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PREFACE

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) is an autonomous, international, philanthropic and non-profit centre for research, education and training as well as clinical service. The Centre is derived from the Cholera Research Laboratory (CRL). The activities of the institution are to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility with a view to develop improved methods of health care and for the prevention and control of diarrhoeal diseases and improvement of public health programmes with special relevance to developing countries. ICDDR,B issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at ICDDR,B. The views expressed in these papers are those of authors and do not necessarily represent views of International Centre for Diarrhoeal Disease Research, Bangladesh. They should not be quoted without the permission of the authors.

ABSTRACT

The classical Vibrio cholerae of Dacca was replaced by El Tor Vibrio cholera in 1973. Earlier studies of El Tor cholera in the same communities where classical cholera existed in rural Bangladesh indicated as well as data from other countries had demonstrated a many more infections for each clinically ill case than was true for the classical biotype.

In the present study the infection rate itself (31.3%) was higher than has been recorded both for classical (13%-24.6%) and El Tor (8.7%-20.6%) disease. The infection to case ratio of 4 to 5 in this study differs markedly from the ratio of 100 to 1 to 34 to 1 reported earlier.

In past observations multiple cases in families occurred 10.6%-17.7% of the time in classical cholera while in El Tor epidemics only 3.7% of families had multiple cases. In the present study 88% of families had multiple cases.

Several other interesting facts came to light in our study. When index cases were children up to 14 years of age or women the subsequent infection and case rates were higher than when index cases were adult males. The rate of hospitalisation of the family contacts of the index cases was several hundred

times higher than the general population in Dacca city during the same time. From this study it may be concluded that under certain socioenvironmental conditions the virulence of V. cholerae El Tor equals to that of the classical biotype. Observations of a similar kind in other endemic zones of the world are needed.

INTRODUCTION

Cholera in Bangladesh was due to the classical biotype of V. cholerae until 1972. Studies on classical cholera [1-6,8] have shown that the infection rates in family contacts were high (13% to 24.6%). In cholera due to the El Tor[3,7,8] biotype rates were somewhat lower but overlapping (8.7% to 20.6%). There was, however, a sharp difference in the number of infections of classical as compared to El Tor cholera associated with each case of clinical cholera. The infection to case ratio in classical[2,3,8] being 2-4:1 and for El Tor[3,8,9] 4-100:1. The infection to hospitalisation ratio and multiple case family rates were also much higher for classical than El Tor cholera.[7] Previous observation on cholera El Tor in Bangladesh[3,7] were in agreement with studies from other parts of the world.[9-11] More recently a higher secondary infection and case rates, infection to case ratios and multiple case per family have been observed among the contacts of cases hospitalised with cholera due to V.cholerae of the El Tor biotype. These differences

between previously published rates and those observed in Dacca prompted us to initiate a family study with a 10 day follow up period of El Tor cholera cases to delineate the characteristics of this disease in a congested urban setting in the same community where many former studies on cholera had been done in Dacca.

METHODS

Over the past 18 years the Cholera Research Laboratory (CRL) has become the principle treatment centre for all diarrhoea cases occurring in and around Dacca. Cases for this study were selected from the CRL hospital if the family of the index case was from the city, willing to co-operate and if index cases had less than two days' history of untreated diarrhoea yielding the El Tor biotype of Vibrio cholerae on rectal swab culture. The families were visited by field teams on the morning following admission, for collection of data on age, sex, number of family members and history of illness.

The family members were visited daily, asked about diarrhoea and rectal swabs were obtained on all members for culture. The swabs were first streaked on Monsur's agar (Taurocholate, Tellurite, Gelatine, Agar-TTGA) and then placed in bile peptone media. Identification of V.cholerae El Tor was done as previously published[12-14].

The first case of a family admitted into the hospital was defined as an index case. A contact yielding V.cholerae El Tor on culture was termed an infection. An infected contact, having three or more loose motions in a day, was defined as a case and an infection without symptoms, an inapparent infection. Contact cases requiring hospitalisation were termed as hospitalised contacts and the remaining contact cases were field cases. Members living together and eating from the same cooking pot, formed a family or household.

