JOURNAL OF CLINICAL MICROBIOLOGY, Dec. 1984, p. 1044–1048
0095-1137/84/121044-05$02.00/0

Vol. 20, No. 6

Streptococcus faecium Outbreak in a Neonatal Intensive Care Unit

PHILIP E. COUDRON,[1] C. GLEN MAYHALL,[2,3] RICHARD R. FACKLAM,[4] ALICE C. SPADORA,[2] V. ARCHER LAMB,[2,3] MARGARET R. LYBRAND,[2] AND HARRY P. DALTON[1]*

Division of Clinical Pathology, Department of Pathology,[1] Hospital Epidemiology Unit,[2] and Division of Infectious Diseases,[3] Department of Medicine, Medical College of Virginia, Medical College of Virginia Hospitals, Virginia Commonwealth University, Richmond, Virginia 23298; and Reference Bacteriology Section, Division of Bacterial Diseases, Center for Infectious Disease, Centers for Disease Control, Atlanta, Georgia 30333[4]

Received 25 May 1984/Accepted 13 August 1984

An outbreak of bacteremia and meningitis in a neonatal intensive care unit is described. Seven cases occurred in premature infants with severe underlying diseases. An epidemiological investigation failed to document the reservoir of the epidemic strain but suggested that its transmission among the infants was via the hands of hospital personnel. All patients had nasogastric tubes and multiple intravascular devices, and the portal of entry may have been either the gastrointestinal tract or the sites of the intravascular devices. Conventional biotyping of isolates failed to differentiate between isolates from infected patients and isolates recovered from prevalence surveys and from the environment. However, rapid identification systems (API-20S [Analytab Products, Plainview, N.Y.] and the AutoMicrobic system [Vitek Systems, Inc., Hazelwood, Mo.]) were able to distinguish isolates recovered from infected patients and hands of hospital personnel from isolates recovered during prevalence and environmental surveys and 29 isolates from widespread geographical areas. This is the first known report of a nosocomial neonatal outbreak of bacteremia and meningitis due to *Streptococcus faecium*; it underscores the importance of identifying streptococci to species level.

Patients in neonatal intensive care units (NICUs) are at high risk for nosocomial infections. Low birth weight, instrumentation, surgery, supportive measures, and patent ductus arteriosus are associated with an increased incidence of nosocomial infections and mortality in this population (12, 13, 22).

According to recent reports, nosocomial infections in NICUs have been attributed to a variety of organisms, including *Klebsiella pneumoniae*, *Pseudomonas cepacia*, *Flavobacterium meningosepticum*, and *Streptococcus agalactiae* (1, 3, 6, 15, 16, 18, 22, 27). A number of neonatal group D streptococcal infections have been reported, but the species has not always been indicated (2, 4, 5, 11, 17). To our knowledge, no reports of nosocomial neonatal sepsis specifically due to *Streptococcus faecium* have been published. This report describes an outbreak due to *S. faecium* in an NICU and documents the need to identify to species level all streptococci isolated from blood and cerebrospinal fluid (CSF). We also describe the use of physiological characterization of isolates in an attempt to develop a system of epidemiological markers for *S. faecium*.

MATERIALS AND METHODS

Background. The NICU at the Medical College of Virginia Hospitals provides tertiary care for infants born in central Virginia. During the outbreak, patients in the NICU were transferred to a new hospital. The capacity of the old unit was 42 bassinets, distributed among an intensive care room, an intermediate care room, and a convalescent care room. The average daily census for the old unit was 39 patients. The capacity of the new unit was 48 bassinets, distributed between an intensive care room and an intermediate care room. The average daily census in the new unit was 49 patients. The most common diagnoses were prematurity, respiratory distress syndrome, and hyperbilirubinemia.

Epidemiological investigation. A case of infection due to *S. faecium* was defined as an occurrence of infection in a patient whose blood or CSF yielded *S. faecium* on culture. Laboratory records were reviewed for isolates of *S. faecium* during the 12 months before the onset of the outbreak and during the outbreak.

