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= Abstract =

Neonatal Sepsis and Antimicrobial Susceptibilities in the Neonatal Intensive Care Unit and Nursery

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Background : To delineate the changes in the causative agents of neonatal sepsis and their antimicrobial susceptibilities in the neonatal intensive care unit and nursery of Hanyang University Hospital during the past 10 years.

Methods : Hospital records of 15,144 patients hospitalized at the NICU and nursery of Hanyang University Hospital from 1989 to 1998 were reviewed and neonates diagnosed of neonatal sepsis were sorted and included in the study. The study period was divided into Period A(the first 5 years) and Period B(the second 5 years) to analyse causative agents and their antimicrobial susceptibilities.

Results : Neonatal sepsis was diagnosed in 170 patients(1.1%(Period A 1.2%, Period B 1.0%)) among the total of 15,144 inpatients. Two hundred isolates(Period A 109 isolates, Period B 91 isolates) were identified in 186 blood cultures(Period A 99 cultures, Period B 87 cultures) from 170 patients(Period A 91 patients, Period B 79 patients). The average age at the onset of the disease, when the initial blood culture was drawn, was 12.3 days old(Period A 8.8 days, Period B 16.3 days), and the proportion of the early onset disease was 34.7% in Period A and 23.0% in Period B, indicating that neonatal sepsis developed earlier during Period A. Among the isolated organisms including Gram positive bacteria[132(66.0%)], Gram negative bacteria [60(30.0%)], and fungi[8(4.0%)], coagulase negative *Staphylococcus*(CNS) was the most common organism(69/34.5%), followed by *Staphylococcus aureus*(36/18.0%), *Klebsiella pneumoniae*(17/8.5%), *Enterococcus*(12/6.0%), *Enterobacter cloacae*(8/4.0%), *Escherichia coli*(6/3.0%), and *Pseudomonas aeruginosa*(5/2.5%). The isolated fungi were *Candida parapsilosis*, *Candida albicans*, and *Trichosporon pullulans*. CNS, *S. aureus* and *Acinetobacter baumannii* were isolated more frequently in Period A compared to Period B. Antimicrobial susceptibilities of CNS and *S. aureus* to methicillin and the first generation cephalo-

sporins were decreased in Period B compare to Period A, those to aminoglycosides were increased in Period B, and vancomycin resistant strains were not identified. *K. pneumoniae*, Enterococcus, *E. coli*, and *P. aeruginosa* were isolated less frequently in Period B, compared to Period A. For *K. pneumoniae*, antimicrobial susceptibilities to the first generation cephalosporins were low in both Periods A and B, those to tobramycin and gentamicin were increased in Period B, and those to amikacin, ceftriaxone, and trimethoprim-sulfamethoxazole were high in both Periods A and B. Antimicrobial susceptibilities of Enterococcus to ampicillin, penicillin, and the first generation cephalosporins were decreased in Period B, but vancomycin resistant strains were not identified.

Conclusion : The occurrence rate of neonatal sepsis during the past 10 years in the NICU and nursery of the Hanyang University hospital was 1.1%, and the most common causative agents were CNS and *S. aureus*, to which the antimicrobial susceptibilities to the first line drugs decreased in the later half of the study period with no vancomycin resistant isolates identified. Group B *Streptococcus* known to be the most common agent causing neonatal sepsis was not identified, and *K. pneumoniae* was isolated more commonly during the later half of the study period without decreased antimicrobial susceptibilities.

Key Words : Neonatal sepsis, Antimicrobial susceptibility, Neonatal intensive care unit

서 론

가 ²⁾.

10

가

1.

48

72

1989

1

1998

12

가

15,144

198

0.1~1%

가

¹⁾

coagulase negative Staphylococ-

가

170

cus, *Staphylococcus aureus* Group B streptococci

가

¹⁾

2.

10 1989 1993
Period A, 1994 1998 Period B 1.

, , 1.1%(170 /

15,144) , Period A 1.2%(91 /7,550),

povidone iodine Period B 1.0%(79 /7,594) .

75% 186 200 7†

brain heart infusion thioglycolate . 13 2 ,

0.5 mL 35°C 11 2 , 2 3

7 , 1 1

National Com- 2 .

mittee for Clinical Laboratory Standards(NCCLS) 170

12.3 Period A 8.8 , Period B

16.3 Period B† Period A

3

54 (29.2%) , Period A 34

(34.7%), Period B 20 (23.0%) (Table 1).

