Epidemic Diarrhea of the New-born: A Report of Two Outbreaks

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TWO outbreaks of diarrhea of newborn infants occurred in a hospital in Rochester, N. Y., within a 4 month period. In the first outbreak the disease seemed to be transmitted chiefly by contaminated rubber nipples and formulae and to a lesser extent by indirect contact; in the second it was apparently transmitted by faulty maternal breast technic. Both outbreaks promptly came to an end following control measures based upon studies of the mode of transmission.

METHODS OF INVESTIGATION

The investigation was conducted by representatives of the Rochester Health Bureau and the New York State Department of Health, with the coöperation of the hospital staff. Data for all infants, sick and well, were transcribed from hospital records to epidemiological record forms upon which were entered name, address, date of birth, sex, color, nursery or nurseries occupied, outcome, and daily observations of weight, body temperature, feeding, stools, special procedures, and unusual occurrences. To provide a base-line of normalcy, these records were obtained for pre- and post-epidemic as well as the epidemic periods. The methods employed by the hospital for recognition of cases, isolation, general nursery technic, and formula preparation were studied in detail, and samples of feces and of nipples, bottles, and formula were subjected to bacteriological examination.

FIRST OUTBREAK: APRIL–MAY, 1942

An investigation was begun May 1, when through following up a death certificate it was discovered that a number of cases of diarrhea, some fatal, had occurred among infants in the hospital during the latter part of April.

Nature of the illness—Severe cases were characterized by frequent loose greenish stools, reddening of the buttocks, mild fever, dehydration, and loss of weight. This was the type of case generally conceded by hospital staff physicians to represent clear-cut diarrhea of the new-born. There were 28 such cases, in which group all of the 3 fatalities occurred. One death was of an infant with a cephalic deformity compatible with life, one in an infant with cerebral hemorrhage, and one in an infant born prematurely but of normal birth weight.

Twenty-two infants which presented signs and symptoms only slightly less marked were considered by the investigators to be definite cases also, making a total of 50 in this outbreak. Twelve others with still milder signs were classified as suspicious cases, and an additional 21 who showed only slight

deviations from normal, such as a few green stools or a temporary increase in number, were classified as probably normal. One hundred and thirty-five infants were considered to be normal. Thus, as in many other diseases, there was a gradation from normal to very severe which, in the absence of a means of laboratory confirmation, presented a very difficult problem in diagnosis.

Diagnosis—From the epidemiological standpoint it made little difference whether one diagnosed as epidemic diarrhea of the new-born only the 28 severe cases, or included the 22 definite but milder cases, since the distribution of the two types was similar with respect to date of onset, nursery of occurrence, feeding history, etc. From the standpoint of control, however, the diagnosis and segregation of the milder cases was of great importance since they also were presumably infectious. This may have been true of the suspicious cases as well. As an aid in diagnosis a rigid classification was set up and adhered to. The essence of it was that if an infant had more than one loose stool in one day he was considered as suspicious, and if loose stools persisted for two or more days he was classified as a case.

Chronology—Figure 1 shows the distribution of severe, mild, and suspicious cases according to date of onset. The probably normal infants are not shown because they present no chronological relationship to the epidemic and are considered to represent only simple biologic variations from the norm. The outbreak began about April 7 and ended May 8. A marked peak occurred on April 27 when 14 definite cases occurred. The distribution of suspicious cases does not follow closely the other two types except that

