

INFANTILE GASTRO-ENTERITIS WITH SPECIAL
REFERENCE TO THE SPECIFIC SEROLOGICAL TYPE
O 55 B 5 H 6 (*BETA* TYPE) OF *BACTERIUM COLI*

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In this country and abroad the association of certain specific serological types of *Bacterium coli* with infantile gastro-enteritis has been receiving increasing attention. The original observation made by Bray (1945) that, from the majority of cases in a hospital outbreak at Hillingdon, an organism which he named *Bact. coli neapolitanum* could be isolated, was corroborated and extended by the work of Giles & Sangster in Aberdeen (1948), and by the extensive observations of Taylor, Powell & Wright (1949) in London, by Rogers, Koegler & Gerrard (1949) in Birmingham, by Holzel, Martyn & Apter (1949) in Manchester, by Beeuwkes, Gijsberti Hodenpijl & Ten Seldam (1949) in Holland, by Magnusson, Laurell, Frisell & Werner (1950) in Sweden, and more recently in this country by Payne & Cook (1950), and by Kirby, Hall & Coackley (1950). In a further paper, Giles, Sangster & Smith (1949) showed that in addition to *Bact. coli neapolitanum* another distinct serological variety could be recovered from certain sporadic cases, and from groups of cases in outbreaks. Again Smith (1949) showed that this organism, which had received the designation *Beta*, was tending to replace the first type in its association with cases of gastro-enteritis in Aberdeen.

In order to avoid confusion it is necessary to give the present position of the terminology which has been used to designate the various types.

	Author	Designation
First type	Bray	<i>Bact. coli neapolitanum</i>
	Giles and Sangster	<i>Bact. coli</i> type α
	Taylor	D 433
	Rogers <i>et al.</i>	<i>Bact. coli</i> B.G.T.
	Kauffmann	{ O 111 B 4 O 111 B 4 H 2 O 111 B 4 H 12
Second type	Giles <i>et al.</i>	<i>Bact. coli</i> type β
	Kauffmann	O 55 B 5 H 6

Workers in this country have interchanged strains of the two types and found them to be serologically distinct and specific. They have also referred their strains to Kauffmann at the State Serum Institute in Copenhagen, whose extensive serological survey of the coli group (1947) has enabled him to place them in his classification. The *Bact. coli neapolitanum* strain described by Bray was found by Kauffmann to have a new 'O' antigen to which he assigned the number 111. The *Beta* variety of Giles *et al.* was found to correspond with another variety which he had already designated O 55 B 5 H 6. Kauffmann, in a personal communication

previous to the publication of a paper on these types, has informed workers that the strains of the first type can be further subdivided by the absence of an 'H' antigen in certain strains, and by the presence of an 'H2' or an 'H12' antigen in others. Variations of antigenic formulae in different strains will no doubt help considerably in the elucidation of the epidemiological problems associated with the distribution of the organism.

REVIEW OF CASES 1949-50

It was decided to review the case notes of infants who had been admitted to the Gastro-enteritis Unit at the City Hospital, Aberdeen, and to comment on outbreaks in other hospitals and children's nurseries in the region during the 18 months' period 1949 to 30 June 1950. In all, 295 cases were admitted, the majority of whom gave a history of vomiting and/or loose stools for varying periods, and all were referred for admission as suffering from 'gastro-enteritis'. As the diagnostic error among enteritis admissions is high, even with full laboratory and radiological diagnostic aids, it was decided not to classify the cases according to their clinical diagnosis on admission, but according to the bacteriological findings of the stool examinations. To provide the necessary data the faeces, to begin with, were examined only once a week, but this was soon increased to two or more examinations during the same period. Furthermore, detailed notes were kept throughout, such symptoms as the onset of loose stools, vomiting, weight loss, or failure to gain weight, being particularly noted. Thus, as shown in Table 1, Group 1