The hospital chart of each patient was reviewed and the following data were collected: date of birth, birth weight, gestational age, sex, location before hospitalization at the Medical College of Virginia Hospitals, diagnosis(es), surgical operations, diagnostic procedures, instrumentation, information on feeding, medications administered (including antibiotics), and results of cultures and antimicrobial susceptibility tests.

Point prevalence culture surveys of patients were performed with swabs moistened in sterile water. Cultures were taken from the nasopharynx with calcium alginate swabs mounted on flexible wire and from the umbilicus and rectum with cotton swabs.

Cultures were also taken from the hands of medical personnel and from environmental surfaces by using cotton swabs moistened with sterile saline. Intravenous (i.v.) and umbilical catheters removed from patients were placed in sterile tubes for transport to the laboratory.

Microbiology. Blood samples were collected from a peripheral venous site and inoculated directly into bottles containing a biphasic medium consisting of brain heart infusion with agar as the liquid phase and tryptic soy agar as the solid phase. Each CSF specimen was centrifuged at 1,000 × *g* for 15 min, and the sediment was Gram stained and inoculated onto blood agar, supplemented chocolate agar, and into thioglycolate broth (19). All conventional media were obtained from Difco Laboratories, Detroit, Mich.

Unused i.v. and umbilical catheters were aseptically removed from their packaging and cultured in brain heart infusion broth. Umbilical and i.v. catheters removed from patients were cultured semiquantitatively by the technique of Maki et al. (21). Solutions for i.v. administration were cultured in an equal volume of double-strength brain heart

* Corresponding author.

infusion broth. Fat emulsions for i.v. administration were cultured in letheen broth. Isolates on swabs taken from infants during point prevalence surveys, from the hands of hospital personnel, and from environmental surfaces were inoculated onto bile-esculin-azide agar.

Streptococcal isolates were identified by conventional biochemical reactions, including bile-esculin hydrolysis, growth in 6.5% NaCl, and fermentation of arabinose, sorbitol, and lactose (9), as well as by the API-20S system (Analytab Products, Plainview, N.Y.). In addition, the isolates were serogrouped by the Phadebact system (Pharmacia Diagnostics, Piscataway, N.J.) to detect the group D antigen. Physiological characteristics of these strains were determined by conventional tests previously described (8, 9). Acid formation in melibiose, salicin, and sorbose broths was determined by a previously described technique (8). Isolates were also tested for physiological characteristics by two rapid procedures, the API-20S Streptococcus system (25) and the AutoMicrobic system (AMS; Vitek Systems, Inc., Hazelwood, Mo.) (28).

Twenty-nine strains of *S. faecium* were selected from the Centers for Disease Control Streptococcus Reference Laboratory Collection and used for comparing physiological characteristics. All 29 strains were isolated over a 10-year period (1973 to 1983) from humans from a wide geographical area within the United States.

Susceptibility to antibiotics was determined by the agar dilution method as described by the National Committee for Clinical Laboratory Standards (26). The following antibiotics were tested at the indicated concentrations (in micrograms per milliliter): penicillin (0.5, 1, and 5); nafcillin and gentamicin (1, 5, and 10); amikacin (2, 10, and 20); tetracycline and erythromycin (1 and 5); and ampicillin, cefoxitin, cefazolin, and chloramphenicol (1, 5, and 25).

Gel electrophoresis for the detection of plasmids was performed by a method described previously (20). Briefly, glycine-treated cells were lysed with sodium dodecyl sulfate, the lysate was subjected to agarose gel electrophoresis, and the DNA was stained with ethidium bromide.

RESULTS

Description of the outbreak. The first blood and CSF cultures from the patient with the index case that were positive for *S. faecium* were taken on 29 May 1982. The second and third cases occurred on 30 May and 15 June, respectively. On 16 June all patients were moved to the NICU in the new hospital. The fourth and fifth cases occurred on 26 and 27 June, respectively; and the sixth case occurred on 26 July, 6 weeks after the new unit opened. All patients were treated with either penicillin or ampicillin combined with gentamicin after cultures of blood and CSF were obtained. Patients 3 and 4 died 11 and 2 days, respectively, after the start of therapy.