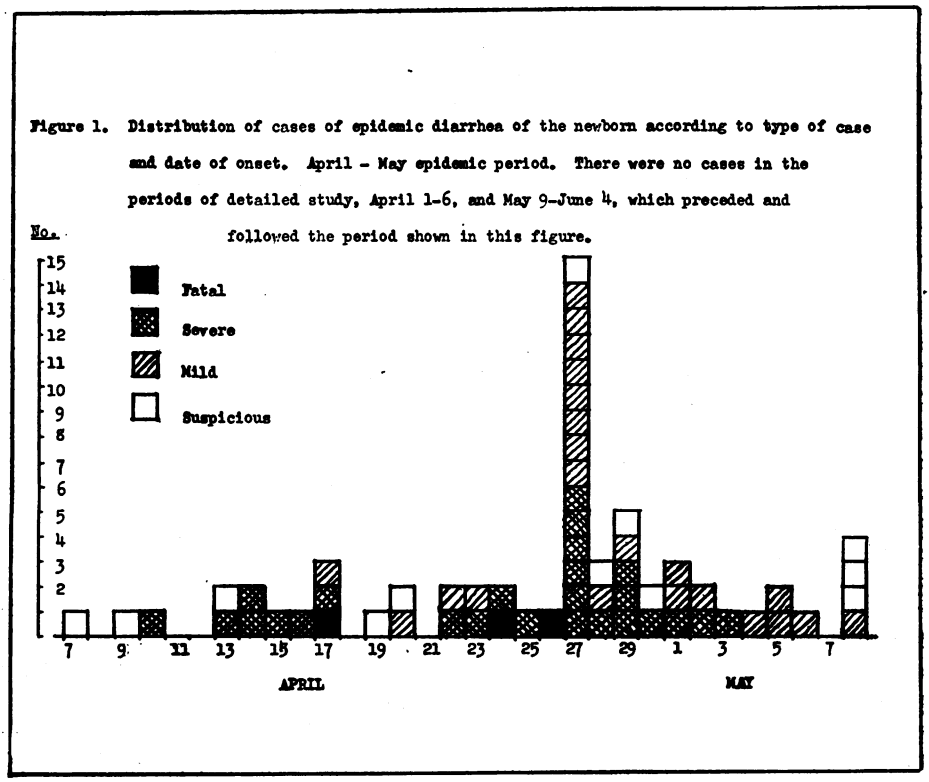

Figure 1. Distribution of cases of epidemic diarrhea of the newborn according to type of case and date of onset. April - May epidemic period. There were no cases in the periods of detailed study, April 1-6, and May 9-June 4, which preceded and followed the period shown in this figure.

their occurrence was limited to the epidemic period. Subsequent tables omit suspicious cases and group the severe and mild cases together.

TABLE 1

Distribution of Infants and Cases of Diarrhea, According to Nursery

Nursery	*Date Opened to Admissions*	*Date Closed to Admissions*	*No. of Infants Admitted*	*Number Ill*	*Per cent Ill*
H1–A	Prior to Apr. 1	Apr. 24	33	12	36.4
H2–A	Prior to Apr. 1	Apr. 28	121	30	24.8
H2–B	Apr. 27	May 1	9	3	33.3
H3	May 1	May 4	15	5	33.3
H2–Prem.	May 5	*	5	0	....
H1–B	May 5	*	58	0	....
H2–C	May 11	*	85	0	....

* Still open June 4

Nurseries affected—Table 1 shows the distribution of infants and cases according to nursery. The number of infants for nurseries H1-A and H2-A is made up of those infants in such nurseries on April 1 and those admitted subsequently. A few infants who died or left the hospital shortly after birth are excluded from the figures. Fifty cases of diarrhea occurred among 178 infants at risk April 1 to May 5, a rate of 28.1 per cent. The similar attack rates in nurseries H1-A and H2-A suggests that the factor or factors producing the illness were operating with approximately equal force in each. The first definite case occurred in H2-A on April 10 and in H1-A on April 14. The chronological distribution of cases was approximately the same in each of these nurseries and in each instance the peak incidence fell on April 27. The first case occurred in H2-B 5 days, and in H3 5 days after these nurseries were opened.

Relationship to type of feeding—It was customary in this hospital to give routinely only 5 per cent lactose for the first 2 or 3 days of life; subsequently most infants were put to breast and given supplementary feedings of whole or evaporated milk formula. Thus every infant had some exposure to the possibility of infection by contaminated nipples, bottles, and lactose or formula. A small number were never put to breast, and a very small number never received any formula.

Table 2 shows the attack rate according to type of feeding for 177 infants for whom data are available at risk during the epidemic period. Although the numbers on which these rates are based are small, there appears to be a definite trend toward increased risk of attack as the amount of artificial feeding increases and breast feeding decreases. There is no statistically significant difference between evaporated and whole milk, either alone or