Table 1. Demographic Data of 170 Neonates with Culture Proven Sepsis

	Period A(n=7,550)*	Period B(n=7,594)	Total(n=15,144)
No. of patients	91(1.2%)	79(1.0%)	170(1.1%)
No. of episodes	99(1.3%)	87(1.1%)	186(1.2%)
No. of organisms	109(1.4%)	91(1.2%)	200(1.3%)
Age at (+) blood culture (d)	8.8±12.6	16.3±24.8	12.3±19.6
No. of episodes of early onset(≤3d)	34/98(34.7%)	20/87(23.0%)	54/185(29.2%)
Birth weight(gm)	2,360.8±904.7	2,407.3±1008.5	2,383.0±952.9
No. of LBW(<2,500 gm)	49/87(56.3%)	40/79(50.6%)	89/166(53.6%)
IUP(W)	36.0±4.7	35.9±4.7	36.0±4.7
No. of premature baby(<37 w)	42/89(47.2%)	34/77(44.2%)	76/166(45.8%)
Infants with central lines	36/91(39.6%)	23/79(29.1%)	59/170(34.7%)
Infants on TPN	11/91(12.1%)	22/79(27.9%)	33/170(19.4%)
Infants with central lines and TPN	8/91(8.8%)	12/79(15.2%)	20/170(11.8%)
Infants with mixed infection	10/91(11.0%)	4/79(5.1%)	14/170(8.3%)
Infants deceased	19/91(20.9%)	5/79(6.3%)	24/170(14.1%)
With central lines and TPN	3/8(37.5%)	2/12(16.7%)	5/20(25%)
With mixed infection	3/10(30%)	0/4(0%)	3/14(21.4%)
Infants discharged AMA	11/91(12.1%)	9/79(11.4%)	20/170(11.8%)
With central lines and TPN	0/8(0%)	1/12(8.3%)	1/20(5%)
With mixed infection	1/10(10%)	1/4(25%)	2/14(14.3%)

*Total number of neonates admitted to the NICU and the nursery during the study period
LBW : low birth weight infants, IUP : Intrauterine period, TPN : Total parenteral nutrition

2. ,
가 166
2,383.0 gm , Period A 2,360.8 gm, Peri-
od B 2,407.3 gm . 2,500
gm Period A 49
(56.3%) 1,699.6 gm, Period B 40
(50.6%) 1,529.3 gm . 가
166 Intrauterine period(IUP)
36.0 Period A 89 , 36.0 , Period B
77 , 35.9 . IUP 37 76
(45.8%) IUP 31.6 Period A
42 (47.2%) IUP 31.8 Peri-
od B 34 (44.2%) IUP 31.3
(Table 1).

[100%(6/6)],
K. pneumoniae[83.3%(10/12)], *E. cloacae*[75%(6/8)]
A. baumannii[75%(3/4)] .

3. ,
170 (Period A 91 , Period B 79
) 가
59 (34.7%) Period A 36 (39.6
%), Period B 23 (29.1%) ,
33 (19.4%) , Pe-
riod A 11 (12.1%), Period B 22 (27.9%) .
가

20 (11.8%) , Period A 8 (8.8%), Period B
12 (15.2%) . 가

20 5 (25%) , Pe-
riod A 3 (37.5%), Period B 2 (16.7%) ,
 . 14
3 (21.4%) ,
(Table 1).

170 (Period A 91 , Period B 79
) 2가
14 (8.3%) , Period A 10 (11%),
Period B 4 (5.1%) .

170 (Period A 91 , Period B 79
) 24 (14.1
%) , Period A 19 (20.9%), Period B 5 (6.3%)
 ,
20 (11.8%) , Period A 11 (12.1%),
Period B 9 (11.4%) .

