CHAPTER VI

SUMMARY AND CONCLUSION
The role of enteropathogenic E. coli in the pathogenesis of diarrhoeal diseases was investigated for a period of five years in three hospitals in Calcutta.

In all, 1309 cases of diarrhoea occurring in all ages were investigated. In 183 (14.1%) of these patients one or the other of the following nine serotypes of E. coli were isolated and categorised:


Two diarrhoeal epidemics occurring in the new born infants in the hospital nursery were encountered during this period. The first was observed in November 1959 continued up to the end of April 1960 (first episode). After an intermission of 8 weeks there was a second out-break which continued till the end of December 1960 (2nd episode).

A single serotype of E. coli, 0127:B8 was isolated from 84.4% of these 90 cases.

The younger infants were found to be more susceptible with more severe clinical symptoms. The earliest age of onset was 34 hours after birth. There were 3 deaths during this epidemic. All the patients responded dramatically to chloramphenicol and the organisms usually disappeared from the stool within 48 hours after the administration of the antibiotic except in 16 cases where excretion continued up to 9 days.

The second epidemic was observed in May 1964 shortly after a baby was admitted in the hospital with diarrhoea.
E. coli 055:B5 was isolated from this case. Twelve days after the admission of this baby, there was an outbreak of diarrhoea in the nursery affecting 39 neonates spreading over a period of 10 weeks. Majority of these cases were excreting E. coli 055:B5 in their stools.

In contrast to the first epidemic the clinical severity of these cases was milder and there was no fatality. The cases responded very well to antibiotic treatment and most of the children ceased to excrete the organism within 2 days of commencement of the antibiotic.

The most potent source of spread of the organism in both the epidemics was found to be the bathing bowls which were heavily contaminated. Adult contacts: doctors, nurses and mothers were found to excrete the organism in high percentage (25.7%) without any symptoms. Throat-carriage was undetectable, and vaginal carriers of the specific serotype was infrequent and were invariably associated with faecal carrier state.

Apart from these two epidemics which affected 129 infants, 275 sporadic cases of diarrhoea among neonates were recorded. Two enteropathogenic serotypes, E. coli 0111:B4 and 0127:B8 were isolated only in 6.3% of these cases.

Investigation of 379 sporadic cases of diarrhoea occurring in children up to the age of 2 years revealed enteropathogenic E. coli in 9.2% of the cases.

Enteropathogenic E. coli was also isolated from 3.5% of the cases of diarrhoea occurring in children between 2-12 years of age and in 5% of adults.
It was evident that enteropathogenic E. coli was an important pathogen producing gastroenteritis only in the neonatal period and in early infancy.

A total of 622 healthy persons belonging to all age groups and sexes were surveyed, and 10.6% of the random population were found to be carriers of enteropathogenic E. coli.

A remarkable difference in the carrier rates between the low and high socio-economic groups was observed. The significantly higher incidence in the lower socio-economic group has been related to unsatisfactory state of environmental sanitation and poor personal hygiene both in the rural and urban population belonging to this group.

It is significant that 0127:B8 was never encountered in the healthy population. E. coli 055:B5 which caused a mild epidemic in the nursery and which was apparently introduced from outside, was the second commonest serotype isolated from the general population. Another serotype, E. coli 0111:B4, which was the most frequent isolate from the general population, was responsible only for sporadic cases in the nursery. It seems therefore reasonable to postulate that introduction of a new serotype in the institution causes severe form of the epidemic.

No significant seasonal variation was related to the carrier state. This is also true regarding the epidemics as well as the sporadic cases.

The characters of the strains isolated from different epidemics and during the epidemics were carefully studied. Apart
from the capacity to ferment dulcitol and a changing pattern of antibiotic sensitivity, no significant difference was observed in the in-vitro bacterial characters. The E. coli 0127:B8 strains isolated during the first episode of diarrhoea appeared to be a quick dulcitol fermenter when compared to strains of the same serotype isolated from the second episode of the same epidemic. The clinical severity during the second episode was milder than what was observed during the first episode.

The antibiotic sensitivity pattern of strains of E. coli 0127:B8 isolated during the two episodes showed certain characteristic differences. While all the strains of the first epidemic were sensitive to chloramphenicol only one strain, however, seemed to acquire resistance during the second episode. On the other hand, tetracycline sensitivity rose from 41.7% to 95.4% and percentage of streptomycin resistant strains increased from 83.3% to 97.8%. This change in the pattern during the first epidemic can be related to the administration of Chloro-strep. The sensitive strains having been able to overgrow the resistant ones accounted for the increased sensitivity to tetracyclines. Streptomycin resistant strains emerged under the impact of the antibiotic.

Attempts were made to reproduce lesions in the intestine in a suitable experimental model as a means of confirming enteropathogenicity of the isolated strains.

Introducing the causative organism in suckling rabbits through natural routes failed to initiate symptoms. It was,
however, possible to establish the organism in a limited number
of suckling rabbits when the organisms were either introduced
through duodenal intubation or inoculated directly into the
upper part of the small intestine.

The rabbit-loop technique performed in adult rabbits
gave uniformly negative results with freshly isolated strains
from diarrhoea cases as well as with standard strains well known
to cause positive loop reaction.

Using the same technique in suckling rabbits, over 60%
positive results were achieved with only one serotype e.g.
0127:B8. The other epidemic strains and the standard strain E.65
obtained from NCTC failed to produce a consistent and reproduc-
ible result.

The obvious limitations of the rabbit-loop technique
in categorising pathogenicity of strains causing diarrhoeal
disease in infants have been emphasised. Many atypical reactions
were noted which could only be related to the individual suscep-
tibility of the host. It was significant that a non-pathogenic
strain was able to produce same type and degree of positive
reaction produced by a freshly isolated pathogenic strain in an
adjoining loop.

Inspite of these limitations of this technique observed
in the present study, a close analogy could be established with
human disease. The establishment of the infection and its capacity
to produce pathogenic lesions seemed primarily governed by age
specific host susceptibility.
The question of false positive reactions has been critically examined. It seems justifiable that even in the absence of demonstrable histopathological changes under light microscopy, presence of exudation along with multiplication of the organism should be considered as a positive reaction. The limitation of light microscopy as a reliable parameter of functional impairment leading to exudation of fluid has been emphasised.

The results of feeding of volunteers with epidemic strains of E.coli O127:B8 have been compared with those of a control nonepidemic strain.

The epidemic strains were able to establish themselves in adult healthy human volunteers without producing any clinical symptoms. This was associated with a corresponding increase in haemagglutinating antibody titre. It appears, that when strains of enteropathogenic E.coli isolated from a severe epidemic are introduced in adults, they are capable of establishing themselves without causing diarrhoeal disease.

The high incidence of carrier rates in older children and adults, and the low incidence of enteropathogenic E.coli associated with diarrhoeal diseases in these age groups poses serious doubts regarding the role of E.coli in the pathogenesis of diarrhoeas in older age groups. The significant role of enteropathogenic E.coli seems to be confined to neonates and young infants particularly in institutional outbreaks.