RESULTS

Below the age of five the infection rates for males and females were 56% and 28% respectively; but older males (5 and over) also had higher infection rates than females. The overall rate for both sexes was 31.3% (Table 1).

The case rates for all contacts, infected persons and the infection-to-hospitalisation ratio is shown in Table 2. Of the 31.3% infection rate 6.7% were asymptomatic, 17.9% had field diarrhea and 6.7% needed rehydration in hospital. The overall case rate was 24.6%. The infection rate, case rate and infection to case rate were higher in 0-4 and 5-9 years age groups than the group aged 10 and over. But for 6.5 infections one needed hospitalisation in 0-4 years age group and one out of 3.6 infection needed it in 10 years or over age group. On the whole

TABLE 1

AGE, SEX, AND INFECTION RATE OF CONTACTS OF INDEX CASES OF V. CHOLERAE EL TOR

Age	Contacts	Male Infections	Rate/100	Contacts	Female Infections	Rate/100	Total/100
0-4	16	9	56.2	14	4	28.6	43.3
5-9	17	8	47.0	12	3	25.0	38.0
10+	28	9	32.1	47	9	19.1	24.0
Total	61	26[a]	43.3	73	16[b]	22.0	31.3

a vs b Significant

$p < 0.01$

TABLE 2

SPECTRUM OF INFECTION IN CONTACTS

Age Group	Contacts No.	INFECTION SPECTRUM						
		Asympto-matic No.	Mild/moderate Diarrhea No.	Hospital-ised No.	Infection Rate %	Case Rate %	Infection Case %	Inf./Hosp: Ratio
0-4	30	2	9	2	43.3	36.7	84.6	6.5:1
5-9	29	2	7	2	37.9	31.0	81.8	5.5:1
10+	75	5	8	5	24.0	17.3	72.2	3.6:1
Total	134	9	24	9	31.3	24.6	78.7	4.7:1
Total	%	6.7	17.9	6.7	-	-	-	-

one out of every 4.7 infection needed hospitalisation for re-hydration. In all, for one hospitalised case there are 3.7 cases and 4,7 infections.

The duration of excretion of V.cholerae by index cases, secondary cases and inapparent infections is shown in Table 3. Excretion of vibrios was 34% for one day, 19% for two days, 16% for three days, 12% for four days, 1.5% for eight days. The average for the index cases was 3.2 days; for secondary cases, 2.9 days; and for symptomless infections 1.4 days. All the index cases, and 9 hospitalised contacts however, were given Tetracycline. The indexes stopped excretion by 8 days except one case; the contact cases and inapparent infections stopped by 7 and 3 days respectively.

The attack rates in small, medium and large families were 17%, 42% and 34% respectively. (Table 4). These differences are highly significant between the small and the medium groups. The differences in infection rates in these families, are related to the number of children below nine.

When the index case was an adult male (Table 5), the secondary infection rate was 6.3%; and case rate was also 6.3%. If the index case was an adult female, the rates are 44.4% and 37% respectively. If the index cases were children, the infection rate was 31.9% and case rate was 24.2%. All of these differences were significant.

TABLE 3

EL TOR FAMILY STUDY

Duration of Excretion of Vibrio

Days	1	2	3	4	5	6	7	8	9	10	11	Average
Index	6	6	4	4	2	1	-	1			1	
%	24.0	24.0	16.0	16.0	8.0	4.0		4.0			1.0	3.24
Contact Cases	10	7	5	4	3	3	1	-				
%	30.3	21.2	15.2	12.1	9.0	9.0	3.0					2.87
Inapparent Infection	7	-	2	-	-	-	-					
%	77.7	-	22.2	-	-	-	-					1.44
Total	23	13	11	8	5	4	1	1	-	-	1	
%	34.3	19.4	16.4	11.9	7.5	6.0	1.5	1.5	-	-	1.5	2.82