4.
200
(Period A 109 , Period B 91)
132 (66.0%) 60 (30.0%),
8 (4.0%) (Table 2).

coagulase negative *Staphylococ-*
cus(CNS), *S. aureus*, *Enterococcus*가,

K. pneumoniae, *E. cloacae*, *E. coli*, *P. aerugino-*
sa *A. baumannii*가

, CNS가 69 (34.5%) 가
 , *S. aureus* 36 (18.0%),
K. pneumoniae 17 (8.5%), *Enterococcus* spp. 12
(6.0%), *E. cloacae* 8 (4.0%), *E. coli* 6 (3.0%), *P.*
aeruginosa 5 (2.5%) .

CNS, *S. aureus*, *A. baumannii*
Period A Period B 가 ,
Enterococcus spp., *K. pneumoniae*, *E. coli*, *P. aeru-*
ginosa Period A Period B

Candida parapsilosis, *Candida albicans*,
*Trichosporon pullulans*가 Period A
2.8% Period B 5.5% Period B 가
(Table 2).

가
[100.0%(8/8)], *E. cloacae*[87.5%(7/8)], *K. pneu-*
moniae[64.7%(11/17)], *S. aureus*[44.4%(16/36)], CNS
[21.7%(15/69)] .

5.
가
CNS, *S. aureus*, *Enterococcus* spp., *K. pneumoniae*,
E. cloacae, *E. coli*

Table 2. Microorganisms Isolated on Blood Cultures from Neonates with Sepsis

	Microorganism	Period A (n=109)	Period B (n=91)	Total (n=200)
Gram positive organisms	CNS	34(31.2%)	35(38.5%)	69(34.5%)
	<i>Staphylococcus aureus</i>	16(14.7%)	20(22.0%)	36(18.0%)
	Enterococcus	10(9.2%)	2(2.2%)	12(6.0%)
	<i>Streptococcus sanguis</i>	1(0.9%)	2(2.2%)	3(1.5%)
	β hemolytic streptococcus	1(0.9%)	2(2.2%)	3(1.5%)
	α hemolytic streptococcus	2(1.8%)	0(0.0%)	2(1.0%)
	Gram(+) bacilli	2(1.8%)	0(0.0%)	2(1.0%)
	<i>Streptococcus bovis</i>	0(0.0%)	2(2.2%)	2(1.0%)
	<i>Listeria monocytogenes</i>	1(0.9%)	0(0.0%)	1(0.5%)
	Streptococcus group F	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Aerococcus viridans</i>	0(0.0%)	1(1.1%)	1(0.5%)
	Total	68(62.4%)	64(70.3%)	132(66.0%)
Gram negative organisms	<i>Klebsiella pneumoniae</i>	15(13.8%)	2(2.2%)	17(8.5%)
	<i>Enterobacter cloacae</i>	4(3.7%)	4(4.4%)	8(4.0%)
	<i>Escherichia coli</i>	5(4.6%)	1(1.1%)	6(3.0%)
	<i>Pseudomonas aeruginosa</i>	5(4.6%)	0(0.0%)	5(2.5%)
	<i>Acinetobacter baumannii</i>	0(0.0%)	4(4.4%)	4(2.0%)
	<i>Alcaligenes xylosoxidans</i>	2(1.8%)	0(0.0%)	2(1.0%)
	<i>subspcies xylosoxidans</i>			
	<i>Acinetobacter junii</i>	0(0.0%)	2(2.2%)	2(1.0%)
	<i>Xanthomonas maltophilia</i>	0(0.0%)	2(2.2%)	2(1.0%)
	<i>Psudomonas picketti</i>	1(0.9%)	1(1.1%)	2(1.0%)
	<i>Acinetobacter calcoaceticus</i>	1(0.9%)	1(1.1%)	2(1.0%)
	<i>Aeromonas hydrophilia</i>	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Chryseobacterium meningosepticum</i>	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Klebsiella oxytoca</i>	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Pseudomonas spp.</i>	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Serratia marcescens</i>	1(0.9%)	0(0.0%)	1(0.5%)
	<i>Costomonas testosteroni</i>	0(0.0%)	1(1.1%)	1(0.5%)
	<i>Providencia alcalifaciens</i>	0(0.0%)	1(1.1%)	1(0.5%)
	Salmonella group E	0(0.0%)	1(1.1%)	1(0.5%)
	<i>Serratia fonticola</i>	0(0.0%)	1(1.1%)	1(0.5%)
	<i>Veillonella spp.</i>	0(0.0%)	1(1.1%)	1(0.5%)
	Total	38(34.9%)	22(24.2%)	60(30.0%)
Fungus	<i>Candida parapsilosis</i>	1(0.9%)	3(3.3%)	4(2.0%)
	<i>Candida albicans</i>	2(1.8%)	1(1.1%)	3(1.5%)
	<i>Trichosporon pullulans</i>	0(0.0%)	1(1.1%)	1(0.5%)
	Total	3(2.8%)	5(5.5%)	8(4.0%)

