

Neonatal Diarrhea with Sepsis in the Nursery of the  
Phra Mongkutklao Hospital

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**OBJECTIVE :** To define the cause of and to and make recommendations for methods of terminating an epidemic of neonatal diarrhea with sepsis.

**BACKGROUND :** Neonatal sepsis is a world wide problem. Because of the hospitalization of mothers for delivery and the subsequent placing of the newborn infant in common nurseries, nosocomial neonatal infections are and will continue to be an aggravating and potentially severe problem. The extent of this problem may be partially estimated by the output of scientific articles dealing with it. A computerized literature search resulted in retrieval of an average of 2,500 references/year over the past 10 years.

For at least the first half of 1975, the nursery at the Phra Mongkutklao Hospital experienced neonatal diarrhea. During this period between two and ten cases of diarrhea occurred per month.

During the third quarter of 1975 a marked increase in the incidence of neonatal diarrhea, up to 20-30 cases per month, was noted by the nursing staff. Because of the increase in the number of cases the pediatric service of the Phra Mongkutklao Hospital requested the assistance of the SEATO Medical Research Laboratory in investigating the source of the epidemic and in formulating recommendations for eradicating this problem.

**DESCRIPTION :** Five lines of investigation were followed:

1. A review of the nurseries, clinical and laboratory records for the preceeding year to determine the extent, cause and, if possible, source of the epidemic.
2. A bacteriologic survey of a sample of infants in the nursery to determine if colonization of infants with pathological organisms was occurring.
3. A bacteriological survey of the nursery to identify the types of organisms found and to indicate possible areas of contamination.
4. A bacteriological survey of the personnel entering and/or working in the nursery and delivery areas to identify carriers of pathogenic organisms.
5. A review of antibiotic sensitivities on bacterial isolates from the nursery.

**Review of Clinical and Laboratory Records :**

During the first half of 1975 hospital records showed diarrhea related Morbidity rate of 1.9% among approximately 1600 deliveries at the Phra Mongkutklao Hospital. In the third quarter the diarrhea related morbidity rate jumped from 2% in July to 12.2% in August, to 8.4% in September and to 9.4% in October.

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Table 1. Monthly Isolation of Pathogenic Organisms  
from Rectal Swabs Submitted by the Phra Mongkutklao Hospital  
from October 1974 - September 1975

Pathogenic Organisms	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
<b>Escherichia coli</b>													
0127 : B8	4	20	28	7	1	2	?	1		2	3	12	80 (32.7%)*
0119 : B14	4	1	1						2		2	1	11 (4.5%)
0125 : B15				1				1			6		8 (3.3%)
0112 : B11						1		4					5 (2.0%)
025 : B19 : B23		1		1		1			1				4 (1.6%)
026 : B6	2			1					1				4 (1.6%)
0128 : B12						3							3 (1.2%)
086 : B7				1						1			2 (0.8%)
055 : B5												1	1 (0.4%)
0111 : B4	1												1 (0.4%)
<b>Total E. coli</b>	11	22	29	11	1	7	?	6	4	3	11	14	119 (43.7%)
<b>Other pathogens</b>	0	2	5	6	4	0	?	2	0	0	3	5	27 (11.0%)
<b>Total pathogens</b>	11	24	34	17	5	7	?	8	4	3	14	19	146 (54.7%)
<b>Total samples</b>	12	31	52	24	20	8	?	19	15	8	25	31	245

\* Percent of total cultures

Review of the isolations from rectal swabs sent for routine culture to the Microbiology Department of the SEATO Medical Research Laboratory from October 1974 through September 1975 revealed the continuous presence of pathogenic *Escherichia coli*. Of 245 specimens received, pathogenic *E. coli* were detected in 107 or 44%. Other pathogenic organisms such as *Shigella* and *Salmonella* were occasionally cultured. There were 10 serotypes of pathogenic *E. coli* isolated (Table 1), however one subtype 0127 : B8 was consistently present throughout the year and represented 75% of all pathogenic *E. coli* isolated.

