

# SHIGELLOSIS IN CHILDREN: A PROSPECTIVE HOSPITAL BASED STUDY

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## ABSTRACT

From 1985 to 1988, fecal samples of 950 hospitalized children suffering from diarrhea or dysentery were screened for *Shigella* species using standard methods. *Shigella* species were isolated as sole pathogen from 192 (20.2%) cases and *S. flexneri* type 2 was the predominant serotype. *Shigella* infection was prevalent throughout the year with high isolation rate during the summer and early monsoon months. *Shigella* strains isolated during the period were resistant to most of the commonly used drugs for the treatment of shigellosis. Nearly 16% of the *Shigella* strains were also resistant to nalidixic acid. Presence of blood and mucus in stools (dysentery) was the common clinical presentation of shigellosis cases. Malnutrition was associated with longer duration of illness. High cases fatality rate (16.7%) was observed among hospitalized children infected with *Shigella*.

**Key words:** Shigellosis, *Shigella* serotypes, *S. flexneri* type 2, Malnutrition, Dehydration.

Shigellosis continues to be a major cause of diarrhea in the world. About 20% of hospitalized diarrhea patients have shigellosis worldwide(1). Several epidemics of shigellosis particularly by *S. dysenteriae* type 1 were reported from different corners of the globe since 1968(2,3). A devastating epidemic of multidrug resistant *S. dysenteriae* type 1 swept through West Bengal and State capital Calcutta in the year 1984(4). Since then a large number of Shigellosis cases were admitted in different hospitals of Calcutta. This paper presents an analysis of shigellosis patients up to the age of 5 years admitted to Dr. B.C. Roy Memorial Hospital for Children, Calcutta, between the period January, 1985 and December, 1988.

## Material and Methods

Dr. B.C. Roy Memorial Hospital for Children, Calcutta is a large children hospital, providing free treatment to inpatients and outpatients. Catchment areas of this hospital include Calcutta metropolis and suburbs. Patients come from all socio-economic groups. The number of diarrhea or dysentery cases treated in the hospital varied between 10,000 and 12,000.

Between January, 1985 and December, 1988, children of both sexes aged up to 5 years, suffering from acute watery diarrhea or dysentery, admitted to hospital between

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8 am and 1 pm on the first four days of the week, were included in the study. Patients who had received antibiotics prior to hospitalization were excluded from the study.

Detailed clinical history was obtained and a thorough physical examination was performed. The severity of watery diarrhea cases was assessed by clinical signs and symptoms of dehydration(5). In dysentery cases, severity of illness was determined from the frequency of stools and presence of associated symptoms such as fever(6). The patients were weighed to the nearest 10 g and were allocated to different "weight for age" nutritional groups according to the Indian Academy of Pediatrics using the Harvard standard weight(7). All patients were followed up daily till discharge or death. The WHO guidelines for management of Shigellosis were followed(5). Older children received full hospital diet and the feeding schedules of younger children were also continued.

**Microbiological methods:** Fresh stool sample was obtained from each patient before initiation of therapy and transported to the laboratory immediately for detection of established enteropathogens using standard techniques(8). A battery of culture media including MacConkey's agar, Deoxycholate agar, xyloselysine deoxycholate agar and *Salmonella Shigella* agar were used. Suspected colonies were biochemically characterized by API 20E system (API system, montalin, verlin, France) and were finally serotyped by slide agglutination with *Shigella* polyvalent and monospecific antisera commercially obtained from Wellcome Reagent Ltd., England. The isolates were tested for their susceptibility to various antimicrobials by dry disk diffusion techniques(9).

Statistical analysis was done using the Chi-square test and Fisher's exact test.