lin(Period A 3%, Period B 4.4%), methicillin(Period A 15.6%, Period B 9.1%), lincomycin(Period A 30 %, Period B 50%), cefazolin(Period A 70%, Period B 50%), chloramphenicol(Period A 76.7%, Period B 84.6%), amikacin(Period A 69.7%, Period B 96.2%), vancomycin(Period A 100%, Period B 100%)

methicillin cefazolin Period B
chloramphenicol amikacin
Period B
vancomycin (Fig. 1).

S. aureus
methicillin(Period A 35.7%, Period B 9.1%), 1
cephalosporin(Period A 42.9%, Period B 7.1%), ka-
namycin(Period A 20%, Period B 0%), gentamicin
(Period A 46.7%, Period B 58.8%), amikacin(Period
A 86.7%, Period B 100%), chloramphenicol(Period
A 100%, Period B 100%), vancomycin(Period A
100%, Period B 100%) methicillin 1 cepha-
losporin, kanamycin Period A
Period B, gentamicin

amikacin Period B
chloramphenicol vancomycin 100%
(Fig. 2).

K. pneumoniae
1 cephalosporin(Period A 6.3%, Period B 0
%), gentamicin(Period A 21.4%, Period B 50%),
tobramycin(Period A 41.7%, Period B 100%), amika-
cin(Period A 93.3%, Period B 100%), ceftriaxone
(Period A 100%, Period B 100%), Trimethoprim-sul-
famethoxazole(TMP-SMZ)(Period A 100%, Period B
100%) 1 cephalosporin Period A, B
tobramycin gentamicin
Period B amikacin

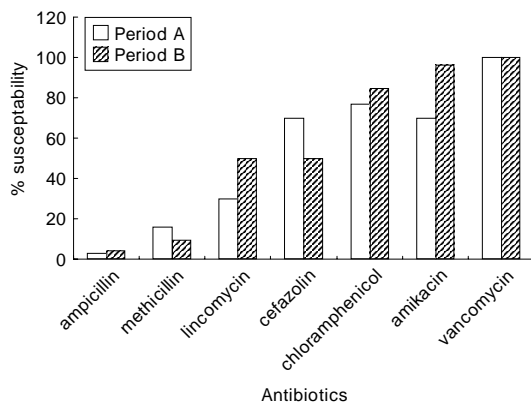


Fig. 1. Antibiotics susceptibility of coagulase negative staphylococcus(65 isolates).

kacin, ceftriaxone, TMP-SMZ Period A, B
(Fig. 3).

E. cloacae
ampicillin(Period A 33.3%, Period B 33.3%), carbe-
nicillin(Period A 50%, Period B 50%), gentamicin
(Period A 50%, Period B 75%), ceftriaxone(Period
A 100%, Period B 50%), TMP-SMZ(Period A 100
%, Period B 100%), chloramphenicol(Period A 75%,
Period B 100%) gentamicin Peirod B
ceftriaxone
Period B . Period A
B chloramphenicol TMP-SMZ
carbenicillin
(Fig. 4).

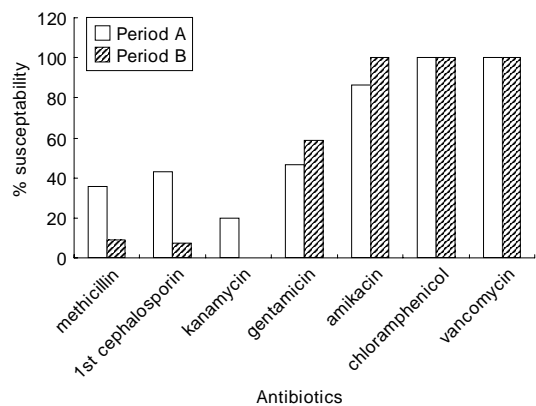


Fig. 2. Antibiotics susceptibility of *Staphylococcus aureus*(19 isolates).

