*Research article*

# Clinical manifestations and microbiology of Shigella diarrhoea in children admitted to Teaching Hospital, Jaffna, Sri Lanka

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**Abstract:**

**Introduction**: Diarrhoeal diseases are an important public health problem in Sri Lanka.

**Objectives:** To determine the organisms that caused diarrhoea, the clinical profile, socio-demographic details including living conditions, microbiological analysis and response to treatment.

**Method:** A retrospective study was done from October 2014 to January 2015. Hospital records were used to analyse living conditions, water supply and general wellbeing of the children in addition to clinical and microbiological data.

**Results**: A total of 346 (4% of total admissions) cases were admitted with diarrhoeal illness to the paediatric wards during the study period. One hundred and twenty one (35%) children had blood and mucous diarrhoea of whom *Shigella sp*. was isolated from the stools of 15. The mean age of children with proven shigellosis was 2.3±1.1years. Seven of the patients with proven shigellosis had poor growth indicated by the low weight for height i.e. between the -2SD and -3SD. *Shigella flexneri II* was identified in 14 patients and *Shigella sonnei* from one patient. Eight (53%) patients with *S. flexneri* were treated with IV gentamicin to which there was a clinical response. Majority (12) of the households did not have a proper water supply and 10 families had to travel >5 km to get clean drinking water facilities. All 15 cases demonstrated poor hygienic practices.

***Conclusions**:* Blood and mucus diarrhoea accounted for 121 of 346 admissions for diarrhoea during a 4 month period in Jaffna Hospital. A positive aetiological diagnosis was made in only 15 patients, with *S. flexneri* isolated from 14 and *S. sonnei* from one patient.

*Key words: Dysentery, developing countries, Shigella*

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## Introduction

According to the 2006 World Health Organization (WHO) report on infectious diseases, diarrhoea has been the 6th leading cause for hospitalisation with 676.1-961.3 admissions per 100,000 population in developing countries.[1]

Diarrhoeal diseases are an important public health problem in Sri Lanka. Although there has been a dramatic reduction in case fatality rate over the last few decades, admissions to hospital due to diarrhoeal diseases have not decreased considerably, with incidence rates remaining almost the same or showing a marginal reduction throughout the years.[1] Childhood food habits, the use of contaminated water and improper disposal of excreta increase the incidence of these diseases. [2]

The occurrence of diarrhoea varies by age. Children aged 9-11 months are more prone to get diarrhoeal diseases as this is the time of weaning and development of greater mobility making them more exposed to pathogens.[1] Prevalence of diarrhoea of 5 percent or more has been reported in the Sri Lankan districts of Nuwara Eliya, Batticaloa, Ampara, Anuradhapura, and Polonnaruwa.[3] The Jaffna district has also experienced a higher incidence of diarrhoeal diseases (4%) in recent years.[4]

The causative agents of watery diarrhoea are mainly viruses.[1] The main cause of dysentery is *Shigella* which is a bacterium.[1] However, there are many other microbes that can cause dysentery, including *Campylobacter jejuni, Entamoeba histolytica* and *Escherichia coli*.[5] *Shigella* species are classified into four serogroups, namely *S. dysenteriae, S. flexneri, S. boydii and S. sonnei.*[5] *S. flexneri* is the most frequently isolated species worldwide, and accounts for 60% of cases in the developing world.[1] *S. sonnei* causes 77% of cases in the developed world, compared to only 15% of cases in the developing world[1] and *S. dysenteriae* is usually the cause of epidemics of dysentery, particularly in confined populations such as in refugee camps.[5] *S. dysenteriae* and *S. flexneri* are the predominant species in the tropics.[3] Clinically, *S. dysenteriae* serotype 1 is associated with severe disease, large outbreaks, or epidemics.[1] *S. sonnei* occurs more frequently in industrialized than in developing countries and causes milder illness than *S. dysenteriae* and *S. flexneri*. In USA too, the distribution by species was similar to previous years, with *S. sonnei* accounting for the largest percentage of infections (75%), followed by *S. flexneri* (12%), *S. boydii* (0.8%), and *S. dysenteriae* (0.3%).[6] More recently, the predominant species has shifted from *S. flexneri* to *S. sonnei* in Thailand, Vietnam, and Sri Lanka, a phenomenon possibly linked with the level of development of these countries.[2]