#### Environmental Survey of the Nursery :

Several site visits were made to the nursery in mid-October 1975. The nursery was located on the second floor of a ten year old Obstetrics and Gynecology building. It lay within the Obstetric Department; adjacent to the delivery area (Figure 1).

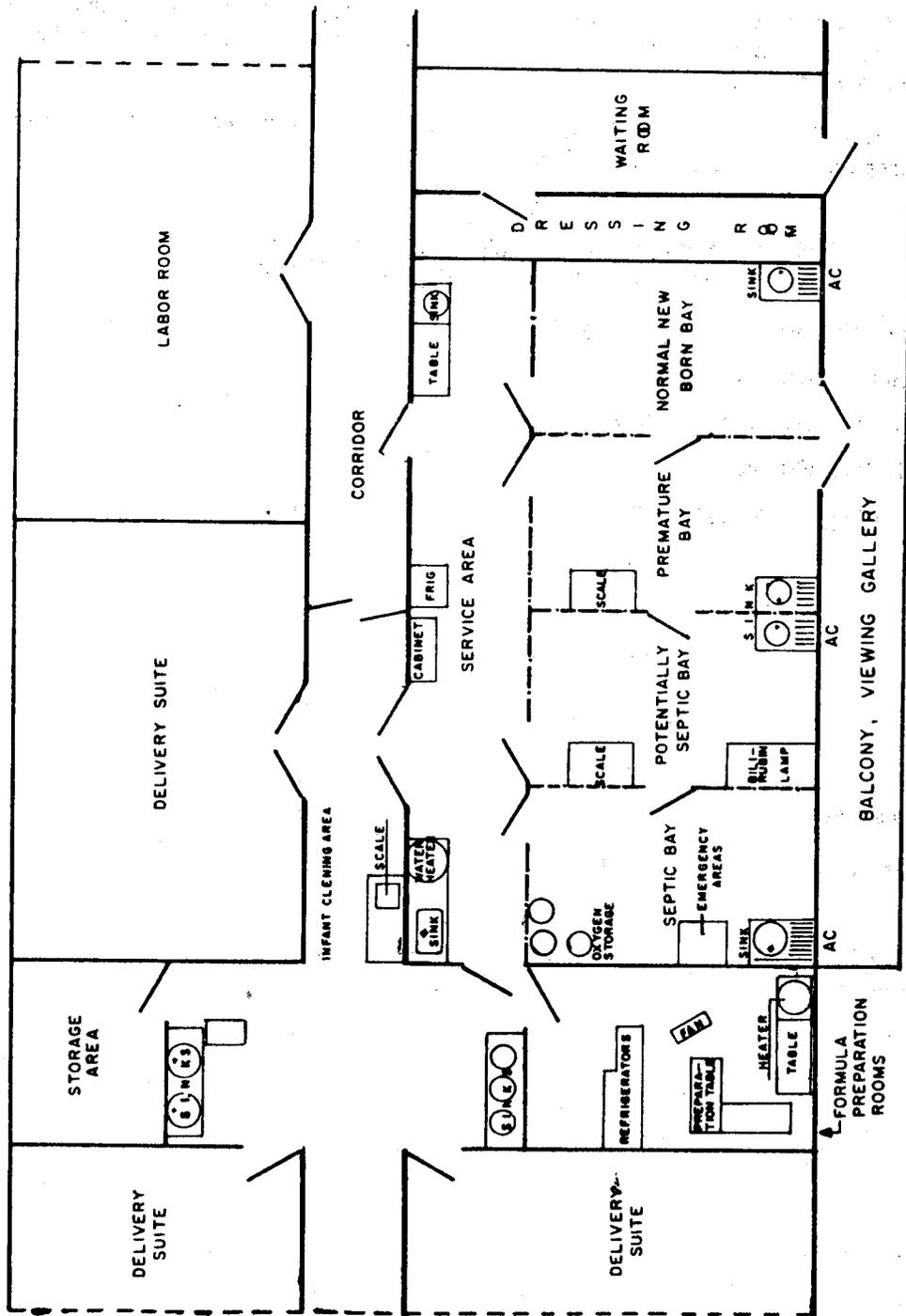


FIGURE 1. FLOOR PLAN FOR NURSERY PRAMONGKHUT KLAO HOSPITAL

The neonatal unit was composed of a series of interconnecting rooms. Infants were housed in one of four bays which were separated from each other by glass and screen partitions. A service area, along one end of the bays, was partially partitioned from them by a glass wall with screening at the top. The four bays were loosely designated: 1) normal newborn bay, 2) premature infant bay, 3) potentially septic and intensive care bay, and 4) septic bay. There were separate entrances from the service area into each of the four nursery bays but air could circulate freely between bays through the screened partitions.