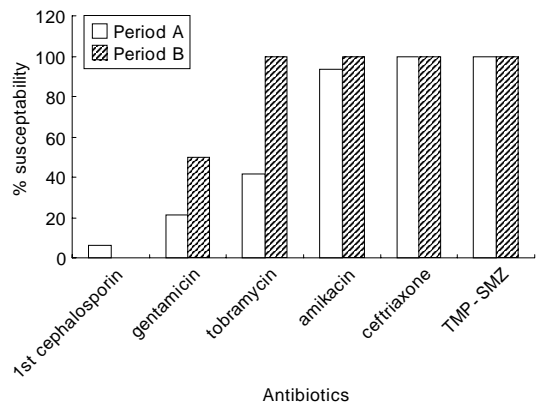


Fig. 3. Antibiotics susceptibility of *Klebsiella pneumoniae*(17 isolates).

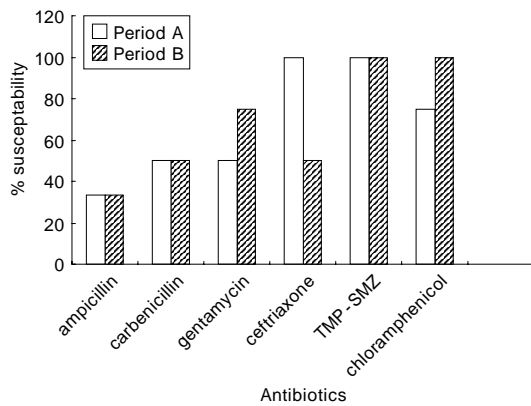


Fig. 4. Antibiotics susceptibility of *Enterobacter cloacae*(8 isolates).

E. coli Period B
riod 가 ,
TMP-SMZ, kanamycin, amikacin
ampicillin (16.7%)

Enterococcus spp. Period B 2
10 가 Period A
, ampicillin, penicillin 1 cephalosporin
vancomycin

0.1 ~ 1.0%
가 가
1), 1,000
300 (30%) 가
7

(, , 7
,) ,
, ,
, 24 ~ 72
3~7

3

. 1950 *S. aureus*,
1960 *E. coli*, *K. pneumoniae*, *Pseudomonas*
, 1970
group B *Streptococcus*(GBS), 1970
methicillin-resistant *S. aureus*(MRSA)
CNS가

. 1990
CNS Enterococcus,
, *Candida*가
2). 1996 CDC national noso-
comial infection surveillance system(NNIS)
CNS가(51%)
가 GBS
(7.9%), *S. aureus*(7.5%), *Candida*(6.9%), *E. coli*(4.3
(2.7%), *Enterobacter*(2.9%), *Streptococcus* species
(2.5%), *K. pneumoniae*(2.5%)
. Jarvis
WR 1987 1995 NICU
(3)
(4)
group B *Streptococcus*가,
CNS가 가

, 1,000
6.9 ~ 10.4 , 0.66~4.53%
3-8), 1960 *E. coli* *S.*
aureus^{9, 10}, 1970 *S. aureus* ¹¹, 1980
*S. epidermidis*가 가
5, 6, 12), 1997

CNS *S. aureus*가 가³⁾.
 10
 1.1% , 가 methicillin resistant *S. aureus*(MRSA)가
 CNS *S. aureus*, *K. pneumoniae*, 1992
Enterococcus, *Enterobacter cloacae*, *E. coli*, *P. aeru-*
ginosae CNS *S. aureus* 가^{16, 17)} *S. aureus* hexachlo-
 rophene
 GBS가 . Vancomycin MRSA
 vancomycin
 MRSA
S. aureus 76%
 64.3% 90.9% 가
 MRSA가 가
 CNS
 NICU
 50%²⁾ 1990
⁶⁾, ¹²⁾, ¹³⁾, ¹⁴⁾
K. pneumoniae
 CNS
 CNS¹⁸⁾
K. pneumoniae
 NICU *Staphylococcus hemolyticus*
Staphylococcus epidermidis 가 가
¹⁵⁾ CNS 가
 가
 가
 penicillin, gentamicin SMZ, ceftriaxone
 vancomycin 가 *Enterococcus*
 penicillin, gentamicin *facium* *Enterococcus faecalis*
 vancomy-
 cin¹⁹⁾
²⁾
 가 Staphylo-
 cocci (77%), (33%),
 가 가 40~90% (21%) . Vancomycin