TABLE 4

FAMILY SIZE, CHILDREN AND INFECTION

Family Size (Index Excluded)	No. Contacts	Percent of Children	Secondary Infection/100	Secondary Case/100
Up to 4	41	9.8[a]	17.0[d]	9.8[f]
5-6	43	69.8[b]	41.9[e]	39.5[g]
7+	50	52.0[c]	34.0	24.0
Total	134	44.8	31.3	24.6

a vs b P = <.001

a vs c P = <.01

d vs e P = <.01

f vs g P = <.01

TABLE 5

INFECTION RATES FOR CONTACTS OF INDEX CASES OF VARYING AGES

Age/Sex Index	Infection/100	Case/100
Male 15+	6.3[a]	6.3[e]
Female 15+	44.4[b]	37.0[f]
Children Up to 14	31.9[c]	24.0

a vs b p = $\leq$ 0.01

a vs c p = < 0.01

e vs f p = < 0.05

The findings of previous and present studies of Classical and El Tor cholera is summarized in Table 6. The main similarities as revealed from the present study of El Tor cholera with Classical cholera of the past are in the infection-to-case ratio, hospitalisation rates and index-specific subsequent attack rates in children. The main differences with previously reported El Tor data are in age distribution, secondary case rates, infection-to-case ratios, hospitalisation rates, multiple hospitalised case family rates, the infection-to-hospitalisation ratio and the duration of excretion of vibrio under tetracycline coverage[15,16].

DISCUSSION

For many years cholera caused by Vibrio cholerae biotype El Tor was considered to be milder than that due to the Classical biotype. This study shows that this is not so in Dacca where the secondary infection rate, infection-to-case rate, infection-to-hospitalisation ratio and multiple case per family rate were all higher for Vibrio cholerae of the El Tor biotype than for previous epidemics due to classical Vibrio cholerae.

Since these observations are qualitatively different than those reported in previous epidemics due to El Tor biotypes, both an explanation is required and further studies needed. A

TABLE 6

SUMMARY OF PAST AND PRESENT OBSERVATIONS

	Observation on Classical Up to 1969	El Tor Up to 1970	Present El Tor
Secondary Infection Rate	4.2 - 20.9%	17.8-20.6%	31.3%
Rate Under 9 Years	30.3%	17.8-25.9%	40.7%
Second, Case Rate	4.2 - 16.4%	4.0-9.3%	24.6%
Infection:Case Ratio	2-4 : 1	4-36:1	1.3:1
Hospitalisation Rate	6.2, 9.9%	1-1.2%	6.7%
Infection:Hospitalisation Ratio	1.3 - 2.6:1	15-17:1	4.7:1
Multi.Hosp.Case/Family Rate	10.6 - 17.6%	3.6-3.7%	20%
Index			
> 15 Male :	Secondary Infec.Rate:Low	N.A.	6.3%
> 15 Female	Secondary Infec.Rate:High	N.A.	44.4%
Child < 15	Secondary Infec.Rate:High	N.A.	31.9%
Mean:Duration of Excretion of V.C.	7 - 2.6 Days (Tetracycline)	5 Days (No Tetracycline)	3.2 Days (Tetracycline)

change in virulence of El Tor organism may be responsible since, in the same socioenvironmental condition the Vibrio cholerae of the El Tor biotype has proven to be as virulent as Vibrio cholerae of the classical biotype. The increase in the population of Dacca city and the probable deterioration of sanitation may have contributed to the changing pattern as well as any biological changes in the vibrio. These findings may not be unique to Dacca alone. Studies are badly needed in other countries with endemic cholera due to El Tor biotype. In addition, this study reveals two more important factors: (1) The age and sex of the first case of a family significantly influences the subsequent attack rates among the contacts, and (2) family contacts have several hundred fold greater risk of being hospitalised with cholera than does the population of the same area.

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