TABLE 2

Attack Rates According to Type of Feeding

April-May Outbreak

Type of Feeding	*No. of Infants*	*No. Ill*	*Per cent Ill*
Breast milk and lactose	9	1	11.1
" " " whole milk	60	11	18.3
" " " evap. milk	75	19	25.3
Evaporated milk only	17	8	47.0
Whole milk only	10	5	50.0
Other (dry milk, etc.)	6	5	83.3
Totals	177	49	27.7

in conjunction with breast milk. Grouping the types of feeding it is found that, whereas only 21.5 per cent of 144 infants receiving breast milk and supplement became ill, 54.5 per cent of the 33 receiving formula alone became ill. This difference, which is statistically significant, emphasizes the association between risk of attack and type of feeding. Similarly, only 16, or 11.1 per cent, of infants receiving some breast feeding developed severe cases while 12, or 36.4 per cent, of those receiving only formula became severe cases. On this evidence alone, however, it is impossible to state whether breast milk confers a protective effect or whether formula carries increased risk of infection.

TABLE 3

Attack Rates According to Birth Weight

Birth Weight *	*No. of Infants*	*No. Ill*	*Per cent Ill*
Less than 4.75 lb.	2	0	..
5.25	7	4	57
6.25	30	5	17
7.25	65	13	20
8.25	58	22	38
9.25	14	6	43
More than 9.75	2	0	..
Totals	178	50	28.1

* Grouped to nearest indicated weight

Relationship to birth weight—Table 3 shows that in this outbreak overweight as well as underweight infants apparently were somewhat more susceptible than those of normal birth weight.

Sex—There were 28 cases in males, 22 in females. All 3 deaths occurred in males.

Age—In the absence of knowledge of the date of effective exposure it is impossible to fix the incubation period. Table 4 shows the distribution of cases according to the day following birth in which first symptoms occurred. The median case fell on the 5th day. The most interesting feature of this table is the indication that the incubation period may be as short as 24 hours. The brevity of this period suggests an infectious or toxic agent received by ingestion, paralleling the experience with gastroenteritis in older children and adults.

TABLE 4

Distribution of Cases by Day of Onset

Onset: Days after Birth	*No. of Cases*
1	3
2	3
3	5
4	10
5	6
6	7
7	7
8	4
9	1
10 and over	4
Total	50

Mode of transmission—The medical histories of the mothers and the causes of illness among nurses absent from duty or cared for by the institutional medical service were reviewed without gaining any information as to the manner in which the agent responsible for the outbreak was originally introduced.

There was little opportunity for direct contact, the bassinets being kept in cubicles with intervening partitions 2 feet in height. Breast-fed infants were conveyed to mothers in a large carrier, a partition 10 inches high separating the infants. Although in these circumstances respiratory spray from one infant might reach another, none presented any respiratory illnesses which would forcibly eject such a spray for a great distance. Transmission of infection by equipment did not seem likely since individual tubs, toilet articles, and thermometers were used, infants were diapered in their own bassinets, and a clean drape was placed on the scale before weighing each infant.

Some degree of transmission through breaks in nursing technic seemed quite possible although the evidence was indirect. In the previous year the hospital averaged about 100 deliveries

per month, but the phenomenal rise in the birth rate in 1942 increased this rate to more than 150 per month. Coincidental with the increase there was difficulty in securing sufficient and well trained nurses. Prior to and in the early weeks of the epidemic the nurseries were understaffed, it being reported that on occasion a single nurse might be responsible for the care of 30 or more infants for a period of hours, and it was indeed observed that one nurse would frequently be caring for as many as 20 infants at one time. The ratios of infants to nurses far exceeded minimum standards. In the large nursery, H2, bassinets were in two adjoining rooms, yet a sink was provided in only one. In the several nurseries nurses were occasionally observed to wash their hands only perfunctorily after diapering an infant and to use cold or tepid water and very little soap. Until May 2 or 3 the routine provided for diapering infants before feeding, thus increasing the risk of transmission of infection if a break in technic occurred.

As reported previously,[1] rubber nipples have been suspected as a vehicle of infection. In this hospital they were washed in the nursery after use, placed in a vessel of boiling water for a period of 3 to 15 minutes, removed with sterile forceps, and placed in a sterile covered jar until the time of the next feeding when they were applied to the bottles by hand by the nursery nurse. No precautions were taken to insure complete submersion of nipples in the water. The period of boiling seemed rather short in view of a finding some weeks previously by the obstetrical supervising nurse that satisfactory bacteriological results were not obtained with less than a 20 minute period.