- 가²⁰⁾ .²³⁾ .
 12 *Enterococcus* *Alcaligenes xylosoxidans*
 3 가 . 10 ,
 2 chlorhexidine
E. faecium *E. faecalis*
 1994 가
 2 *E. faecium* ^{24, 25)} .
 vancomycin resistant enterococcus(VRE) *Acinetobacter baumannii*
 .
Enterobacter *E. cloacae*가 가
 , 42~69% , Nagels²⁶⁾
²¹⁾ *Enterobacter* 80%
 , , 37°C
 가 ,
 . *E.* 6 *Acinetobacter*
*cloacae*가 4 , 4
 가 , 1
 가 , 1
²²⁾ *Candida*
Enterobacter 21 (18)가 . *Candida*
 ampicillin ceftriaxone , genta- 1 4 ~ 19%
 micin imipenem, ciprofloxacin
 , *Enterobacter* ,
 imipenem genta-
 micin . 1,500 gm
 19 ~ 47%
 8 gentamicin ceftriaxone 2.6 ~ 8.0% . *Candi-*
 ampicillin *da albicans* , *Candida tropicalis*
 33.3% TMP-SMZ amika- *Candida parapsilosis* . *C.*
 cin 100% *albicans* *C. pa-*
 가 . *rapsilosis*
E. coli 가
 40%가 K1 capsular antigen . *Candida* 15
 11 가 *C. albicans*
C. parapsilosis .
 vaccine 25~54% *C. albicans*
E. coli kanamycin, gentamicin amo- *Candida*
 noglycosides TMP-SMZ , , ,

가^{27, 28)} .
가 2.8% 1989 1993 () 1994 1998
5.5% 가 *C. parapsilosis*가 ()
가 가 . , ,
8
가 : 15,144 170
, 가 1.1%(91 , 1.2%, 79
. 1.0%) , 186 (99 , 87)
200 (109 , 91)
가 가 12.3
8.8 , 16.3 ,
34.7%, 23.0%
, ampicillin cefotaxime 132
3 cephalosporine ampicillin (66.0%), 60 (30.0%), 8 (4.0%)
aminoglycoside 가 , Coagulase negative *Staphylococcus*(CNS)가
, 가 69 (34.5%) 가 ,
¹⁾ . *Staphylococcus aureus*(*S. aureus*) 36 (18.0%),
3 cephalosporine *Klebsiella pneumoniae*(*K. pneumoniae*) 17 (8.5%),
cephalosporin *Enterococcus* 12 (6.0%), *Enterobacter cloacae*(*E. cloacae*) 8 (4.0%), *Escherichia coli*(*E. coli*) 6
²⁹⁾ . (3.0%), *Pseudomonas aeruginosa*(*P. aeruginosa*) 5
(2.5%) . *Candida*
가 *parapsilosis*, *Candida albicans*, *Trichosporon pullulans*
. 가 CNS, *S. aureus* *Acinetobacter*
ampicillin gentamicin , *baumannii*(*A. baumannii*), *Candida*
amikacin, vancomycin 3 cephalosporine , CNS *S.*
가 *aureus* methicillin 1 cephalosporin
. aminoglycosides 가
, vancomycin .
K. pneumoniae, *Enterococcus*, *E. coli* *P. aeru-*
ginosa *K.*
pneumoniae 1 cephalosporin ,
10 tobramycin gen-
, tamicin 가 ami-
kacin, ceftriaxone, trimethoprim-sulfamethoxazole
. Enterococ-
: 1989 1998 10 cous ampicillin, penicillin 1 cephalosporin
vancomycin
15,144 .

: 10
1.1% , CNS *S. aureus* 7†
 ,
vanco-
mycin .
group B Streptococcus
 , *K. pneumoniae*

1) Cole FS. Bacterial infections of newborn. In :
Tausch HW, Ballard RA, ed. Avery's Disease
of the Newborn. 7th ed. Philadelphia : WB
Saunders Co, 1998:490-512.

