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An outbreak of gastroenteritis due to *Escherichia coli* 0142 H6 in a neonatal department

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Summary: An outbreak of gastroenteritis due to *Escherichia coli* 0142 H6 in a neonatal ward is described. The epidemic affected 16 of 24 infants (infection-rate 66 per cent), of whom one died due to necrotizing enterocolitis. Administration of antibiotics was of limited value in treatment or in eradicating *E. coli* 0142 H6 from the stools. Termination of the epidemic was only accomplished by isolating the patients, accompanied by strict hygienic measures, including the use of disposable gloves. Gastroenteritis due to this organism occurred only in prematurely born infants during the first 2 weeks of life.

Introduction

Escherichia coli 0142 was first reported as a cause of infantile gastroenteritis in 1960 in Indonesia (Orskov *et al.*, 1960). Subsequently several outbreaks of gastroenteritis due to *E. coli* 0142 in neonatal nurseries have been described (Table I).

The mortality rate in the outbreaks varied widely, the infection-rates were sometimes high and there is some evidence that infections were maintained by cross-infection.

Table I. *Summary of reported outbreaks of gastroenteritis due to* E. coli *0142 in newborn nurseries*

	No. of symptomatic cases	Infection rate (%)	Mortality rate (%)	Duration of epidemic (days)	*E. coli* strain
Olarte & Ramos-Alvarez (1965)	18	100	40	33	K86H6
Kennedy *et al.* (1973)	12	NM	16	± 90	K86H6
Love *et al* (1972)	30	NM	3	±240	K86H6
Hone *et al* (1973)	48	15	0	±180	K86H6
Boyer *et al.* (1975)	59	22	7	±275	K86H6
Bockemühl, Fricke & Seeliger (1979).	5	19	0	16	K86H34

NM = not mentioned

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In March 1980 we encountered an outbreak of infantile gastroenteritis due to *E. coli* 0142 affecting 16 newborns. We report here the clinical and bacteriological characteristics of the outbreak and the efficacy of various measures taken to bring the epidemic under control.

Materials and methods

The neonatal department

Het Wilhelmina Kinderziekenhuis in Utrecht is a University Children's Hospital with a special department for neonatal care. The department is divided into a Neonatal Intensive Care Unit (NICU) for 10 patients and a Medium Care Unit (MCU) for 30 patients. Because the hospital has no obstetric ward all patients are referred from other hospitals or from home. The nursing staff of the MCU (17 persons) is separate from the nursing staff of the NICU. The paediatric house-staff (seven persons) works in both the NICU and the MCU. Another 11 persons involved in the care of the infants (radiology, laboratory personnel and physiotherapists) also work in both the NICU and MCU.

Routine procedures to prevent cross-infections in the nursery include handwashing with 'Leverlux' soap before entering the working-area, handwashing between examinations of patients and wearing aprons during infant care.

Microbiology

From all infants admitted to the NICU or MCU cultures are taken from the following sites: nose, throat, external auditory meatus, eyes, umbilicus, skin, rectum, subsequently cultures from ear, nose, throat and stools are taken once a week.

During the outbreak stools of all infants and personnel of the neonatal department were cultured twice a week. From every faecal sample a Gram's stain was made. Stools were cultured on the following media: SS agar and selenite broth for detection of salmonella and shigella; desoxycholate citrate agar and selenite broth with 0·1 mg novobiocin per ml for *Yersinia enterocolitica*; MacConkey agar; blood agar and Ludlam agar for staphylococci; Sabouraud dextrose agar for *Candida albicans*; reinforced clostridial agar supplemented with vancomycin 10 mg/l, polymyxin sulfate 2500 units/l and trimethoprim 5 mg/l for campylobacter and on sulphite polymyxin milk agar (De Vos *et al.*, 1982) for clostridia.