The nursery bays were individually ventilated, with window air conditioners. Each bay was provided with a sink and separate waste and diaper disposal pails.

Table 2. Isolations of Pathogenic Organisms from Nursery Personnel at the Phra Mongkutklao Hospital

Personnel Frequenting the Nursery	97
Personnel Adequately Cultured	62
Carriers of Pathogenic Organisms	
<b>Salmonella B.</b>	1
Pathogenic <i>E. coli</i> 0127 : B8	8
026 : B	1
0119 : B14	1
0124 : B17	1
0125 : B15	1
0126 : B16	1
Total carriers	14 (23%)*

\* Percent of adequately cultured

The formula preparation area was located adjacent to the nursery area. Formula was prepared from powdered preparations by the addition of boiled tap water. No terminal sterilization was used.

The bacteriological survey identified wide spread contamination of the neonatal unit and formula preparation area. Pathogenic organisms were isolated from ten of 60 cultures obtained from sites throughout the nursery bays and the food preparation area. These sites included floors, preparation tables, door handles and lids to diaper pails. One culture grew *Shigella boydii* and the remaining nine grew pathogenic *E. coli* of three serotypes; two strains each of 0128 : B12 and 0127 : B8 and five strains of 0119 : B14.

#### Bacterial Survey of Infants :

Stool cultures were obtained from 30 babies housed in the newborn nursery on 15 October 1975, 21 of these were housed in the normal or premature nursery bays, seven were housed in the potentially septic bay and two were in the septic bay. From these infants six potential pathogens were isolated, five pathogenic *E. coli* serotypes 0127 : B8 (three) and 0119 : B14 (two), were isolated from seemingly healthy infants and one *E. coli*, serotype 0128 : B12, from an infant with diarrhea.

Table 3. Sensitivity Patterns on Rectal Isolates from Infants  
at the Phra Mongkutklao Hospital June - September 1975

Organism	AMP*	CHL*	COL*	GEN*	KAN*	NEO*	SDZ*	TRM* SMZ	STR*	TET*	Total Organisms
<b>Escherichia coli</b>											
0127 : B8	17/0**	17/0	5/12	4/13	15/2	16/1	17/0	0/17	17/0	16/1	17
0119 : B14	3/3	3/3	1/5	1/5	4/2	4/2	4/2	0/6	5/1	3/3	6
0112 : B11	5/0	5/0	0/5	0/5	0/5	0/5	5/0	0/5	5/0	5/0	5
0125 : B15	7/0	7/0	0/7	7/0	1/6	1/6	7/0	0/7	7/0	7/0	7
026 : B6	1/0	1/0	0/1	0/1	1/0	1/0	1/0	0/1	1/0	1/0	1
086 : B7	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1
025 : B19 : B23	1/0	1/0	0/1	0/1	1/0	1/0	1/0	0/1	1/0	1/0	1
055 : B5	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	1
All organisms	35/4	35/4	7/32	13/26	23/16	24/25	36/3	1/38	37/2	32/5	39

\* AMP = Ampicillin, CHL = Chloramphenicol, COL = Colymycin, GEN = Gentamicin, KAN = Kanamycin,  
NEO = Neomycin, SDZ = Sulfadiazine, TRM/SMZ = Trimethoprim - fufamethoxazole, STR = Streptomycin,  
TET = Tetracycline.