Table 1. *Classification of cases admitted to gastro-enteritis unit*

Year	No. of cases	Group 2, Group 3, O 55 O 55		Group 1, O 55 positive on ad- mission	Group 3, O 55 negative on ad- mission	O 111 on ad- mission	O 111 positive on ad- mission	<i>S. typhi</i> <i>murium</i> infections	Sonne dysentery	Cases omitted
		on ad- mission	through- out							
1949	224	53	91	37	4	8	1	30		
1950	71	23	28	13	0	0	2	5		
Total	295	76*	119	50	4	8	3	35		

* This group includes twelve symptomless carriers

consists of 76 cases whose faeces showed the O 55 type of *Bact. coli* on admission; Group 2 comprises 119 cases with negative stools and of whom 97 were suffering from a parenteral infection; and Group 3 cases are those with negative faeces examination and doubtful symptomatology, but later becoming O 55 positive. It was thought that this third group of cases, those with few real clinical symptoms of true gastro-enteritis, and negative faeces on admission but later becoming positive, should provide some evidence of the relationship of the organism to the disease. In fact, a cross-infection in hospital is presumably the nearest approximation that can be made to a crucial feeding experiment of infants, though such an experiment can be carried out in adults (Kirby *et al.*, 1950). Further, in four cases

the infection was associated with the O 111 type, in eight with *Shigella dysenteriae* Sonne, in three more with *Salmonella typhi murium* while 35 cases were omitted on account of incomplete bacteriological findings.

During the past 18 months the most notable feature of the disease has been its mildness as compared with the severity of the previously reported series of cases which occurred during the epidemic period of 1947. After an incubation period of 3–10 days the majority of cases started by having rather loose stools, and this was followed by a refusal of feeds, or actual vomiting. The infants looked pale and toxic, often before there was any evidence of dehydration, and despite adequate feeds several infants failed to thrive although no dramatic loss of weight was noted. On the other hand, a continuous spectrum of severity could be observed starting with the asymptomatic carrier and going on to the severe case dying fairly rapidly. There were, however, no fulminating cases dying within a few hours of admission, and there was little evidence of liver damage.

The stools had a rather distinctive, but not particularly offensive smell, a characteristic which was found to be of considerable diagnostic value, and this odour seemed to be different from that associated with the O 111 type of infection. Several cases had high spikes of fever which suggested a possible bacteraemia, and in one case the symptoms suggested an encephalitis. Recovery from the acute phase was fairly rapid and no case went on to a state of marasmus. Treatment was similar to that used by other gastro-enteritis units, though there was perhaps a tendency to initiate intravenous therapy at an earlier stage in the disease. The mortality rate for the whole of the 295 admissions to the unit was 6 or 2.03%. In Group 1 there were no deaths, in Group 2 three out of 119, and in Group 3 one out of 50, while in the series discarded on account of incomplete bacteriological findings there were two.

A comparison of the incidence of parenteral infections in Groups 1 and 2 is given in Table 2. In the O 55 faecal positive group there were 12 cases with no

Table 2. *Incidence of parenteral infections in Group 1 (O 55 positive) and Group 2 (O 55 negative) on admission*

	Total	Respiratory system	Dietetic upset	Urinary infections	Central nervous system	Various	None
Group 1, O 55 positive	64	19	—	—	—	1	44
Group 2, O 55 negative	119	72	10	4	2	9	22

signs or symptoms of gastro-enteritis, being carriers who had been removed to isolation from other units following routine examination of faeces of contacts in certain outbreaks which will be described later. These have, therefore, been excluded. Thus it will be seen that 31% of the O 55 positive group had clinical evidence of parenteral infection as compared to 82% of the O 55 negative group. The respiratory tract was most commonly the seat of the infection, a fact already noted by Smellie (1939) and Gairdner (1945). The duration of stay in hospital is some

indication either of the severity of the disease, or of the possible superimposition of another infection, or of the effectiveness of chemotherapy. Thus after 17 cases in Group 1 treated with chloromycetin are excluded, 58 O 55 positive cases had an average stay in hospital of 31.5 days. In the Group 2 series of O 55 negative cases three died, leaving 115 cases with an average stay of 17 days. In the Group 3 series of cases who became positive after admission one case died, three remained in hospital and six were treated with chloromycetin leaving 40 cases with an average stay of 45 days. It would seem, therefore, that a cross-infection in hospital with the O 55 type definitely prolonged the illness.