**TABLE I—*Shigella* Serotypes Isolated from Hospitalized Children with Diarrhea and Dysentery.**

<i>Shigella</i> serotypes	No. positive	% positive
<i>S. dysenteriae</i>		
type 1	56	29.2
type 2	2	1.0
type 4	2	1.0
type 6	1	0.5
<i>S. flexneri</i>		
type 1	4	2.1
type 2	96	50.0
type 3	5	2.6
type 4	2	1.0
type 6	2	1.0
<i>S. boydii</i>		
type 2	4	2.1
type 6	4	2.1
type 12	2	1.0
type 14	3	1.6
<i>S. sonnei</i>	9	4.7
Total	192	100.0

## Results

Of the 950 hospitalized children up to the age of 5 years suffering from diarrhea or dysentery presenting between January, 1985 and December, 1988, *Shigella* species as a sole pathogen were recovered from their stools in 192 (20.2%) of cases. *Shigella* infection was prevalent throughout the year, but its incidence was higher in summer and early monsoon months (April through August). *Table I* shows the rate of isolation of different *Shigella* serotypes during the period of observation. *S. flexneri* type 2 was the predominant serotype isolated. Shigellosis was not seen among children upto the age of 6 months (*Table II*).

**TABLE II—Age Distribution of 192 Hospitalized Shigellosis Cases**

Months	No. of cases studied	No. (%) of cases positive for <i>Shigella</i>
0-6	80	0
7-12	130	22 (16.9)
13-24	175	33 (18.8)
25-36	198	42 (21.1)
37-48	186	48 (25.8)
49-60	181	47 (26.0)

**TABLE III—Clinical Characteristics of 192 Patients Infected Solely with *Shigella***

Clinical features	No	%
Dysentery	165	85.9
Watery diarrhea	27	14.1
Vomiting	22	11.5
Abdominal pain	140	72.9
Fever (>38°C)	129	67.2
Anorexia	113	58.8
Tenesmus	95	49.5
<i>Dehydration status</i>		
No dehydration	162	84.4
Some dehydration	27	14.0
Severe dehydration	3	1.6

All isolates of *Shigella* were resistant to streptomycin (100.0%), chloramphenicol (95.3%), tetracycline (93.2%), trimethoprim-sulphamethoxazole (75.0%), ampicillin (63.5%) and kanamycin (47.9%) but were susceptible to furazolidone (80.2%), gentamycin (86.4%), nalidixic acid (83.8%) and ofloxacin (100.0%).

The salient clinical characteristics of shigellosis patients are summarized in Table III. Shigellosis patients presented either as watery or blood mucus diarrhea (dysentery). Most of the cases complained

of blood and mucus in stools. Vomiting was commonly associated with watery diarrhea. Abdominal pain, fever and tenesmus were commonly present in children complaining of blood and mucus diarrhea. Majority of the shigellosis patients (84.4%) had no dehydration.

Of 192 children with Shigellosis, 93 (48.4%) were well-nourished, and 99 children (51.6%) were malnourished, with their body weight being less than 79% reference standards for weight for age. Of the 93 well-nourished children with shigellosis, 90 (96.8%) recovered within 13 days of the onset of illness. In only 3 (3.2%) of these diarrhea persisted for more than 14 days. Among the 99 malnourished children, 80 cases (80.8%) recovered within 13 days and in 19 cases (19.2%) diarrhea persisted for more than 14 days. Duration of diarrhea ( $\geq 14$  days) was longer in malnourished children and this was statistically significant ( $\chi^2 = 10.527$ ,  $p = 0.000117$ ). Out of 34 children with shigellosis presenting with watery diarrhea, only 1 (2.9%) had longer duration of diarrhea, compared with 21 (13.3%) amongst 158 shigellosis cases presenting with blood and mucus diarrhea. The difference in duration of diarrhea in two groups was not significant (Fisher exact test,  $p = 0.67$ ). Severity of the disease on admission with infecting serotypes of *Shigella* could be compared only between *S. dysenteriae* type 1 ( $n = 56$ ) and *S. flexneri* type 2 ( $n = 96$ ). Infection with other *Shigella* serotypes was less frequent. High fever (>38°C) and increased frequency of stools ( $\geq 15$  times/day) were observed more often with *S. dysenteriae* type 1 infections compared with *S. flexneri* type 2 infections. This was statistically highly significant (85.7% vs 52.1%;  $p = .00001$ ).