About 9 months later, a seventh case of *S. faecium* infection (bacteremia) occurred. The patient was successfully treated with penicillin and gentamicin. Intensive surveillance since the last case in April 1983 has revealed no further cases of bacteremia or meningitis due to *S. faecium*.

Epidemiological investigation. A review of laboratory records for blood and CSF cultures for 1 year before the onset of the outbreak revealed no isolates of *S. faecium*.

S. faecium was isolated from the CSF and blood on the same day from four of the seven patients. The organism was isolated from only the blood of two patients and from only the CSF of one patient. *Staphylococcus aureus* was also isolated from two of these seven patients; *S. faecium* and *Staphylococcus aureus* were isolated simultaneously from the blood and CSF of one patient, and both organisms were isolated from the same blood specimen of one patient with meningitis and bacteremia.

Three cultures of CSF taken on different days from two of the five patients (including the one patient who had only meningitis) yielded *S. faecium*. In addition, glucose and protein levels in the CSF of these two patients were <10 mg/100 ml and ≥1.3 g/100 ml, respectively. Although laboratory data on the CSF of three patients with single cultures of CSF were incomplete, available data strongly supported the diagnosis of meningitis. First, *S. faecium* was isolated from the CSF and blood on the same day. Second, one patient had a glucose level in CSF of 16 mg/100 ml, one had a leukocyte WBC count in CSF of 688/mm^3 with 66% neutrophils, and one also had *Staphylococcus aureus* isolated simultaneously from blood and CSF. This patient had a peripheral WBC count of 3,200/mm^3, and many WBCs were seen on a Gram-stained smear of CSF.

Of the seven patients, six were transferred from five community hospitals. The average birth weight was 990 g, with a range of 630 to 1,340 g. The average gestational age was 29 weeks, with a range of 26 to 31 weeks. Six infants were female. All patients were severely ill with multiple underlying conditions. Four of the seven patients had intraventricular or periventricular hemorrhage and six had severe respiratory disease.

All the patients received penicillin or ampicillin and gentamicin parenterally before the onset of infection due to *S. faecium*. All the patients had peripheral venous catheters, umbilical arterial or venous catheters, and nasogastric tubes, and all had received total parenteral nutrition. Six of the seven patients had received blood or blood products, and five had undergone suctioning of the upper respiratory tract. The one patient with only meningitis had had a ventriculostomy performed before the infection developed. The only intravenous medication other than antibiotics that was received by all the patients was calcium gluconate. All the patients had received vitamin E via the nasogastric tube.

During the outbreak, a point prevalence culture survey was conducted on 20 July, before the availability of selective culture medium (bile esculin azide). Only 3 of 50 (6%) patients had cultures positive for *S. faecium*; one culture was obtained from the umbilicus of a patient, one from the nasogastric aspirate of a patient with no occurrence of *S. faecium* infection (a non-case patient), and one from the rectum of another non-case patient.

Results of the five point prevalence culture surveys carried out with selective medium are shown in Table 1. Only two infants with a culture positive for *S. faecium* in one survey (26 April 1983) had a positive culture in another survey (10 May 1983), and only one of the infected patients was culture positive in these surveys. The first two prevalence surveys were taken after the outbreak ended. The next two surveys were taken when one additional case occurred in April 1983. The last survey was taken to determine the ongoing rate of colonization of patients in the NICU. Except for one isolate recovered from the nasopharynx (2%), all cultures positive for *S. faecium* from the five prevalence surveys were taken from the rectum (65%) or umbilicus (33%).

Cultures of 51 peripheral i.v. catheters, 21 umbilical arterial catheters, 5 peripheral arterial catheters, 2 umbilical venous catheters, and 1 scalp vein cannula were all negative for *S. faecium*. A total of 75 unused intravascular catheters were cultured and none yielded *S. faecium*; 36 samples of

solutions for i.v. administration were culture negative for *S. faecium*.

