Infant diarrhoea due to *Escherichia coli* 091 K? H7

M. H. HUGHES, J. L. GREAVES, AND K. A. BETTELHEIM

From the Public Health Laboratory and the Royal Hampshire County Hospital, Winchester, and the Salmonella Reference Laboratory, Colindale, London

SYNOPSIS A small outbreak of infective diarrhoea occurred among babies in hospital at Winchester, England. The causal agent was found to be a strain of *Escherichia coli* 091 K? H7 which was resistant to several antibiotics. Epidemic diarrhoea due to *E. coli* 091 has previously been reported from south Germany.

The children's ward at the Royal Hampshire County Hospital is a small unit of 35 beds catering for medical and surgical cases of mixed age groups. Around Christmas, 1966, the proportion of babies in the ward was increased by the admission of a series of infants with acute bronchiolitis. Between 28 December 1966 and 4 January 1967 nine infants who had been admitted for this and other conditions developed diarrhoea.

Two infants had diarrhoea on 28 December: one of them (case 1) was a healthy baby born on 2 December after 32 weeks' gestation who had been in the ward since birth; the other (case 2) had been transferred from a children's convalescent home where she had had loose frequent stools in the preceding week and had also developed bronchiolitis; this child may have brought in the infection. Five infants admitted between 28 December and 1 January developed diarrhoea five, five, four, three, and one days after admission respectively.

On 2 January it was recognized that an outbreak of infectious diarrhoea was in progress and the admission of infants to the ward was stopped. The faeces of affected babies had yielded no *Salmonella*, no *Shigella* and no *Escherichia coli* that were agglutinable with antisera to O groups 26, 55, 86, 111, 119, 126, 127 or 128. It was therefore postulated that the causative agent might either be virus, a serotype of *E. coli* which was not agglutinable with the available range of antisera, or another microbial agent. Cultures of faecal extracts were made in stationary monolayers of HeLa and secondary Rhesus monkey kidney cells, but virus was not isolated from the seven infants so investigated. Nose and throat swabs from four of these infants were cultured in HeLa, Rhesus kidney, and HEp 2 cells, also in stationary WI 38 cells incubated at 37°C and human embryo kidney tissue cultures

rolled at 33°C, but virus was not isolated. One-day-old mice were inoculated with all the specimens but Coxsackie viruses were not found.

The antibiotic sensitivity of the *E. coli* population of the faeces of the affected infants was tested by the disc method. It soon became apparent that all the babies with diarrhoea harboured a predominant strain of *E. coli* which was resistant to sulphonamide, tetracycline, ampicillin, streptomycin, and chloramphenicol but which was sensitive to neomycin and kanamycin. On the assumption that a strain of *E. coli* with this unusual resistance pattern was the cause of the outbreak the affected infants were treated with neomycin; one baby had died before this decision was reached but all the others responded favourably. The resistant nature of the epidemic strain of *E. coli* made it possible to isolate it from other organisms by laying a chloramphenicol disc on the primary MacConkey agar plates on which faecal specimens were cultured.

The situation was now seen as an outbreak of diarrhoea in which the faeces of all the affected babies yielded strains of *E. coli* with the same unusual antibiotic resistance pattern. Cultures were sent to the Salmonella Reference Laboratory where all but one were found to consist of *E. coli* 091. One culture proved to be a *Klebsiella*, but a later specimen from the same baby yielded *E. coli* 091. Full antigenic analysis showed that all the strains from the affected babies had the same antigenic formula, 091 K? H7. At present there is no reason to believe that this serotype of *E. coli* is common in the United Kingdom. The records of the Salmonella Reference Laboratory, Colindale, show that in the past two years 680 strains of *Esch. coli* have been identified from cases of infantile diarrhoea but none was found to belong to this serotype or to this O group.

Once the cause of the outbreak had been recog-

nized as *E. coli* 091, a selective culture procedure discovered, and an agglutinating antiserum for identifying the organism made available, it was a fairly simple matter to bring the outbreak to an end. Cultures were made of the faeces of all the children remaining in the ward and of all the staff. No symptomless excretors of *E. coli* 091 were found among unaffected children but two nurses and a ward attendant were found to be excreting the organism; they were removed from contact with uninfected babies until cultures were negative.