The WHO and the Ministry of Health guidelines recommend that all episodes of diarrhoea with blood in the stool be treated with antibiotics.[1,6] The WHO currently recommends treatment with ciprofloxacin (a quinolone) or one of the three second-line antibiotics, pivmecillinam, azithromycin or ceftriaxone (a third-generation cephalosporin).[6,7] The recent emergence of ciprofloxacin resistance has further narrowed the use of effective antibiotics.[8]

There is a lack of recent reliable data on shigellosis, especially from Sri Lanka and a recently observed surge of this infection in Jaffna, the disease burden in this part being high when compared to the rest of the country, promoted us to conduct this retrospective survey.[8]

## Objectives

The objectives of this study were to determine the aetiological agents of dysentery and analyse the clinical profile, socio-demographic details including living conditions and the response to treatment in children under the age of 12 years admitted to hospital in the period October 2014 to January 2015.

## Method

A hospital based retrospective study was done from October 2014 to January 2015. All children aged less than 12 years who were admitted with a history of diarrhoea were included in the study. Diarrhoea was defined as the passage of liquid stools or passage of large volume of stools more than 3 times per day.[9] Data regarding socio-demographic details, clinical presentation and microbiological investigations were obtained from the patient record sheets maintained in the paediatric wards.

Stool samples had been collected and cultured at the microbiology laboratory according to the standard operating procedures.[10] Isolates suspected as *Shigella* species on xylose-lysine-deoxycholate (XLD) and MacConkey agar and showing a *Shigella* pattern on Kligler iron agar (KIA) were speciated by slide agglutination using commercial antisera and sent to the Medical Research Institute, Colombo, for subtyping. Antibiotic sensitivity of the recommended antibiotic panel for *Shigella* species had been performed by disc diffusion method according to the Clinical Laboratory Standards Institute (CLSI) methodology.[10,11] Antibiotics that did not have breakpoints in CLSI were tested using the Joan Stokes comparative method.[12] The collected data was analysed using Statistical Package for Social Sciences version 21. The response to treatment was assessed considering the number of days in hospital, recurrence of admission, chronicity of the symptoms where it lasted more than 14 days and the appearance of haemolytic uraemic syndrome. Follow up of the cases was done via telephone after obtaining informed consent. Approval was obtained from the hospital research committee and director to use the records.

## Results

A total of 346 (4% of total admissions) cases had been admitted with diarrhoeal illness to the paediatric wards during the study period. The mean age was 3.8±1.2years. Average distance between home and the tertiary health care facility was 5.2±1.3km. The clinical profile of the 346 children with diarrhoeal illness is shown in Figure 1. Watery and mucoid diarrhoea together were reported in 225 (65%) of the patients and blood and mucous diarrhoea (dysentery) in 121(35%) patients. Stool cultures had been done in 67 patients (41 patients with dysentery, 25 patients with watery/mucoid diarrhoea and in 1 patient without a documented reason. Of these, 15 were positive for *Shigella spp*. Fifty cultures were negative and reports were not available for 2 patients.