Bacterial isolates were identified using standard bacteriological methods. *E. coli* strains were serologically typed and assessed for toxin production (P. A. M. Guinée, National Laboratory for Public Health, Bilthoven, The Netherlands and B. Rowe, Central Public Health Laboratory, London, UK).

Antibiotic susceptibility testing was performed using the agar disc diffusion method.

Stools were also investigated for rotavirus, enterovirus and adenovirus (A. Hekker, National Laboratory for Public Heath, Bilthoven, The Netherlands).

Antibiotics

Systemic antibiotics administered during the outbreak were ampicillin (100–150 mg/kg/24 h) and gentamicin (5 mg/kg/24 h).

Oral antibiotics included neomycin (50–100 mg/kg/24 h), colistin (15 mg/kg/24 h) and gentamicin (5 mg/kg/24 h). In cases of candidiasis nystatin (100,000 units/kg/24 h) was given orally.

Results

Outbreak

Twenty-four children were hospitalized in the MCU during the outbreak which lasted from 14 March to 21 April 1980. Three of them were referred from another hospital because of gastroenteritis; one was referred from home because of pyloric stenosis and 20 infants were transferred from the NICU of our hospital.

During the outbreak 16 infants were affected, of whom four were severely ill. Symptoms included: diarrhoea, vomiting, lethargy, bradycardias, poor circulation and distended abdomen. Two of the severely ill infants developed necrotizing enterocolitis and one of them died.

Diarrhoea lasted from 9 to 35 days. *Escherichia coli* 0142 was isolated from the stools of 16 of 19 (84 per cent) premature infants and from these 16 infants 14 (88 per cent) were symptomatic. None of the term infants was infected with *E. coli* 0142, and none had diarrhoea.

Microbiology

Escherichia coli 0142 was isolated from the stools of 14 of 16 infants with diarrhoea and from two asymptomatic infants. Stool cultures from the two symptomatic *E. coli*-0142-negative infants only yielded *Cand. albicans.*

From seven of the 16 infants from whom stool cultures yielded *E. coli* 0142 the same strain was also isolated from nose and throat. Stool cultures remained positive for a period ranging from 7 days to 22 weeks. Four nurses had stool cultures positive for *E. coli* 0142. They had no gastrointestinal symptoms. Urine and blood cultures of all patients were negative for *E. coli* 0142. All *E. coli* 0142 strains isolated were susceptible to gentamicin, cephalothin and colistin and resistant to ampicillin, tetracycline and kanamycin and were moderately susceptible to neomycin. None of the *E. coli* strains produced heat-labile or heat-stable toxins. The *E. coli* strains did not react with the antisera available for testing classical pathogenic *E. coli* strains. Ultimately they were typed 0142 by the Dutch Reference Public Health Laboratory. No other pathogens were detected.

Treatment

Antibiotics. The administration of antibiotics in relation to diarrhoea and stool carriage of *E. coli* 0142 is shown in Figure 1. Six infants were initially treated with systemic antibiotics (ampicillin and gentamicin) because of symptoms of sepsis. Five of these infants and seven of the eight remaining symptomatic *E. coli*-0142-positive infants received oral antibiotics. Figure 1 demonstrates that antibiotic treatment was only partially successful in terminating diarrhoea and eradicating *E. coli* 0142 from the stools.