An analysis of the necessity for the use of infusion fluids showed that in Group 2 cases with negative bacteriological findings 14 out of 15 cases required such treatment on the day of admission or within a short period thereafter. In the Group 3 series which became O 55 positive after admission, 18 cases required intravenous therapy, seven on admission, nine when the dehydration was closely and two when it was more distantly related to the date on which the faeces became positive. The bacteriological findings usually became available after intravenous therapy had been started. It would seem, therefore, that the aggravation of symptoms seemed to coincide to a considerable degree with the appearance of O 55 in the faeces. The classification of the Group 3 cases in relation to symptoms developing after becoming cross infected was as follows:

	Cases
Severe gastro-enteritis with no parenteral symptoms	10
Moderate gastro-enteritis with no parenteral symptoms	7
Mild gastro-enteritis with no parenteral symptoms	11
Moderate gastro-enteritis with no parenteral symptoms but treated with chloromycetin	5
Severe gastro-enteritis with parenteral symptoms	0
Moderate gastro-enteritis with parenteral symptoms	2
Mild gastro-enteritis with parenteral symptoms	2
Hyperpyrexia with no gastro-enteritis	1
Faecal positive cases with no symptoms	12
Total	50

One infant had a mild gastro-enteritis superimposed upon a tuberculous peritonitis. Three more children had an upper respiratory tract and one a urinary tract infection, but as all had mild symptoms of gastro-enteritis it was difficult to decide whether the enteritis was due to the parenteral infection or not. Further, 33 out of the 50 cases had some form of gastro-enteritis without parenteral infection, five more cases had gastro-enteritis associated with a parenteral infection, and discounting the case of the child with hyperpyrexia, 12 or 24 %, showed no symptoms. These latter cases could be recognized as temporary carriers, as their faeces became negative again within 4 weeks.

SERIES OF CASES TREATED WITH CHLOROMYCETIN

As it was apparent that *Bact. coli* O 55 type was associated with a mild form of gastro-enteritis prevailing in Aberdeen, chloromycetin (chloramphenicol) was administered to 28 patients, cases of gastro-enteritis and symptomless carriers, to

see whether the O55 type could be eliminated from the stools, and whether clinical improvement took place in those cases with gastro-enteritis. The mildness of the disease and the small number of cases have made assessment difficult.

Chloromycetin has the advantage over several drugs which have already been tried that, when given by mouth, it acts both on the contents of the bowel and also systemically. This latter action might be important as the O111 type has, on occasion, been obtained from liver, spleen, mesenteric nodes and meninges, and one case has been described in which the O55 type has been obtained from the liver. Probably, however, the spread of these organisms is accidental in some cases and in others occurs prior to death. Chloromycetin is dispensed in the form of 250 mg. capsules which are unsuitable for babies. Consequently, the powder from these was added to orange juice, as chloromycetin is unaffected within a pH range of 2-9. Surprisingly the infants took this unpalatable mixture well, though in two cases the sickness from the gastro-enteritis appeared to be aggravated. The dose in each case corresponded approximately to 50 mg./lb./day, the actual amount being in multiples of 250 mg. which is the content of one capsule. As supplies of the drug were limited it was decided, as a trial, that each course should last 4 days. It became apparent that a longer course was necessary, and latterly a 6-day course was introduced. No other drugs were given during the course, and only routine alterations to the feeds were made according to the progress of the infant. Stools were tested, as far as possible, immediately before and after treatment.