Cultures were taken from the hands of 98 hospital personnel between 22 July and 10 September 1982, and three (3%) were positive for *S. faecium*. These three were from registered nurses; the first culture was taken on 22 July, 4 days before the last case was identified, and one was taken 3 weeks and one 4 weeks after the outbreak ended. All were culture negative when recultured 2 to 6 weeks later. None of the personnel had evidence of dermatitis. A second set of cultures was taken from hands of personnel when the seventh case appeared. Cultures of 66 hospital staff were all negative.

Cultures were taken from environmental surfaces on two occasions. The first set (137 samples) was taken 8 weeks after diagnosis of the sixth case and the second set (100 samples) was taken after diagnosis of the seventh (late) case. Of 237 cultures taken, 18 (7.6%) were positive for *S. faecium*. Positive cultures included those taken from an i.v. pump, an i.v., pole, an isolette, rectal thermometers, scales, sinks, the handle of an addressograph, an oxygen monitor, a refrigerator, and clipboards.

Microbiology. Isolates of *S. faecium* from patients, personnel, and the environment were resistant to most antibiotics tested, including penicillin (MIC, ≥5 μg/ml), ampicillin (MIC, ≥25 μg/ml), nafcillin (MIC, ≥10 μg/ml), cefazolin (MIC, ≥25 μg/ml), cefoxitin (MIC, ≥25 μg/ml), gentamicin (MIC, ≥10 μg/ml), amikacin (MIC, ≥20 μg/ml), and tetracycline (MIC, ≥5 μg/ml). Susceptibilities to chloramphenicol (MIC, 1 to 25 μg/ml) and erythromycin (MIC, 1 to 5 μg/ml) were variable.

S. faecium isolates from four patients, the hands of two health care workers, and two prevalence surveys were screened by gel electrophoresis; no plasmids were seen.

The results of tests to determine the physiological characteristics of the isolates by conventional methods are shown in Table 2. The physiological characteristics of strains isolated during the outbreak from patients with cases of *S. faecium* infection, hands of personnel, patients during point prevalence studies, and the environment were very similar to those of other *S. faecium* strains isolated during human infections. The strains recovered from infected patients and all other sources during the investigation had uniform characteristics except for acid formation in melibiose broth and reduction of 0.04% tetrazolium. Since these two characteristics were the only possible physiological markers by which the strains could be differentiated from other *S. faecium* strains and from each other, all isolates were retested for reduction of tetrazolium and acid formation in melibiose broth. Three strains isolated from the infected patients and one other epidemiological isolate that initially reduced tetrazolium failed when retested with a fresh batch of medium to give the brick-red color characteristic of reduction of tetrazolium. Several changes in the test results were noted, implying that acid formation in melibiose broth was a variable characteristic and could not be used as an epidemiological marker. The reactions of 12 of the 21 strains retested for acid formation in melibiose broth remained identical to the initial results (3 remained positive and 9 remained negative). However, the reactions of the other nine strains changed from positive to negative (one strain) or from negative to positive (eight strains) when retested.

Five isolates from four infected patients, two isolates from the hands of personnel, nine isolates from point prevalence surveys of infants, and five isolates from the environment were tested with the API-20S system and AMS. The test results with the API-20S system show that five strains from the infected patients had the same profile number. In addition, the two isolates from hands of personnel and one isolate from a prevalence survey were identical to the strains isolated from the infected patients, but none of the other eight isolates from prevalence surveys or the five from the environment had the same profile number. The prevalence survey isolate with the same profile number as the isolates from the infected patients was recovered from the rectum of a non-case infant in a prevalence survey conducted during the outbreak (20 July 1982). The test results obtained with AMS were the same as those obtained with the API-20S system. Thus, isolates from infected patients and hands and

TABLE 1. Results of point prevalence surveys by patients culture positive for *S. faecium* at one or more sites[a]

Date (mo/day/yr)	No. of infants cultured	No. of infants with one or more positive cultures (%)
9/8/82	49	7 (14)
10/26/82	46	5 (11)
Subtotal	95	12 (12.6)
4/26/83	55	10 (18)
5/10/83	51	9 (18)
Subtotal	106	19 (18)
10/3/83	43	5 (11.6)
Total	244	36 (14.8)

[a] Sites include rectum, umbilicus, and nasopharynx.