\*\* Resistant / sensitive

### Personnel Survey :

Ninety-seven people were reported to frequent the nursery. Sixty-two of these people provided an adequate perineal swab for culture. Fourteen pathogenic organisms were isolated (Table 2), one was a *Salmonella B.* and the remaining 13 were pathogenic *E. coli* of six serotypes. Eight, (over half of the pathogenic organisms isolated,) were pathogenic *E. coli* serotype 0127:B8. Thus 22.5% of the personnel who frequented the nursery and were adequately sampled, were found to be carriers of pathogenic organisms.

### Sensitivity of Isolates :

We were able to recover the antibiotic sensitivity data on 39 strains of pathogenic *E. coli* collected from infants in the nursery at Phra Mongkutklao Hospital from June to September 1975 and tested by the Kirby Bauer Disc Technique (Table 3). The isolated pathogenic *E. coli* were generally found to be susceptible to trimethoprim-sulfamethoxazole (one resistant strain out of 39 strains tested). The next best drugs appeared to be Cholymycin (seven resistant strains out of 39 strains tested), and Gentamycin (12 resistant strains out of 39 tested).

### Discussion and Recommendations :

Investigation of the epidemic of neonatal diarrhea and sepsis in the nursery at Phra Mongkutklao Hospital indicated five possible contributors to the epidemic:

1. Carriers of pathogenic organisms among personnel assigned to the nursery.
2. Large number of individuals, (nearly 100) who frequent the nursery and delivery areas.
3. General contamination of the nursery and formula preparation area with pathogenic organisms.
4. Failure to use terminal sterilization.
5. Open nursery bays allowing for free movement of air from contaminated to uncontaminated areas.
6. Introduction of new strains of pathogenic organisms from septic deliveries.

No one organism could be implicated as the cause of the epidemic. The major group of pathogenic organisms isolated from rectal swabs on affected infants were pathogenic *E. coli* of at least ten serotypes. These organisms were also isolated from environmental surfaces in the nursery and from perineal swabs from 22.5% of the nursery personnel who submitted adequate cultures. *E. coli* serotype 0127:B8 was the most prevalent organism cultured in both the rectal swabs of affected babies and in the perineal swab of the nursing personnel. Ninety-seven percent of 39 organisms tested were sensitive to Trimethoprim-sulfamethoxazole, 82% were sensitive to Cholymycin and 66% were sensitive to Gentamycin.

Recommendations were made to the hospital in eight general categories:

1. General decontamination of the nursery and delivery areas.
2. Treatment of all personnel associated with the nursery with an appropriate antimicrobial therapy.
3. Suspension of all new admissions to potentially contaminated areas and admission of all new babies to a decontaminated nursery.
4. Alterations in the preparation of formula to allow for terminal sterilization.
5. Decrease traffic in and through the nursery area.
6. Minor structural alterations to decrease air circulation, increase isolation and facilitate formula production.
7. Increase emphasis on sterile precautions in the nurseries.
8. Changes in the linen and waste disposal systems.

**Follow - up :**

The first two recommendations were implemented in mid-November 1975. The nurseries and the food preparation areas were thoroughly decontaminated using a glutaraldehyde preparation and all personnel frequenting the nursery were provided with adequate amounts of Trimethoprim - sulfamethoxazole for a ten day period of therapy.

Following this the neonatal morbidity rate due to diarrhea fell from 9.4% in October to 1% in December, with a corresponding decline in the sepsis related mortality rate from 7% to 0%. During the same period the number of rectal swabs submitted from the nursery to the Microbiology Department at the SEATO Medical Research Laboratory fell from 75 in October to 15 in December and the number of pathogenic organisms isolated fell from 27 isolates, of seven different pathogenic strains of *E. coli* in October, to two isolates of one pathogenic strain of *E. coli* (0127:B8) in December.

**SUMMARY :** During 1975 the neonatal nursing at the Phra Mongkutklao Hospital experienced an epidemic of neonatal diarrhea. Investigation revealed that the epidemic was due to pathogenic *E. coli* of several serotypes.

The organisms had contaminated the nursery environment, were colonizing the infants and were carried by over 20% of the nursery staff. Decontamination of the nursery and treatment of the nursing staff with Trimethoprim-sulfamethoxazole led to a marked decrease in diarrhea cases.