2) Harris JS, Goldmann DA. Infection acquired in
the nursery. In : Remington JS, Klein JO, ed.
Infectious diseases of the fetus and newborn
infants. 5th ed. WB Saunders Co, 2001:1371-
418.

3) , .
48
1998:53.

4) , , , .
6
48
1998:378.

5) , , , , , ,
 , , .
1987:30:130-7.

6) , , , .
1990:33:1489-94.

7) , , , .
1993:36:771-7.

8) , , .
10
48
1998:53.

9) , , , .
1966:9:
61-9.

10) , , .
1968;11:229-35.

11) , , , .
1975;18:567-75.

12) , , , , , .
1991;34:755-62.

13) , , , , , ,
 .
1993;36:1542-53.

14) , , , .
1994;37:1676-86.

15) Bialkowska-Hobrzanska H, Jaskot D, Hammer-
berg O. Molecular characterization of the co-
agulase-negative staphylococcal surface flora of
premature neonates. J Gen Microbiol 1993;139:
2939-44.

16) Bartzokas CA, PAton JH, Gibson MF, et al.
Control and eradication of methicillin-resistant
Staphylococcus aureus on a surgical unit. N
Eng J Med 1984;311:1422.

17) Back NA, Linnemann CC Jr, Pfaller MA, et
al. Recurrent epidemics caused by a single
strain of erythromycin-resistant *Staphylococcus*
aureus. The importance of molecular epidemi-
ology. JAMA 1993;270:1329.

18) , , , .
Klebsiella pneumoniae
 .
2000;43:477-83.

19) Noskin GA, Peterson LR, Warren JR. *Entero-*
coccus faecium and *Enterococcus faecalis* bac-
teremia : acquisition and outcome. Clin Infect
Dis 1995;20:296-301.

20) McNeeley DF, Saint-Louis F, Noel GJ. Neona-
tal enterococcal bacteremia : an increasingly fre-
quent event with potentially untreatable patho-
gens. Pediatr Infect Dis J 1996;15:800-5.

21) Gallagher PG. *Enterobacter bacteremia* in pedi-
atric patients. Rev Infect Dis 1990;12:808-12.

22) , , , , , ,
 .
Enterobac-

- ter* . 1998;41:466-72.
- 23) Rennels MB, Levine MM. Classical bacterial diarrhea : Perspectives and update-*Salmonella*, *Shigella*, *Escherichia coli*, *Aeromonas* and *Pseudomonas*. *Pediatr Infect Dis J* 1986(Suppl 1): S91.
 - 24) Schoch PE, Cunha BA. Nosocomial Achromobacter xylosoxidans infections. *Infect Control Hosp Epidemiology Arch Pediatr* 1997;4:260-2.
 - 25) Vu-Thien H, Darbord JC, Moissenet D, Dulot C, Dufoureq JB, Marsol P, Garbarg-Chenon A. Investigation of an outbreak of wound infection due to *Alcaligenes xylosoxidans* transmitted by chlorhexidine in a burn unit. *Eur J Clin Microbiol Infect Dis* 1998;17:724-6.
 - 26) Nagels B, Ritter E, Thomas P, Schulte-Wissermann H, Wirsing von Konig CH. *Acinetobacter baumannii* colonization in ventilated preterm infants. *Eur J Clin Microbiol Infect Dis* 1998;17: 37-40.
 - 27) Benjamin DK Jr, Ross K, McKinney RE Jr, Benjamin DK, Auten R, Fisher RG. When to suspect fungal infection in neonates : A clinical comparison of *Candida albicans* and *Candida parapsilosis* fungemia with coagulase-negative staphylococcal bacteremia. *Pediatrics* 2000;106: 712-8.
 - 28) Kossoff EH, Buescher ES, Karlowicz MG. Candidemia in a neonatal intensive care unit : trends during fifteen years and clinical features of 111 cases. *Pediatr Infect Dis J* 1998;17: 504-8.
 - 29) American Academy of Pediatrics. *Escherichia coli* and other bacilli : Septicemia and meningitis in neonates. In Peter G, ed. 1994 Red Book : Report of the Committee in Infectious Diseases. 23rd ed. Elk Grove Village, IL : American Academy of Pediatrics 1994:184.