Thirty-four courses of treatment were given, as follows:

Number of courses	Duration (days)
1	1½
1	2½
24	4
8	6

In 29 cases stools which were positive immediately before treatment were negative at the first test afterwards; 21 out of 24 on the 4-day course, and 7 out of 8 on the 6-day course responded thus. One case on the 6-day course which did not respond was also having intramuscular dihydro-streptomycin for a tuberculous peritonitis. All cases which did not respond were on full strength milk feeds, whereas those that did respond were on half strength Ringer lactate solution, or on part strength milk feeds. Eventually, however, after the influence of the drug had been completely removed no less than 10 cases subsequently became positive again.

Only 13 cases showed evidence of clinical gastro-enteritis at the onset of treatment, although it may be that the institution of early treatment prevented the onset of the disease in a higher proportion. Seven of these 13 were more severe cases and required intravenous therapy at varying periods during the week prior to the onset of antibiotic therapy. In all 13 cases, in the opinion of four observers, there was definite clinical improvement. The stools became more formed and lost their typical smell, while the infants became keener on their feeds and showed a definite all round change for the better. These signs of improvement were most evident in the seven severe cases. Various features of the disease were studied in

an attempt to present, in statistical form, evidence of the improvement. The number of stools without reference to their character and to the type of feeds was found to be of no value, but weight increase was believed to be a suitable guide. In all patients undergoing 4- and 6-day courses of treatment (the 1½- and 2½-day courses were excluded) the average weight gain over the 7 days from the first day of therapy was 13 oz., while the average weight gain in the 13 cases with gastro-enteritis was 12 oz. This is practically double the normal gain of 6-7 oz. per week.

CROSS-INFECTION IN HOSPITAL WARDS AND CHILDREN'S NURSERIES

During the past year and a half it has been the routine practice to send specimens of faeces from all children under 2 years of age in hospital wards and children's nurseries who showed evidence of gastro-enteritis, and accordingly many hundred examinations have been carried out. The results of this investigation are summarized in Table 3. There have not been any serious outbreaks, but those that have occurred

Table 3. *Cases infected with Bact. coli type O55 in wards and institutions not reserved for gastro-enteritis*

Hospital or Institution	Ward	Type	No. of beds	Type of case	No. of outbreaks			Total examinations	Sonne dysentery
					Single sporadic cases	No. of clinical cases	No. carriers		
C.H.	No. 1	Open	30	Part primary tuberculosis, part I.D.	1	0	0	18	0
	No. 3	Cubicle	16	Pneumonia, I.D.	4	0	0	30	1
	No. 7	Open	16	Primary T.B.	0	4	2	26	0
	No. 8	Semi-cubicle	24	I.D.	0	0	0	14	4
R.H.S.C.	No. 9	Cubicle	16	I.D.	0	0	0	32	0
	Isolation	Cubicle	10	Various	1	0	0	6	0
Thorn-grove Home	3 wards	Open	30	Infants residential	0	2 (1)	1	133	0
							3		
Westfield Home	2 wards	Open	20	Infants residential	0	2	1	59	11
Woodend Home	2 wards	Open	20	Infants residential	1	4	0	24	0
Pitfoldes Home	7 wards	Open	40	Infants residential	0	0	0	159	17
Four day nurseries	—	Open	Variable	Infants	1	0	0	31	11
					8	27	25	558	44

I.D. = infectious disease.

have provided useful information. There has been an almost complete absence of the O111 type, but the relationship of the O55 type to cases and outbreaks is again close. The frequency of Sonne dysentery was markedly diminished in 1949, but in 1950 infections due to this organism again became more prevalent.

No comment is necessary on the sporadic clinical cases which are recorded in Table 3, as most of them were admitted under a wrong diagnosis and were transferred to the gastro-enteritis unit, when they were found to be infected with the

O55 type. It is necessary, however, to comment on the small outbreaks which occurred in different institutions.

City Hospital, Ward 7. In February 1949, two children who had been discharged from this ward developed gastro-enteritis at home and had to be re-admitted to the gastro-enteritis unit, one being seriously ill and the other having moderate infection. Both children yielded the O55 type of *Bact. coli*. Specimens from eight contacts showed four to be positive, two having mild infections and the other two being symptomless carriers. All the positive cases were removed and no further cases occurred.