The possibility of transmission through contaminated formula[1] was seriously considered in view of the nearly simultaneous onset of the epidemic in the two nurseries operating in April, the explosive occurrence of cases on April 27, and the similar course of the epidemic in both nurseries. Formula was prepared in a room which was well equipped but obviously too small for the purpose. Bottles were boiled for 15 minutes before being filled. Whole milk formula, water and 5 per cent lactose solution, were reported to be boiled prior to filling bottles. Evaporated milk was boiled in the can, added to Karo and boiled water in a graduate, and the mixture poured into bottles. Powdered milk formulae were made with boiled water but the resultant mixture was not boiled. After the nursing bottles were filled a boiled rubber cap was applied. Some were sent to the nurseries to be refrigerated until needed and some, together with additional formula held in reserve in quart bottles, were stored in the formula room refrigerator. Failure to defrost often and frequent opening of the refrigerators cast some doubt as to the adequacy of refrigeration. These preparations were carried out by one or more student dietitians and a maid, under supervision of the chief dietitian. Other demands on the time of the latter were so great that close supervision was not maintained.

Nipples and formula which were ready for use by infants were secured at random under sterile precautions, and examined by the Rochester Health Bureau Laboratories and the Division of Laboratories and Research, New York State Department of Health. Total bacteria counts were obtained for nipples by swabbing outer and inner surfaces with a sterile swab moistened in buffered dilution water, reimmersing the swab in 2 ml. of the water and then plating out 1 ml. Counts were obtained for formulae by the standard plate count method for milk examination.

TABLE 5

Total Bacteria Counts Obtained upon Examination of Rubber Nipples and of Formula

Date Prepared	Nipples: Total Bacteria per Entire Surface				Formula: Total Bacteria per ml.			
	No. of Samples	Maximum	Median	Minimum	No. of Samples	Maximum	Median	Minimum
April 30					7	180	60	20
May 1	2	>160,000	....	>160,000	1	10	..	10
2	20	>160,000	6,500	60	0	..	..	..
4	19	>160,000	7,000	28	2	150	..	10
5	7	16	4	<4	5	470,000	70	10
6	14	8	0	0	15	550	80	10
7	1	2	..	2	2	12,000	..	2,000
10	5	6	0	0	7	540,000	100	0
11	4	76	0	0	4	100	0	0
12	6	4,300	42	0	6	30,000	0	0
14	2	6	..	2	2	2	..	0
17	4	4	2	0	4	0	0	0
21	5	4	2	0	5	500	0	0
22	2	4	..	0	2	300	..	200
24	2	0	..	0	2	200	..	0
25	1	2	..	2	1	0	..	0
28	3	4	0	0	3	100	1	0
Totals	97				68			

Table 5 shows the number of samples examined and the maximum, median, and minimum counts for the indicated day. Caution must be used in reading the results for formula examination; on May 5 the count next highest to the one of 470,000 was only 200; on May 10 the count next highest to the one of 540,000 was only 200, and on May 12 the count next highest to the one of 30,000 was only 600. A definite reduction in the counts for nipples is observed beginning with reorganization of the formula room May 5. Improvement in formula counts is not so noticeable until May 11. Organisms of the coliform group, indicating contamination presumably of fecal origin, were found on April 30 in 2 samples of formula, May 5 in 1 and May 12 in 1. They were found May 1 on 2 nipples, May 4 on 7, and May 12 on 3.

Diagnostic laboratory findings—53 fecal specimens from 17 sick infants were submitted to the Division of Laboratories and Research for examination. None of the bacillary incitants of enteric disease nor any other microörganisms of recognized diagnostic significance were found. Marion B. Coleman of the Division of Laboratories and Research, New York State Department of Health, kindly repeated the work described in a previous communication.[1] Two or more baby Swiss mice were inoculated intraperitoneally with ether-treated portions of each specimen and in addition single fecal specimens from each of 10 infants in a second hospital in Rochester were similarly examined as controls. The results are summarized in Table 6.