Because of the suspicion that the infection might have been imported from children's units in the neighbouring Southampton Hospital group Dr. J. M. Graham kindly kept a special watch for chloramphenicol-resistant *E. coli* strains from these units. He sent us one strain of *E. coli* 091 K? H7 but no direct epidemiological connexion could be established between the Winchester outbreak and the Southampton excreter owing to the time lapse.

The clinical features are shown in the accompanying table.

Eight of the nine babies affected were less than 6 months of age. The incubation period was not

more than three days. The illness was severe, for six babies required intravenous fluid and one died. Treatment was rehydration, restoration of electrolyte balance, and oral neomycin. This antibiotic was effective in eliminating *E. coli* 091. Hydrocortisone was used in case 1 because of the severe gastroenteritis, but without favourable effect, and in case 9 on account of the bronchiolitis for which the child had been admitted to hospital.

A search of the literature revealed that an outbreak of enteritis due to *E. coli* 091 in a Munich hospital had been described by Ruckdeschel (1966), Ruckdeschel and Linzenmeier (1966), and Astor (1966). Thirty-one newborn babies were affected in the Munich hospital, also babies in three other maternity clinics. A difference between the Munich strain and the Winchester strain was that the former was non-motile whereas the latter possessed flagellar antigen H7. The German strain, like our own, was resistant to chloramphenicol, but differed from ours in being sensitive to tetracycline and streptomycin. The German workers also used chloramphenicol resistance as a means of isolating the organisms in mixed cultures.

TABLE

CLINICAL FEATURES IN NINE CASES OF *E. COLI* ENTERITIS

Case No.	Age	Reason for Admission	Date of Admission	Antibiotics Given for Original Condition	Date of Onset of Diarrhoea	First Date <i>E. coli</i> 091 Isolated	Dehydration	Intravenous Fluids	Other Treatment	Result
1	1/365	Healthy premature infant	3.12.66	Penicillin 17.12.66 Ampicillin and cloxacillin 28.12.66	28.12.66	1.1.67	+++	Yes 1.1.67	Hydrocortisone, sod. bicarbonate (intravenous) Frusemide	Died
2	5/12	Acute bronchiolitis	15.12.66	Ampicillin	28.12.66	3.1.67	Slight	No	Neomycin Penicillin	Clinical cure
3	6/52	Acute bronchiolitis	19.12.66	Ampicillin and cloxacillin	30.12.66	3.1.67	+++	Yes	Nystatin Neomycin	Clinical cure
4	4/12	Acute bronchiolitis	27.12.66	Penicillin Ampicillin and cloxacillin	1.1.67	3.1.67	Slight	No	Neomycin	Clinical cure
5	6/12	Acute bronchiolitis	28.12.66	Penicillin	2.1.67	5.1.67	+	No	Neomycin	Cured
6	1/365	Hypoglycaemia and hypocalcaemia	28.12.66	Ampicillin and cloxacillin	1.1.67	2.1.67	+++	Yes	Nystatin Neomycin	Cured
7	8/12	Pneumococcal meningitis and subdural haematoma	30.12.66	Ampicillin and cloxacillin	1.1.67	2.1.67	+++	Yes	Nystatin Neomycin	Cured
8	6/12	Vomiting and refusal of feeds	31.12.66	None	3.1.67	6.1.67	+++	Yes	Neomycin	Clinical cure
9	5/52	Acute bronchiolitis	1. 1.67	Ampicillin	2.1.67	6.1.67	+++	Yes	Hydrocortisone Neomycin	Cured

ADDENDUM

While this paper was in the press a small outbreak of diarrhoea occurred in a residential nursery in Winchester. Nine children had mild diarrhoea of whom four were found to be excreting *Escherichia coli* 091 K? H7. One more was an excreter's sibling and one harboured *Giardia lamblia*. Twenty-three

children and staff without symptoms were free from *E. coli* 091 but one had *G. lamblia*. No other pathogens were found.

REFERENCES

- Astor, K. (1966). *Munch. med. Wschr.*, **108**, 1427.
Ruckdeschel, G. (1966). *Über Escherichia coli* 091. Thesis. Munich.
—, and Linzenmeier, G. (1966). *Zbl. Bakt., I Abt. Orig.*, **200**, 276.