TABLE 2. Results of biotyping 50 isolates of *S. faecium* by conventional physiological tests

Test	No. of positive isolates (%)		
	Unrelated human isolates[a] (*n* = 29)	Case isolates[b] (*n* = 6)	Non-case isolates (*n* = 15)
Bile-esculin	29 (100)	6 (100)	15 (100)
Arginine	29 (100)	6 (100)	15 (100)
Growth at 45°C	29 (100)	6 (100)	15 (100)
Growth in 6.5% NaCl	29 (100)	6 (100)	15 (100)
Esculin	29 (100)	6 (100)	15 (100)
Trehalose	29 (100)	6 (100)	15 (100)
Litmus milk	28 (97)	6 (100)	15 (100)
Mannitol	28 (97)	6 (100)	15 (100)
Arabinose	28 (97)	6 (100)	15 (100)
Lactose	28 (97)	6 (100)	15 (100)
Salicin	28 (97)	6 (100)	15 (100)
Melibiose	27 (93)	1 (17)	3 (20)
Methylene blue milk	26 (90)	6 (100)	15 (100)
Growth at 10°C	26 (90)	6 (100)	15 (100)
Sucrose	23 (79)	6 (100)	15 (100)
Raffinose	7 (24)	0 (0)	0 (0)
Tetrazolium	5 (17)	3 (50)	1 (7)
Sorbitol	5 (17)	0 (0)	0 (0)
Hippurate	4 (14)	0 (0)	0 (0)
Inulin	2 (7)	0 (0)	0 (0)
Glycerol	0 (0)	0 (0)	0 (0)
Starch	0 (0)	0 (0)	0 (0)
Tellurite	0 (0)	0 (0)	0 (0)
Pyruvate	0 (0)	0 (0)	0 (0)
Sorbose	0 (0)	0 (0)	0 (0)
Glucans	0 (0)	0 (0)	0 (0)

[a] From different geographical areas.

[b] Also includes one isolate recovered from the rectum of a non-case infant in a prevalence survey conducted during the outbreak (20 July 1982).

the same isolate from a prevalence survey again had the same profile number, which was different from the profile number of the remaining isolates from the environment and from prevalence surveys.

When tested with both rapid systems, the 29 reference strains yielded 23 different profile numbers with each system. None of the 29 reference strains had the same profile number as any of the epidemic isolates (five from infected patients, two from hands, and one from a prevalence survey) when tested with the API-20S system, and only one reference strain had the same profile number as the epidemic isolates when tested with the AMS.

DISCUSSION

A review of the laboratory records for the year preceding the outbreak, when streptococci from blood and CSF were identified to species level, revealed no isolates of *S. faecium*. A previously published survey of streptococcal isolates from CSF at our institution from 1979 to 1981 (24) revealed no cases of meningitis due to *S. faecium*. This survey, combined with our laboratory record review for the year preceding the outbreak, indicated that a nosocomial outbreak occurred in the NICU between 29 May and 26 July 1982.

Strong evidence indicated that patients were infected and not just colonized by *S. faecium*. *S. faecium* was isolated simultaneously from the blood and CSF of four patients. One of these four patients had three consecutive cultures positive for *S. faecium* over a period of 8 days, a glucose level in CSF of less than 10 mg/100 ml, and a protein level of 1,300 mg/100 ml. Of the remaining three patients with meningitis and bacteremia, one had a glucose level in CSF of 16 mg/100 ml, one had a peripheral WBC count of 3,200/mm^3 (with many WBCs seen on a smear of CSF), and one had 688 WBCs with 66% polymorphonuclear cells in the CSF. For each of the two patients in whom *S. faecium* was isolated only from blood, the organism was recovered as a single isolate. Three consecutive cultures from the remaining patient with only meningitis were positive for *S. faecium* over a period of 5 days.

