Endemic *Serratia Marcescens* in A Neonatal Intensive Care Unit

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Objective : *To study the endemicity of Serratia marcescens in a neonatal intensive care unit (N.I.C.U).*
Material and Method : *During the first 4 months of 2001, neonates in the N.I.C.U. in a teaching hospital were screened for S.marcescens by serial throat swabs and collections of other appropriate clinical specimens. Environmental cultures were also done in the same period. Isolated S.marcescens were tested for antimicrobial susceptibility and for genotyping by pulsed field gel electrophoresis.*
Results : *During the period, 104 neonates were studied. S.marcescens were isolated in 34.6% of the cases. Environmental cultures were positive for S.marcescens in 1.4%. There were 10 patterns of antibiogram of the 190 strains isolated. All strains belonged to pulsotype A.*
Conclusion : *The study confirmed that S.marcescens was endemic in the N.I.C.U. and belonged to one genotype.*

Keywords : *Endemic, Serratia marcescens, Neonates, Neonatal intensive care unit*

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Serratia marcescens, a gram-negative facultative bacillus, is an important cause of nosocomial infections (N.I.)[1-3]. The infection commonly involves the respiratory tract, blood stream, urinary tract and skin. Severe infections by the organism have been reported in small children especially in neonatal intensive care unit (N.I.C.U.)[4-9], in immunocompromised patients and in patients who received prolonged courses of antimicrobial treatment[1]. However, most studies failed to identify the reservoirs of *S. marcescens* and the correlation between the strains isolated from patients and from their environments. Epidemiological study of *S. marcescens* could be performed by plasmid analysis[2], ribotyping[10,11], polymerase chain reaction (PCR)[9,12,13]. Total DNA analysis by pulsed field gel electrophoresis (P.F.G.E.) has been shown to be the best technique in outbreak studies[14-17].

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In Thailand, *S. marcescens* has long been a problem in high levels of antimicrobial resistance and in causing N.I. In late 2000, there was an increase in the incidence of *S.marcescens* cases in N.I.C.U. of a teaching hospital. An epidemiological study was carried out to verify the sources of and to eradicate the organism.

Material and Method

During the first 4 months of 2001, all neonates in the N.I.C.U. had their throat swabs taken for culture for *S.marcescens*. Other specimens were also collected for culture as appropriate. Throat swabs and tracheal secretion, if available, were collected on the first admission day and once a week thereafter. Environmental cultures of drug mixtures, inhalation sets, sinks, taps in the N.I.C.U. were done once a week. Isolation of *S. marcescens* was done by standard method[18]. Antimicrobial susceptibility was tested by Kirby-Bauer disk diffusion method[19]. Spe 1 restricted fragments of chromosomal DNA from *S. marcescens* were separated by pulsed field gel electrophoresis according to the

method recommended by Maslow JN et al.[20] The genotypes were determined using the criteria by Tenover FC et al[16].

Results

During the study period, 104 neonates were admitted into the N.I.C.U. and *S.marcescens* were cultured from 36 patients (34.6%). The organism was isolated in 184 specimens (Table 1). Throat swabs were the most common specimens (62.0%) from 53.4% of which *S.marcescens* were isolated. Tracheal secretion from endotracheal or tracheostomy tube attributed to 36.9% of total specimens. The yield of *S.marcescens* from tracheal secretion was 42.8%. During this period, environmental cultures were done and the results are illustrated in Table 2. Of the total 428 specimens, only 6 (1.4%) were positive for *S.marcescens*. Three positive cultures were from sink swabs (3.1%) and one positive specimen each was found in normal saline, drug mixture and inhalation set. All specimens from fluids in humidifiers/nebulizers, sink taps were negative for the organism. The antibiogram of all isolates of *S.marcescens* is shown in Table 3. All strains were resistant to ampicillin and ampicillin/clavulanic acid. There were 10 different patterns of antibiogram. Pulsed field gel electrophoresis of 184 strains of *S.marcescens* from patients and 6 strains from environments showed pulsotype A. Ten strains of *S.marcescens* from patients outside the N.I.C.U. were of other pulsotypes. In a follow up study 6 months later in the N.I.C.U., *S.marcescens* was isolated from tracheal secretion of 2 of 13 patients.