Grouping the severe and mild cases, it is found that 39 per cent of inoculated mice died, and grouping the normal controls, only 11 per cent died. Or, considering infants whose feces contained some principle capable of killing mice, 70 per cent of the severely ill possessed this property; while 53 per cent of the severe and mild cases together, and only 27 per cent of the control cases had this property. These data have been so presented as to minimize the apparent difference between sick and well infants and taken as they stand may not appear conclusive. However, taking into account the factors mentioned in the footnotes to Table 6, particularly the prolonged incubation period in fatal instances in

TABLE 6

Lethal Effect upon Baby Swiss Mice of Injection of Ether-treated Suspension of Feces from Infants

Diagnosis in Infants	*No. of Infants*	*No. of Fecal Spec.*	*No. of Mice Inoculated*	*Per cent of Mice Dying*	*Per cent of Infants Whose Feces Caused Death of Mice*
Hospital A					
Severe case	10	36	80	42	70
Mild case	7	17	30	27 *	28
Normal	1	4	8	..	..
Hospital B					
Normal	10	10	20	15 †	30
Totals	28	67	138	33	43

* Of the 8 deaths upon which this percentage is based, 7 occurred among mice inoculated with specimens from a single infant.

† The 3 deaths upon which this percentage is based occurred 6, 7, and 15 days following inoculation, in comparison with a usual period of 1–4 days in mice dying in the other groups. In each instance a mouse inoculated with a portion of the same specimen survived.

NOTE: 4 infants in the "severe" group were receiving sulfaguanidine. For 2 of these all mice survived; for 2 others 13 of 28 mice died.

the control group, it appears justifiable to interpret these findings as showing that some agent lethal for mice is frequently present in feces of infants suffering from diarrhea of the new-born. Unfortunately, this agent has not been identified. The relatively infrequent association of this effect with feces of mildly ill infants may have been due to improper diagnosis or a lesser concentration of the agent in the feces, or both.

Control measures—Prior to the investigation, control measures had consisted of instituting gown technic on April 28, isolating very ill infants by transfer to the pediatric nursery, vacating and washing nursery H1-A, closing H2-A to admissions, and establishing H2-B for new admissions on the dates indicated in Table 1. Mild and suspicious cases were not usually recognized and isolated, and since there was no one person responsible for detecting and ordering isolation of cases it was not uncommon for a day or two to elapse between onset and isolation of a recognized case. The measures described did not seem conspicuously successful, although one cannot state with certainty what the actual outcome would have been had no additional measures been imposed.

On May 1 arrangements were made for the detection of ill and suspiciously ill infants according to the criteria described in the section on diagnosis. Being an attempt to determine infectiousness and based primarily upon feces rather than clinical condition, this standard resulted in the classification of some infants as definite or suspicious cases at a time when their general condition seemed satisfactory to the clinicians. Considerable friendly dispute with clinicians arose thereby, but the standard was rigidly adhered to and all such infants were required to be isolated.

Specific recommendations were made for preparation of nipples and formula in the central formula room. Formula for a 24 hour period was to be made up and subsequently boiled before filling autoclaved bottles; nipples boiled 30 minutes while completely submerged were to be applied to the bottles in a sterile field using aseptic technic; nipples were to be covered with an autoclaved metal cap; and the whole was to be immediately refrigerated.

Assuming that these recommendations would be carried out immediately, a new nursery, H3, was opened May 1 to receive newly-born infants who would have had no contact with others

and who would receive sterile food and drink. Well infants in other nurseries were to remain where they were unless they became ill and required transfer to the pediatric nursery, or until they were discharged home. Establishing H3 was not a successful venture; one-third of the 15 infants admitted within the next 5 days became ill, beginning May 4. The manner in which the disease was introduced is not known, but from a study of Table 5, it would seem reasonable to attribute it to failure to sterilize nipples, and possibly formula, until May 5. On the latter date the formula room was placed in charge of a nurse who taught bacteriology, with immediate improvement in bacteriological results. Under her direction the new procedure was routinized and was subsequently returned to the dietitians. Other control measures provided that infants be diapered after rather than prior to feeding, and placed emphasis on careful handwashing. A larger nursing staff and rearrangement of one of the nurseries were urged.

Having attained satisfactory technic in the formula room, new nurseries, H1-B and H2-Prem. were opened May 5 (see Table 1). No cases occurred among infants born on this date or thereafter for a period of daily study extending through June 4. The cessation of the epidemic following these measures may have been due to prompt recognition and isolation of cases, or improvement in nursing technic, or proper sterilization of nipples and formula, or some combination thereof.