Royal Hospital for Sick Children, Ward 3. Two small outbreaks occurred over a period of 18 months, the first in April 1949, and the second in 1950. In the first outbreak there were two cases, one terminating fatally with marked symptoms and both with positive faeces, while a third child was a symptomless carrier. In the second outbreak there were three moderately severe cases, all with positive faeces and, in addition, three symptomless carriers. As soon as the infected children were removed on each occasion no further cases became cross-infected and all cases in the second outbreak recovered.

Thorngrove Home. This institution normally houses children ranging from 1 month to 2 years in age of both sexes. The children are confined to cots in three wards and looked after by trained sisters with nursery nurses. Two outbreaks occurred in 1949 and one in 1950. The first outbreak in 1949 (April) produced seven cases and six symptomless carriers of the O55 type, the second (August) two cases with three carriers and in May 1950 there were three cases and no less than nine symptomless carriers. As soon as the bacteriological investigation of the cases was completed the clinical cases, along with some of the symptomless carriers, were removed to the gastro-enteritis unit at the City Hospital, while the other symptomless carriers were sent home.

Westfield Home. In (February) 1950, there was an outbreak of Sonne dysentery involving six infants. Two more children had symptoms of gastro-enteritis and both proved to be O55 positive. When eight contacts were examined one further symptomless carrier of *Bact. coli* O55 was discovered.

Woodend Home. One outbreak of four cases occurred in 1949. Two cases were first sent to the gastro-enteritis unit with typical symptoms and when the faeces of eight infants in the same ward were examined two were found to be positive and both of these gave a history of loose stools and general upset.

AGGLUTINATION TESTS ON SERA FROM PATIENTS

One of the simplest methods of obtaining some idea of the relationship of an organism to an infection is by means of the agglutination test, particularly when that is carried out with serum obtained during the acute stage of the illness and again during convalescence. A significant increase in antibodies denotes a definite correlation between organism and the patient's infection. According to Kauffmann the prevalent strain of *Bact. coli* has the antigenic formula O55 B5 H6. It was decided therefore to test the sera under such conditions as would enable one to demonstrate agglutinins, if present, for certain of these antigens. The antigens were

prepared according to the method used by Kauffmann (1947). The 'O' antigen was a 20 hr. broth culture heated to 100° C. for 2½ hr. and the test for agglutinins was carried out at 50° C. for 20 hr. The 'H' antigen was first fully developed by passaging the culture through a series of Craigie tubes containing semi-solid agar, and when found to be actively motile a broth culture was inoculated, incubated over-night, and then killed by the addition of 0.25 % formalin. The agglutination test was then carried out in the water-bath at 50° C. the result being read after an incubation period of 2 hr. The 'B' antigen, which is a 20 hr. agar culture and is used in the agglutination test at 37° C., was not employed to any extent, as the amount of serum available was often very small, and as Kauffmann has reported that the agglutinins even in immunized animals are of very low titre. In all agglutination tests the lowest dilution of the serum to be tested was 1/10, since the total amount available did not permit of a lower dilution. Serum specimens were collected from 98 infants in all on admission, but many of these failed to show the O55 organism in the faeces at any stage during their stay in hospital, and in certain other cases a second specimen was not obtained. In 29, however, it has been possible to carry out duplicate tests on the lines indicated above, and the results are presented in Table 4. From this it is seen that only in eight instances

Table 4. *Results of agglutinin tests on two serum samples from each of twenty-nine cases*

(Antigen: strain O55 B5 H6.)