The shigellosis patients were initially treated with either trimethoprim-sulpha-

methoxazole or ampicillin or furazolidone. In nonresponsive cases therapy was changed to nalidixic acid. Three patients (1.6%) received intravenous Ringer's Lactate Solution. Oral rehydration solution was required in 27 (14.0%) cases. Thirty two children (16.7%) suffering from shigellosis died. Patients were also surveyed for intestinal, extraintestinal and hematological complications. No such complications were observed. Three (1.6%) children developed severe anemia and required transfusion of whole blood. Rectal prolapse was observed in 5 patients (2.6%).

### Discussion

The isolation rate of *Shigella* was low in several studies of diarrheal disease from India from time to time(10-15). In the present study, *Shigella* serotypes were isolated in 20.2% of children hospitalized for diarrhea during the period 1985-1988. The predominant serotype was *S. flexneri* type 2. An extensive epidemic of dysentery due to *S. dysenteriae* type 1 swept through West Bengal in the year 1984(4,16). It appears that Calcutta metropolis and suburbs became an endemic zone for *Shigella* after the 1984 epidemic. A higher rate of isolation of *S. flexneri* type 2 was observed during this period. Neighboring Bangladesh also experienced this change in isolation of *Shigella* species after the preceding epidemic of Shigellosis(17).

The incidence of Shigellosis is higher during the period April through August in Calcutta, compared with Bangladesh, where incidence is higher during the months of October and November(18). The reason for this variation in seasonality is not clear since living and environmental conditions of the people of the state of West Bengal, India and Bangladesh are almost similar. Further there is large scale

movement of the people across the border of two countries. Strains of *Shigella* isolated in the present study were multidrug resistant but most (83.8%) strains were susceptible to nalidixic acid. Nalidixic acid was effective also in intractable cases. Only 16.2% strains of *Shigella* were resistant to nalidixic acid in this period of investigation. Emergence of nalidixic acid resistant strains of *Shigella* have been reported from other parts of India(19,20) and Bangladesh(21).

Malnutrition was associated with increased duration of illness. This corroborates the findings of an epidemiological study from Bangladesh(22). Malnutrition might impair the immunity(23) in these patients and contribute to a longer duration of illness. Shigellosis was not observed on children under the age of 6 months. The protection might have been provided by the breast milk(24). The death rate among shigellosis children was high (16.7%), but intestinal, extraintestinal or hematological complications were rare. Underlying nutritional deficiencies contributed to the deaths of these patients by reducing the metabolic reserves required to sustain patients during the stress of infection.

The clinical characteristics of watery diarrhea in shigellosis patients supported the possible role of enterotoxin(s), inducing secretion of water and electrolytes from small intestine in absence of any bacterial invasion of the mucosa(25,26). In blood and mucus diarrhea, organisms invade colonic epithelial cells. *S. dysenteriae* type 1 produced more severe illness than *S. flexneri* type 2(27).

Oral rehydration therapy is invaluable as life saving therapy for dehydrating watery diarrheas. Such therapy has limited role in preventing death from shigellosis, since most of these cases do not have dehy-

dration. These patients need appropriate antibiotic therapy. The changing resistance pattern of *Shigella* in developing countries necessitates a search for alternative drug for the treatment of shigellosis. Nalidixic acid and newer quinolones(28) were effective in shigellosis. *Shigella* strains have also developed resistance to nalidixic acid as reported from many developing countries(19,21). Newer quinolones are not yet recommended for treatment of shigellosis in young children for fear of potential cartilage toxicity(29). Suitable alternate drugs for the treatment of childhood shigellosis should be sought. Improved personal hygiene will limit the spread of *Shigella* infection in the community.

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