SECOND OUTBREAK: JULY, 1942

After June 4 daily observations were discontinued in the expectation that satisfactory conditions would continue, but on July 22 the hospital reported the recent occurrence of a number of cases of diarrhea. An investigation undertaken in the manner previously described revealed that the nurseries had remained free of diarrhea from June 4 until July 8 and 9 when 3 rather mild cases occurred in H1 nursery. These were not isolated but the outbreak subsided spontaneously. On July 17 an infant in the H1 nursery developed loose stools and was not isolated but, following this, cases began to appear as shown in Table 7.

TABLE 7

Distribution of Cases of Diarrhea among New-born Infants According to Date of Onset and Nursery of Occurrence

Date	*H1*	*H2*	*H3*	*Total*
July 10–16	..	..	Closed	0
17	1	..	"	1
18	..	..	"	0
19	..	1	"	1
20	4	2	"	6
21	..	2	"	2
22	..	5	..	5
23	..	1	..	1
24	..	..	..	0
25	Closed	..	3	3
26	"	..	..	0
27	..	..	Closed	0
28	..	..	"	0
29	1	..	"	1
30	..	..	"	0
31	..	..	"	0
Aug. 1	..	..	"	0
2	..	..	"	0
3	..	1	"	1
4–24	..	..	"	0
Totals	6	12	3	21

The majority of these cases were quite mild, resembling those classified as mild in the April-May outbreak, and there were no deaths. None of the bacillary incitants of enteric disease or any other microörganisms of recognized diagnostic significance were isolated from 11 fecal specimens from 6 sick infants. Twenty-two mice were injected as described previously. One mouse inoculated with material from the most severe case died 8 days later; the others remained well and showed no abnormalities when chloroformed and autopsied 3 or 4 weeks later.

The rather explosive occurrence of cases July 20, 21, and 22, and the similar attack rates of 24 per cent in H1, and 32 per cent in H2 nurseries suggested a common source of infection, probably nipples or formula. In

partial support of this hypothesis it was found that of 8 nipples prepared July 22, one showed a total count of more than 160,000 and others counts of 56,000, 8,000, and 4,400. These were chiefly spore-forming organisms, probably *Bacillus subtilis*. Of 8 samples of formula, only one had a high count, 29,000; this and two other samples yielded *B. subtilis*. Perhaps as a result of the attention focused on the formula room, results were uniformly good July 23 and after.

When feeding histories were analyzed, however, it was difficult to support the hypothesis of spread by contaminated nipples and formula. Table 8 shows attack rates according to feeding history for infants in the hospital July 18–23. Section A of the table classifies infants according to the type of feeding beginning from birth and indicates that in this outbreak breast feeding carried a great risk of attack. This finding was so contrary to what was expected that it was thought possible a number of infants classified in Section A as breast-fed might have gone to breast for only a few days in the preëpidemic period and subsequently received formula as a supplement or alone during the period beginning with the onset of the first case on July 17. Section B of Table 8 classifies infants according to the type of feeding in the period July 17–20. This analysis brought out even more strikingly the risk of breast feeding and the safety of artificial feeding under the conditions prevailing, and directed attention to breast-feeding technic.

It was found that under the stress of a shortage of nurses the practice had developed in each of the two nurseries of providing a single breast tray containing a vessel of 4 per cent boric acid and one of cotton pledgets. Infants were diapered, etc., prior to being taken to the mother for breast feeding. The nurses would then dip cotton pledgets in the boric acid and with the fingers squeeze the excess fluid back into the vessel. Infants were carried to the mothers, the pledgets were used to cleanse the nipples and the infants were then put to breast. The cotton pledgets as such did not fall under suspicion because a fresh supply was received daily from the carefully controlled central autoclave. There remained the possibility that a nurse might contaminate the boric acid solution with her fingers and if the organisms survived for even a short time contamination could be transmitted to the nipples of a number of mothers and thus to their infants.