In two previous reports of septicemia and meningitis due to enteric streptococci in neonates, many infections occurred in infants of normal birth weight and gestational age and without severe underlying conditions (4, 5). Furthermore, many of the cases were maternally acquired, and meningitis occurred in no more than ca. 50% of the infected patients. In our outbreak, all cases occurred in low-birthweight, premature infants with severe underlying conditions. Cases were all hospital acquired since none of the infants was less than 16 days of age at the onset of infection; 71% of our infected patients had meningitis.

To date, no data have been published on the prevalence of *S. faecium* in the gastrointestinal flora of neonates. Excluding the initial survey, the point prevalence rate of *S. faecium* recorded from infants in the NICU for the other five surveys (Table 1) was 14.8%. The relatively low prevalence rate (6%) of the initial survey was probably due to the nonselective culture medium. One isolate recovered from the early prevalence survey taken during the outbreak (20 July 1982) had the same biotype as the isolates from infected patients. With this exception, all isolates of *S. faecium* recovered from infants during the prevalence surveys were of a different biotype than those recovered from infected patients. It is therefore possible that the prevalence rates represent background rates of *S. faecium* in the normal flora of patients in our NICU. Of the isolates, 65% were from the rectum, 33% were from the umbilicus, and 2% were from the nasopharynx. Isolation from these sites is consistent with colonization of the gastrointestinal tract. In a recent study of the bacterial colonization of neonates in a NICU, the investigators found that the enterococcus was frequently part of the stool flora but did not identify isolates to species level (14).

All the patients had received penicillin or ampicillin and gentamicin before the onset of infection with *S. faecium*. Each patient also had a peripheral venous catheter, an umbilical arterial or venous catheter, and a nasogastric tube. One or all of these may have been risk factors for infection with *S. faecium*.

Although only 3% (three) of the hand cultures were positive for *S. faecium*, the fact that the two isolates tested had the same biotype as that of isolates recovered from infected patients suggested that transmission of the strain among patients occurred via the contaminated hands of hospital personnel. Isolates from environmental surfaces were of a different biotype than the isolates from the infected patients, which suggested that the environment was probably not the source of the epidemic strain. Although only one rectal culture yielded an isolate of the case biotype, cultures may have revealed an enteric reservoir for *S. faecium* of the case biotype if they had been taken with selective medium early during the outbreak period. Based on the well-defined epidemiology of outbreaks due to enteric organisms in an NICU, the gastrointestinal tract would be the likely reservoir during an outbreak due to *S. faecium* (1, 6, 7, 14, 15, 18, 22).

The two possible portals of entry for *S. faecium* in patients were the gastrointestinal tract and the various intravascular device sites, but it was not possible to establish either of these sites as the portal of entry for bacteremia. Intravascular devices may not have been the portal of entry, or cultures of intravascular cannulae may have been taken too late to recover the organisms. In the only patient with meningitis and without documented bacteremia, *S. faecium* may have gained entry to the CSF directly via the ventriculostomy.

Although conventional biotyping failed to distinguish between the epidemic strain and isolates from prevalence surveys and the environment, both rapid identification systems (API-20S and AMS) indicated that isolates from infected patients and from the hands of hospital personnel were the same strain. The only isolate of the case biotype not from an infected patient or from the hands of personnel was recovered from the rectum of a patient during the outbreak. This is consistent with an enteric reservoir for the outbreak strain. The ability of these two systems to provide good epidemiological markers for strains of *S. faecium* from a common source is further supported by the differentiation of the epidemic strain in this outbreak from 29 unrelated isolates from people in many different geographical areas. Since no other techniques are currently available for identifying common isolates, such a biotyping system may provide the only effective epidemiological marker. Our results are preliminary, and the efficacy of these two rapid identification systems in providing epidemiological markers will need to be tested by other investigators during outbreaks of infection due to *S. faecium*.