Case no.	First test on admission. Antigens		Second test during convalescence. Antigens		Interval in days between tests
	'O'	'H'	'O'	'H'	
4	0	0	1/50	0	17
5	0	0	1/100	0	17
12	0	0	1/40	0	15
24	0	0	0	1/20	23
25	0	0	0	1/20	23
26	0	0	1/10	1/10	23
33	0	1/10	1/10	1/10	25
68	0	0	0	1/80	23
21 cases	0	0	0	0	15-24

Table 5. *Results of single agglutination test on admission on thirty-two O55 positive and thirty-six O55 negative cases*

	Antigens		Faeces for O55
	'O'	'H'	
Case 48	1/5280	1/40	Positive
Case 93	0	1/20	Positive
30 cases	0	0	Positive
36 cases	0	0	Negative

did agglutination occur with some of the antigens. The result in these eight instances did apparently show some slight increase in the titres of the second

specimen as compared with the first. The increase, however, was so small that it would be difficult to attach any significance to the findings. In another series of thirty-two O 55 positive cases and thirty-six O 55 negative cases, in which only one specimen of serum was examined, two O 55 positive cases showed agglutinins and only one of these with a significant 'O' titre (Table 5). All the O 55 negative cases failed to show any agglutinins.

DISCUSSION

The term 'gastro-enteritis' applies to a syndrome the chief manifestations of which are diarrhoea and/or vomiting, and the diagnosis of the diseases which may cause this syndrome is very difficult on purely clinical grounds. To differentiate between cases of *Shigella*, *Salmonella*, or less severe infantile gastro-enteritis, is impossible without bacteriological aid. The severe cases of the disease associated with the *Bact. coli* O 55 infection presented a more distinctive picture, however. These infants were pale and listless with their eyes rolled upwards; there was little or no fever (occasionally the temperature was of a spiking character) and the stools had a peculiar odour which the ward sister could recognize with accuracy. The latter finding was of particular help in early diagnosis as there was of necessity a time lag before laboratory confirmation was forthcoming. Unless early diagnosis is made severe cases may die before treatment with chloromycetin or other antibiotics is begun.

It is apparent that chloromycetin has a definite action in eliminating specific *Bact. coli* from the bowel in some cases or at least in reducing the profusion of the growth. However, it is not considered to be the answer to the problems either of the therapy of the acute case or of the cure of the carrier condition. Smadel (1949) showed by *in vitro* sensitivity tests that a concentration of 2.5 µg./ml. inhibited the growth of *Bact. coli*; on the other hand, *in vitro* and *in vivo* experiments do not always run in a parallel fashion.

As has been shown in the section on institutional outbreaks some of the infants appear to be merely carriers, but the epidemiological findings suggest that they can infect others and thus produce a continuation of an outbreak. We have always been impressed with the extreme infectivity of the organism, and despite extensive routine precautions cross-infection appeared to occur frequently even in a cubicle ward. In view of these findings, chloromycetin was given to asymptomatic carriers as well as cases with the disease. In consequence, during the past 6 months, no infant was discharged to a nursery, other hospital or home where there were other infants, before a minimum of two negative consecutive stools was obtained. Since then no contact cases and no outbreaks have occurred in the institutions or nurseries following admission of cases discharged from this unit.

The actual relationship of the specific *Bact. coli* types to infantile gastro-enteritis is undoubtedly very close, but it is difficult to obtain proof that they alone are the etiological cause of one form of the disease. It has been suggested by several workers that the appearance of specific types of *Bact. coli* in the faeces during an attack is due to a wash-down effect of the diarrhoea. This argument presupposes that the coliform bacterial flora of the duodenum and jejunum differs to some

extent from that of the lower bowel, and normally the types from the upper bowel are not recognized in the faecal sample. Specimens of faeces from many cases of Sonne and Flexner dysentery, and *S. typhi murium* food-poisoning infections have been examined for the specific types of *Bact. coli* but with negative result except in one particular nursery. In this instance there was undoubtedly a mixed cross-infection of Sonne dysentery and infantile gastro-enteritis, and several infants showed both types of organisms in the faeces. Again a small number of observations have been made with material obtained post-mortem from different levels of the bowel—duodenum, jejunum, upper colon, and middle colon. In six infants who have died of diseases other than gastro-enteritis, none of the specimens showed the specific types of *Bact. coli*.