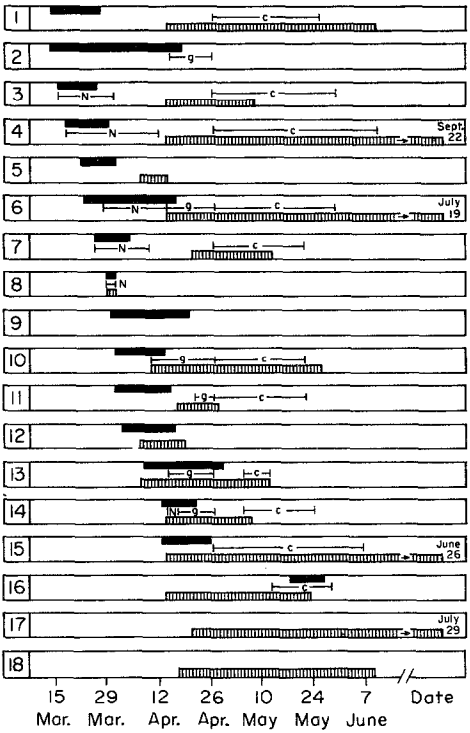

Figure 1. Course of an outbreak of gastroenteritis due to *E. coli* 0142 in a neonatal department. ■, Diarrhoea; ▥, stools *E. coli* 0142 positive. N = neomycin orally and/or ampicillin/gentamicin parenterally; g = gentamicin orally; c = colistin orally.

The four nurses from whom stool cultures yielded *E. coli* 0142 were treated with oral colistin for 1 week. Within 2 weeks after starting treatment stool cultures became negative.

Hygienic procedures. In an attempt to terminate the outbreak the MCU was closed. The *E. coli*-0142-negative patients were either transferred to other departments or discharged from the hospital. The positive infants were hospitalized in a newly opened unit. It was decided that the team

caring for the *E. coli*-positive infants would not be involved in the care of other patients until termination of the outbreak.

Separate aprons and disposable gloves were used for each infant and hands were washed with 'Hibiscrub' before and after every patient contact. Diarrhoea subsided in all infants. No new cases of infantile gastroenteritis due to *E. coli* 0142 were observed during the following 3 years.

Discussion

Escherichia coli 0142 is an enteropathogenic serotype of *E. coli* that has caused several outbreaks of gastroenteritis in newborn nurseries. These outbreaks are summarized in Table I. Affected infants may be severely ill and the duration of the epidemics is often long; both the infection rate and the number of relapses may be high (Rowe and Gross, 1971; Kennedy *et al.*, 1973; Boyer *et al.*, 1975) and this was also our experience.

We encountered an attack rate of 66 per cent and a mortality rate of 6 per cent. Premature neonates appeared to be more susceptible to infection with *E. coli* 0142 than term infants. The increased susceptibility of premature infants may be due to their impaired immunological function (Stiehm, 1980).

The enteropathogenic strain was first isolated from three infants with diarrhoea who were admitted from another hospital in which, however, no other cases of diarrhoea were observed.

The pathogenic mechanism by which enteropathogenic *E. coli* strains cause gastroenteritis is still obscure. Enteropathogenic strains do not produce heat-labile or heat-stable enterotoxins (Gross, Scotland and Rowe, 1976) in which respect they differ from the enterotoxigenic *E. coli* strains, nor are they able to invade the epithelial cells of the bowel as do the enteroinvasive *E. coli* strains. It has been suggested that enteropathogenic strains produce diarrhoea by elaborating potent toxins which alter water transport but which are not detected in conventional assay systems (Klipstein *et al.*, 1978). Another possible mechanism, postulated recently, may be adhesion of certain types of enteropathogenic *E. coli* strains to the enteric mucosal cell surface with disruption of the microvillous brush border (Ulshen and Rollo, 1980; Rothbaum *et al.*, 1982).

Antibiotics (either parenteral or oral) have been administered with varying success (Olarte and Ramos-Alvarez, 1965; Love *et al.*, 1972; Kennedy *et al.*, 1973). This was also our experience, and we feel that antimicrobial agents are of limited value in the treatment of this disease.

Stools from most infants became negative for *E. coli* 0142 after isolation of *E. coli*-0142-positive infants and the application of strict hygienic measures, which possibly prevented relapses due to cross infection. For this reason we agree with others (Boyer *et al.*, 1975) that epidemics of *E. coli* gastroenteritis in newborn nurseries can only be terminated by isolation of

the patients and by applying strict hygienic measures including the use of disposable gloves in patient care.

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