To our knowledge, this report describes the first outbreak of bacteremia and meningitis due to *S. faecium* in a NICU. Many clinical laboratories presumptively identify group D streptococci and simply indicate whether they are enterococci or nonenterococci based upon physiological tests such as growth in 6.5% NaCl broth and hydrolysis of esculin in bile-esculin medium (10). Further identification of streptococci to species level can aid in epidemiological investiga-

tions and indicate trends or, as shown here, help establish the existence of a nosocomial outbreak. This is of particular importance because *S. faecium* is more resistant to antimicrobial agents than *S. faecalis* and infection with *S. faecium* may be more difficult to treat (23). We have documented an outbreak of *S. faecium* septicemia and meningitis in a highly susceptible population in an NICU and presented data suggesting that the mode of transmission was the hands of hospital personnel. Finally, based on our data, 12 to 18% of infants in NICUs may have gastrointestinal colonization by *S. faecium*.

ACKNOWLEDGMENTS

We thank Gaye O. Hall for technical assistance and Francis L. Macrina for performing the plasmid studies.

LITERATURE CITED

1. **Adler, J. L., J. A. Shulman, P. M. Terry, D. B. Feldman, and P. Skaliy.** 1970. Nosocomial colonization with kanamycin-resistant *Klebsiella pneumoniae*, types 2 and 11, in a premature nursery. J. Pediatr. **77**:376–385.
2. **Alexander, J. B., and G. P. Giacoia.** 1978. Early onset nonenterococcal group D streptococcal infection in the newborn infant. J. Pediatr. **93**:489–490.
3. **Baker, C. J.** 1977. Summary of the workshop on perinatal infections due to group B streptococcus. J. Infect. Dis. **131**:137–152.
4. **Bavikatte, K., R. L. Schreiner, J. A. Lemons, and E. L. Gresham.** 1979. Group D streptococcal septicemia in the neonate. Am. J. Dis. Child. **133**:493–496.
5. **Buchino, J. J., E. Ciambarella, and I. Light.** 1979. Systemic group D streptococcal infection in newborn infants. Am. J. Dis. Child. **133**:270–273.
6. **Eidelman, A. I., and J. Reynolds.** 1978. Gentamicin-resistant *Klebsiella* infections in a neonatal intensive care unit. Am. J. Dis. Child. **132**:421–422.
7. **Eisenach, K. D., R. M. Reber, D. V. Eitzman, and H. Baer.** 1972. Nosocomial infections due to kanamycin-resistant, [R]-factor carrying enteric organisms in an intensive care nursery. Pediatrics **50**:395–402.
8. **Facklam, R. R.** 1972. Recognition of group D streptococcal species of human origin by biochemical and physiological tests. Appl. Microbiol. **23**:1131–1139.
9. **Facklam, R. R.** 1980. Streptococci and aerococci, p. 88–110. *In* E. H. Lennette, A. Balows, W. J. Hausler, Jr., and J. P. Truant (ed.), Manual of clinical microbiology, 3rd ed. American Society for Microbiology, Washington, D.C.
10. **Facklam, R. R., J. F. Padula, L. G. Thacker, E. C. Wortham, and B. J. Sconyers.** 1974. Presumptive identification of group A, B, and D streptococci. Appl. Microbiol. **27**:107–113.
11. **Freedman, R. M., D. L. Ingram, I. Gross, R. A. Ehrenkranz, J. B. Warshaw, and R. S. Baltimore.** 1981. A half-century of neonatal sepsis at Yale. Am. J. Dis. Child. **135**:140–144.
12. **Goldmann, D. A., W. A. Durbin, Jr., and J. Freeman.** 1981. Nosocomial infections in a neonatal intensive care unit. J. Infect. Dis. **144**:449–459.