In the Group 3 cases described above, which became O55 positive after being admitted to a cubicle ward, it seemed reasonable to regard the appearance of the O55 organism in the faeces as an indication of cross-infection.

A number of workers have noted the presence of symptomless carriers in infants. In fact, in certain nosocomial outbreaks of infantile gastro-enteritis, there have sometimes been more symptomless carriers of the *Bact. coli* types than there were cases of gastro-enteritis associated with the specific types in the faeces. The occurrence of symptomless carriers does not mean that the organism is non-pathogenic, but that certain individuals are immune. The same phenomenon is encountered in streptococcal infections of the upper respiratory tract, or even for that matter in most infectious diseases. In a recent outbreak of *S. typhi murium* infection in a small hospital with a total of 90 patients and staff, all of whom had partaken of the same food, 46 showed symptoms of food poisoning and 44 did not. Thirty specimens were obtained from those who had been ill and all showed *S. typhi murium*, yet of 13 specimens from those who had not been ill, nine also yielded *S. typhi murium*.

From living infants the specific types of *Bact. coli* have been recovered by several workers from throat and ear swabs, materials from the lung, and in one instance from the cerebro-spinal fluid in a case of meningitis. Post-mortem these organisms have been found in lungs, mesenteric nodes, spleen, and liver. The distribution of the organism in tissues other than the intestine seems to be largely due to chance rather than to their capacity for invasion. Further, in tests made for agglutinins there was a certain amount of evidence of their production in the course of the disease for the specific O55 type of *Bact. coli*. The low agglutinin titres, and failure of titres to rise very much may possibly be explained by supposing that the infection is localized in the intestinal wall and that systemic effects are toxæmic rather than due to bacterial dissemination. However, the titre rises noted in eight out of 29 cases, although low, are probably significant.

In 1947, 94.7% of cases of infantile diarrhoea were associated with the O111 B4 type. During the first half of the year 1948 there were 17 cases infected with O111 B4 and eight with O55 B5 H6, whereas during the second half of the same year there were two cases infected with O111 B4 and 18 with O55 B5 H6. In 1949 there were 86 infections with O55 and four with O111, while in the first 6 months of 1950 there were 27 infections with the O55 type and none with the

other variety. In 1947, the overall mortality was 50 %; in 1948, 32 %; in 1949, 1.7 % and in 1950, 2.7 %. It will be seen, therefore, that not only has a biological change occurred in the type of *Bact. coli* present in Aberdeen, but also that there has been a very marked lowering of the mortality rate. It is to be expected that as more investigations are carried out new serological types of *Bact. coli* will be found to be associated with this disease.

SUMMARY

1. An account is given of the relationship of *Bact. coli* type O 55 B 5 H 6 to cases of infantile gastro-enteritis.

2. In Aberdeen this organism has now largely replaced the O 111 variety (alpha) which had been the prevalent type during 1947 and 1948 in its association with the disease.

3. A brief description has been given of the clinical findings, which show no marked deviation from those found in similar cases elsewhere. The actual severity of the illness as judged by the mortality rate has been greatly lessened.

4. The value of medication with chloromycetin in a small number of cases has been discussed. It is believed that the use of the drug eliminates the organism from the bowel in certain cases and helps to reduce the number of cross-infections even in a cubicle ward. The average weekly weight increase of children on chloromycetin was almost double that of a group of healthy, untreated children.

5. Several small outbreaks of infantile diarrhoea associated with the O 55 B 5 H 6 type in wards and institutions have been recorded. In some the numbers of symptomless carriers of the O 55 type have exceeded those of clinical cases also harbouring the same organism.

6. 'O' and 'H' agglutination tests made with suspensions of the prevalent strain of *Bact. coli* on sera from cases examined early in the disease were mostly negative. Such positive titres as were obtained were low. Examination of paired acute and convalescent sera from 29 cases gave some evidence of increasing titre during the course of the disease in eight cases, but such increase was of low order.

7. The present bacteriological evidence suggests that further specific types of *Bact. coli* will be found to be associated with the disease.

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