Table 1. Prevalence of *S.marcescens* from patients

Specimens	No. positive/total	%
Throat swab	124/232	53.4
Tracheal secretion	59/138	42.8
Urine	1/1	100.0
Pus	0/2	0
Eye discharge	0/1	0
Total	184/374	49.2

Table 2. Prevalence of *S.marcescens* in NICU environments

Environments	No. positive/total	%
Normal saline	1/32	3.1
Drug mixture	1/32	3.1
Inhalation set	1/5	20.0
Sinks	3/96	3.1
Sink taps	0/96	0
Inhalation fluid	0/167	0
Total	6/428	1.4

Table 3. Antibiograms of 190 strains of S.marcescens

Antimicrobial agents	Patterns 1	2	3	4	5	6	7	8	9	10
Ampicillin										
Amoxicillin/clavulanic acid										
Cefotaxime										
Ceftriazone										
Cefoperazone/sulbactam										
Ceftazidime										
Cefepime										
Imipenem										
Piperacillin										
Piperacillin/tazobactam										
Amikacin										
Gentamicin										
Netilmicin										
Ciprofloxacin										
Co-trimoxazole										

Empty spaces indicate resistant, gray spaces indicate sensitive

Discussion

In our N.I.C.U. in 2001, *S.marcescens* was an endemic bacteria. It was found in 34.6% of patients admitted during the study period. The organism was cultured from 49.2% of all specimens collected from patients (Table 1). The predominant specimens in the present study was from the respiratory tract. Many patients in N.I.C.U. had respiratory conditions and required respiratory support. This facilitated colonization or infection of the respiratory tract by intrinsic or extrinsic bacteria. In only one case, *S.marcescens* was isolated from urine. The high prevalence of the organisms in patients increased the chance of spreading them to other patients, to healthcare workers and to an inanimate environment. In surveillance cultures, only 6 of 428 specimens (1.4%) yielded *S.marcescens* (Table 2). The presence of this resistant baeteria, even in low percentage, posed the risk of transmitting the organism to patients. Strict contact precautions in nursing care are required to safeguard the patients. As shown in Table 3, there were 10 different patterns of antibiograms suggesting the heterogeneity of the strains of *S.marcescens*. By pulsed-field gel electrophoresis, however, all strains isolated from the N.I.C.U., from patients and from environment, belonged to one single pulsotype A. The findings indicated that *S.marcescens* were endemic in the N.I.C.U. and had the same pulsotype. Without genetic studies, the endemicity strain could not have been confirmed.

Conclusion

Serratia marcescens were isolated from 34.6% of neonates, 49.2% of clinical specimens, and 1.4% of environmental samples in the N.I.C.U. They were all proved to be the same pulsotype. Endemicity of the organism in the N.I.C.U. was confirmed.

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Serratia marcescens เป็นเชื้อประจำถิ่นในหออภิบาลเด็กแรกเกิด

เชิดศักดิ์ ธีระบุตร, ชาญวิทย์ ตรีพุทธรักษ์, พิณทิพย์ พงศ์เพชร, กุลกัญญา โชคไพบูลย์กิจ, สมหวัง ด่านชัยวิจิตร

วัตถุประสงค์: *ศึกษาความเป็นเชื้อประจำถิ่นในหออภิบาลเด็กแรกเกิดของเชื้อ Serratia marcescens*

วัสดุและวิธีการ: *ใน 4 เดือนแรกของพ.ศ. 2544, ตรวจหา S.marcescens ในเด็กแรกเกิดทุกรายในหออภิบาลเด็กแรกเกิดในโรงเรียนแพทย์แห่งหนึ่งโดยการป้ายลำคอเป็นระยะการเก็บตัวอย่างส่งเพาะเชื้อจากตำแหน่งอื่นร่วมกับการเพาะเชื้อจากสิ่งแวดล้อมในหออภิบาลในช่วงเวลาเดียวกัน. S.marcescens ที่แยกได้นำมาตรวจหาความไวต่อยาต้านจุลชีพและตรวจพันธุกรรมโดยวิธี pulsed-field gel electrophoresis*

ผลการศึกษา: *ผู้ป่วยที่ศึกษามี 104 ราย พบ S.marcescens ใน 34.6% ของผู้ป่วย และ 1.4% ของตัวอย่างที่เก็บจากสิ่งแวดล้อมในหออภิบาล. เชื้อที่แยกได้ 190 สายพันธุ์มีความไวต่อยาต้านจุลชีพ 10 แบบแผน ทุกสายพันธุ์มีแบบพันธุกรรม pulsotype A*

สรุป: *การศึกษานี้ยืนยันว่า S.marcescens เป็นเชื้อประจำในหออภิบาลเด็กแรกเกิดและมีพันธุกรรมเดียวกัน*