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TABLE 8

Attack Rates According to Type of Feeding History—July Outbreak

A. According to Feeding from Birth

Type of Feeding	*No. of Infants*	*No. Ill*	*Per cent Ill*
Breast milk and lactose	14	9	64
" " " formula	24	9	38
Formula alone	8	0	.
Totals	46	18	39

B. According to Feeding from July 17

Breast milk alone	2	2	100
" " and lactose	13	9	69
" " and formula	15	7	47
Formula alone	16	0	..
Totals	46	18	39

TABLE 9

Fate of Organisms Inoculated into 4 Per cent Boric Acid and Allowed to Remain There for Indicated Time

Time in Minutes	*Fraction of Original Culture*	*Average Count per ml. in Suspension*		
		E. Coli	*S. aureus*	*S. faecalis*
<1	1/1,000	180	0	TMC *
	1/100,000	1	0	1,700
5	1/1,000	50	0	TMC
	1/100,000	1	0	1,400
15	1/1,000	27	0	TMC
	1/100,000	0	0	1,400
45	1/1,000	7	0	TMC
	1/100,000	0	0	1,300
75	1/1,000	8	0	TMC
	1/100,000	0	0	2,300

* TMC = too many to count

prepared suspensions of *Escherichia coli, Staphylococcus aureus,* and *Streptococcus faecalis,* and inoculated them into 4 per cent boric acid and into distilled water. At the intervals indicated in Table 9, portions were removed and the average count per ml. determined. With both 1:1,000 and 1:100,000 dilutions there were too many colonies to count in case of all three cultures which were inoculated into distilled water. In 4 per cent boric acid *S. aureus* failed entirely to survive and only a few organisms of the coliform group survived, but *S. faecalis* was not affected. It is not held that *S. faecalis* was the etiologic agent in this outbreak but it does seem reasonable to assume that some type of organism capable of surviving for some time in 4 per cent boric acid was at fault.

As in the previous outbreak sick infants were promptly isolated in a separate nursery (H3). By July 25 the probable mode of transmission was sufficiently appreciated to lead to the recommendation that breast technic be revised. Effective control seems to have been attained shortly thereafter by the use of forceps to handle the pledget, although one case occurred in a formula-fed infant July 29, and one in a breast-fed infant August 3. The technic was later revised to provide for individual pledgets on wooden applicators. No further cases were recognized during a period of close observation concluded August 24.

In explanation of the approximately simultaneous outbreak in the two nurseries is the fact that shifts of nurses occurred at a time and under conditions which would permit the development of cases by the spread of infectious material from the case developing July 17. The greater incidence of cases among those receiving breast milk and lactose solution than among those receiving breast milk and formula is perhaps due to the fact that on the average the former were put to breast more often, and without fail during the night when lapses in technic were more likely to have occurred.

SUMMARY

1. An epidemic of diarrhea of the newborn consisting of 22 mild and 28 severe cases, with 3 deaths, occurred in a Rochester, N. Y., hospital in April and May, 1942.

2. The etiological agent was not determined. Evidence was secured that the feces of sick infants contain an agent fatal to baby Swiss mice in significantly higher proportion than feces of well infants.

3. The incubation period was observed to be as short as 24 hours in 3 cases. The disease tended to select infants below and above normal birth weight. Two of the 3 deaths occurred in infants with birth injury or congenital abnormality.

4. The incidence of illness was significantly greater and more severe among infants artificially fed than among the breast-fed.

5. Opportunity for transmission of infection was afforded by contamination of nipples and formula. Delay and inadequacy in recognition and isolation of cases may have been contributory. The epidemic came to a close following correction of these faults.

6. A second epidemic of diarrhea of the new-born consisting of 21 mild, non-fatal cases occurred in the same hospital in July, 1942.

7. Illness was limited almost exclusively to breast-fed infants. Opportunity for transmission of infection was afforded by probable contamination of a common vessel of 4 per cent boric acid used to cleanse the breasts. The epidemic came to a close following correction of this fault.

CONCLUSIONS

Epidemic diarrhea of the new-born is a disease in which the unidentified etiological agent is present in the intestinal and possibly oral discharges of sick infants. The occasional introduction of the disease into a nursery, probably from an inapparent adult source,[2] is difficult to prevent. If routine technics permit transfer of infectious discharges through contamination of nipples, formula, and breasts, or indirect transmission by attendants, an epidemic will occur when the infection is introduced. Insufficient or inadequately trained personnel and faulty equipment contribute to the opportunities for transfer of secretions and excretions. Prevention and control depend upon laboratory controlled methods of sterilizing nipples and formula, good nursing technic, prompt recognition, reporting and isolation of cases, and immediate epidemiological investigation by a competent person, which ordinarily will mean by an epidemiologist in the health department.

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