13. **Goldmann, D. A., J. Freeman, and W. A. Durbin, Jr.** 1983. Nosocomial infection and death in a neonatal intensive care unit. J. Infect. Dis. **147**:635–641.
14. **Goldmann, D. A., J. Leclair, and A. Macone.** 1978. Bacterial colonization of neonates admitted to an intensive care environment. J. Pediatr. **93**:288–293.
15. **Hable, K. A., J. M. Matsen, D. J. Wheeler, C. E. Hunt, and P. G. Quie.** 1972. *Klebsiella* type 33 septicemia in an infant intensive care unit. J. Pediatr. **80**:920–924.
16. **Hazuka, B. T., A. S. Dajani, K. Talbot, and B. M. Keen.** 1977. Two outbreaks of *Flavobacterium meningosepticum* type E in a neonatal intensive care unit. J. Clin. Microbiol. **6**:450–455.
17. **Headings, D. L., A. Herrera, E. Mazzi, and M. A. Bergman.** 1978. Fulminant neonatal septicemia caused by *Streptococcus bovis*. J. Pediatr. **92**:282–283.
18. **Hill, H. R., C. E. Hunt, and J. M. Matsen.** 1974. Nosocomial colonization with *Klebsiella*, type 26, in a neonatal intensive-care unit associated with an outbreak of sepsis, meningitis, and necrotizing enterocolitis. J. Pediatr. **85**:415–419.
19. **Isenberg, H. D., J. A. Washington II, A. Balows, and A. C. Sonnenwirth.** 1980. Collection, handling, and processing of specimens, p. 52–82. *In* E. H. Lennette, A. Balows, W. J. Hausler, Jr., and J. P. Truant (ed.), Manual of clinical microbiology, 3rd ed. American Society for Microbiology, Washington, D.C.
20. **Macrina, F. L., P. H. Wood, and K. R. Jones.** 1980. Simple method for demonstrating small plasmid deoxyribonucleic acid molecules in oral streptococci. Appl. Environ. Microbiol. **39**:1070–1073.
21. **Maki, D. G., C. E. Weise, and H. W. Sarafin.** 1977. A semiquantitative culture method for identifying intravenous-catheter-related infection. N. Engl. J. Med. **296**:1305–1309.
22. **Mayhall, C. G., V. A. Lamb, C. M. Bitar, K. B. Miller, E. Y. Furse, B. V. Kirkpatrick, S. M. Markowitz, J. M. Veazey, and F. L. Macrina.** 1980. Nosocomial *Klebsiella* infection in a neonatal unit: identification of risk factors for gastrointestinal colonization. Infect. Control **1**:239–246.
23. **Moellering, R. C., Jr., O. M. Korzeniowski, M. A. Sande, and C. B. Wennersten.** 1979. Species-specific resistance to antimicrobial synergism in *Streptococcus faecium* and *Streptococcus faecalis*. J. Infect. Dis. **140**:203–208.
24. **Nachamkin, I., and H. P. Dalton.** 1983. The clinical significance of streptococcal species isolated from cerebrospinal fluid. Am. J. Clin. Pathol. **79**:195–199.
25. **Nachamkin, I., J. R. Lynch, and H. P. Dalton.** 1982. Evaluation of a rapid system for species identification of alpha-hemolytic streptococci. J. Clin. Microbiol. **16**:521–524.
26. **National Committee for Clinical Laboratory Standards.** 1980. Standard method for dilution antimicrobial susceptibility tests for bacteria which grow aerobically: proposed standard method PSM-7, p. 31. National Committee for Clinical Laboratory Standards, Villanova, Pa.
27. **Rapkin, R. H.** 1976. *Pseudomonas cepacia* in an intensive care nursery. Pediatrics **57**:239–243.
28. **Ruoff, K. L., M. J. Ferraro, M. E. Jerz, and J. Kissling.** 1982. Automated identification of gram-positive bacteria. J. Clin. Microbiol. **16**:1091–1095.