hyperthermia, pallor, cyanosis, jaundice, lethargy, apnea, cyanosis, poor peripheric circulation, hepatosplenomegaly, hypo/hyperglycemia, gastrointestinal symptoms (vomiting, abdominal distention and diarrhea), cutis marmoratus and poor sucking were determined as clinical signs and symptoms of sepsis (4,5). Total leukocyte count $<5000/mm^3$ or $>24000/mm^3$, low or high absolute neutrophil count according to Monroe's referance range, immature/mature neutrophil rate ≥ 0.3 , immature/total neutrophil rate ≥ 0.2 and platelet count $<150,000/mm^3$ were accepted as laboratory data supporting sepsis (4,5). Further evaluation such as echocardiography was performed to patients if needed. First line antibiotic treatment which was ampicilin+gentamicin in our NICU was converted to imipenem+amikacin after positive blood cultures obtained for first two cases and this treatment was applied to all cases.

After the begining of outbreak, the cultures of humidifiers, incubators, ventilators, disinfectant solutions, aspirators, intravenous fluids, delivery room materials and stuff hands were taken to find out the source of outbreak (6).

Results

Between December 2000 and January 2001 *Serratia marcescens* was isolated from ten patients (eight from NICU and two from nursery). All isolates were from blood and were sensitive to imipenem, meropenem, amikacin and

ciprofloxacin. Except one case again all were sensitive to cephalosporins.

All of eight neonates had sepsis clinic as described on Table 1 and four of them died. Although two patients who were from nursery had serious course including ventilation assistance and massive transfusions, no deaths occurred. The four-month-aged infant had developed hepatosplenomegaly, cardiac murmur, cyanosis, fever and respiratory insufficiency. Echocardiography was performed for cardiac murmur and it showed patent foramen ovale for this case. Later on resistant thrombocytopenia and gastrointestinal bleeding were added to clinics but prognosis was so good that he was discharged at 30th day. The five-year-old girl had only hepatosplenomegaly, fever and anemia; so that the course was better than the others and she was discharged at 12th day.

When NICU is considered, the severity of sepsis was significant. Fifty percent (4/8) of newborns were lost. Six of eight neonates were prematures, and three deaths occurred were from these six prematures. Except two neonates, birth weight of all neonates were below 2500 grams. Cyanosis, fever, hepatosplenomegaly, gastrointestinal bleeding, cardiac murmur and respiratory insufficiency were observed as the leading signs of infection. Only one patient developed arthritis. (Table 1). Echocardiography showed pulmoner hypertension with tricuspid insufficiency for Case 6 and patent ductus arteriosus for Case 8. General situation of Case 2 did not allow any further evaluation such as echocardiography and this case was lost at the second day. Mortality days for Case 1, 2, 4 and 7 were as 3, 2, 3, and 4 consecutively. Day of discharge for Case 3, 5, 6 and 8 were as 34th, 20th, 24th and 43rd days.

C-reactive protein level was measured for five

Table 1. Clinical and laboratory characteristics of patients

Case number	1	2	3	4	5	6	7	8	9	10
Gestational age (week)	33	34	39	39	34	32	28	31		
Birth weight (g)	2300	2310			2950	2400	1640	1600		
Age at diagnosis (day for newborns)	5	5	4	3	3	20	4	4	5 years	4 months
Signs of infection	Cyanosis HSM, GI bleeding	Cyanosis HSM, GI bleeding, cardiac murmur	Fever, arthritis	Cyanosis, Resp.ins.	Fever Resp.ins GI bleeding	Fever, cardiac murmur	Fever Resp.ins.	Fever, Resp.ins., Cyanosis, cardiac murmur	Fever, HSM, anemia	Fever, Resp İns., GI bleeding, cardiac murmur
Immature/mature	0,36	0,45	0,45	0,4	0,3	0,4	0,5	0,3	0,4	0,3
Thrombocytopenia	-	+	+	+	+	+	-	-	+	-
Anemia	+	+	+	-	-	-	-	-	+	-
Outcome	Ex	Ex	H	Ex	H	H	Ex	H	H	H

HSM:hepatosplenomegaly
Ex:exitus
GI:gastrointestinal
Resp.ins.:respiratory insufficiency

neonates and all were high. Three of eight neonates developed anemia whereas thrombocytopenia was observed in 5/8 of neonates. Immature/mature ratio was high in all patients. Cultures taken to find out the source of outbreak did not result as a certain one, but positive culture obtained from an aspirator was blamed for the rapid spread of the bacteria.

Discussion

Reports of nosocomial outbreaks due to *Serratia marcescens* date from 1965 and the following sources of nosocomial epidemics have been cited; sinks, food, plants, sponges, distilled water, disinfectant solutions, hand solutions, shaving soap and brushes, EDTA blood collecting tubes, mechanical respirators, nebulizers, intravenous catheters, intravenous solutions, plasma derivatives, blood transfusions, breast pumps and soaps (7). *Serratia marcescens* can be isolated from floor dust in rooms where colonized patients are housed, but the major route of spread is by hands of temporarily colonized personnel (8). Point source of epidemics are rare. In most cases the presumed source of infection is an infected neonate, but how these neonates acquire the infection often remains unknown (6,9).

The outbreak was recognized when three neonates on the NICU developed septicemia at the same time and due to antibiograms the treatment modality was changed to imipenem+amikacin as the first step to which *Serratia* was sensitive.

The tendency of *Serratia marcescens* to spread rapidly on neonatal ward (10) made all measures including introduction of strict hygienic measures insufficient to halt the epidemic; so temporary closure of the department to new admissions became necessary. As reported at different papers, this limited the spread of the epidemics (9,11,12).

It has been shown that *Serratia marcescens* is a human pathogen capable of causing significant mortality, with the small premature infants being most at risk of serious infection (12). Zaidi et al (9) reported a 60 percent mortality rate for newborns weighting 2500 grams or less with *Serratia marcescens* infection. Also in our series, low birth weight and prematurity also appear as serious risk factors for mortality and morbidity. Aygün et al (13) had reported that surviving infants with *Serratia marcescens* septicemia had a greater birth weight and gestational age than the ones that died at their series.

Antibiotics used to treat *Serratia* infection include B-lactam agents, aminoglycosides and fluoroquinolones and different resistance mechanisms have been demonstrated (13). In our series, all isolates were sensitive to imipenem, meropenem, amikacin and ciprofloxacin, and except one all to cephalosporins. Since the majority of strains of *Serratia marcescens* have inducible cephalosporinase, it

was deemed necessary to change the antibiotic policy on our NICU to imipenem+amikacin (6).

As a result, *Serratia marcescens* is a serious death causing agent especially for prematures and low birthweighted neonates. Respiratory, gastrointestinal and cardiovascular systems are mostly affected and serious measures including the temporarily closure of units to new admissions should be taken to control the spread. It was reported that *Serratia marcescens* could survive on the hands of medical and nursing staff despite the institution of a strict handwashing protocol. This kind of observations underline the importance of the use of gloves to prevent spread of *Serratia marcescens* (3).

A keen awareness of the danger for the presence of this organism in a newborn unit and control of its spread will be necessary to prevent life threatening infection in the high risk newborn in the future.

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