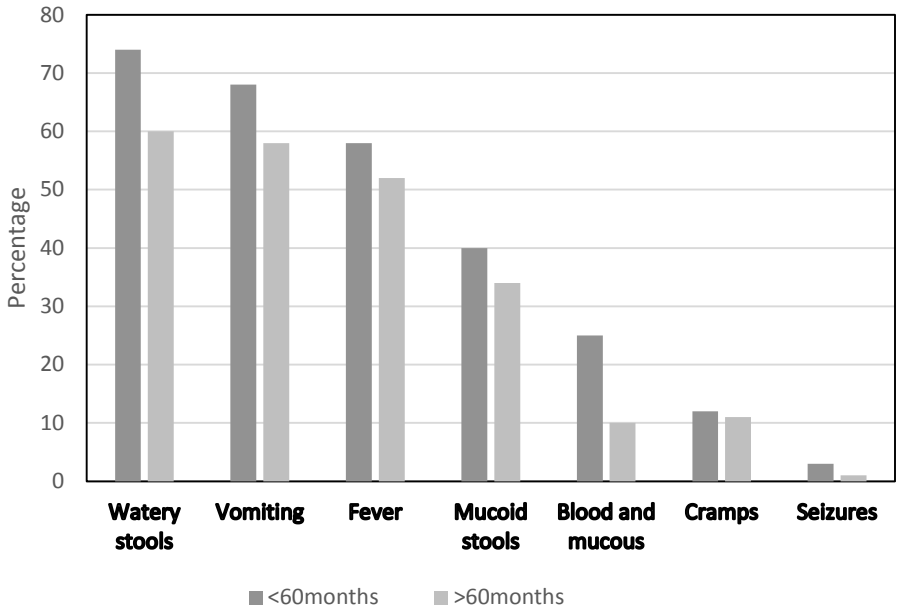


**Figure 1:** Clinical profile of the children admitted to Paediatric wards of Teaching Hospital, Jaffna October 2014 - January 2015

The 15 culture confirmed patients with shigellosis had been further studied. Of these, 3 (20%) had watery stools, 4 (26.7%) had mucoid stools and only 8 (53.3%) had blood and mucous diarrhoea. Whilst 3 (20%) had moderate dehydration, none were severely dehydrated. The mean age of the patients with shigellosis in our study was 2.3±1.1years. Seven patients with proven shigellosis had poor growth indicated by low weight for height i.e. between -2SD and -3SD. However, none of the children had very severe malnutrition (<-3SD). The poor growth did not have a significant association with severe disease as assessed by dehydration (P=0.6). Mean duration of stay in the hospital was 2.8±0.8 days. Anaemia (haemoglobin <10g/dl) was seen in 06 (40%) and did not have a significant effect on the severity of the disease (P>0.5).

The microbiological profile showed 14 of the patients had *S. flexneri II* in the stool culture and one had *S. sonnei*. All *S. flexneri* isolates were susceptible to mecillinam, ciprofloxacin and ceftriaxone and were resistant to ampicillin, trimethoprim-sulfamethoxazole, furazolidone and nalidixic acid. Eight (53%) patients with *S. flexneri* were treated with IV gentamicin, 6 (40%) with IV cefotaxime and one with oral cephalexin at the onset of the disease. Thirteen patients who received IV antibiotics received intravenous therapy for 48 hours and were then converted to oral cephalexin for the next 5 days. Two patients received IV cefotaxime for 5 days. These two children showed signs of dehydration. All the patients were treated with zinc sulphate and probiotics as well.[16]

Looking at the socio-demographic profile of the 15 culture confirmed cases of shigellosis, poor socio-economic status reflected by an earning of < Rs 10,000/= per month was seen in 13 (87%). Twelve households did not have a proper water supply and 5 families had to travel >5 km to access clean drinking water facilities. Five families practiced open air defaecation and 6 used common toilets shared by more than five families. The mother was the main carer of 12 of the patients. The educational level was grade 10 in twelve of the mothers whereas the rest were less than grade 8. All children were exclusively breast fed for 6 months. 11 patients were admitted to the health care facility within 48 hours of the onset of the disease. There was a significant association with the level of hydration and timing of admission to the health care facility (*P <0.01*). All the patients recovered without any sequelae. None of the patients had evidence of haemolytic uraemic syndrome and none had evidence of readmissions to suggest a chronic course.

## Discussion

The burden of shigellosis is greatest in resource poor settings. The incidence of the disease cannot be determined from this study as this study is record based and not a prospective study. In addition, it is known that many patients are treated outside the formal healthcare setting with the possibility of over the counter medications being used by patient carers. Stool cultures were performed in only 41 of 121 patients identified as having dysentery. A multicentre study has shown a higher incidence of shigellosis in the Indian subcontinent when compared to industrialised countries.[2]

The clinical profile in the current study reflects a benign clinical course with no evidence of severe dehydration, interpretation being limited by the small numbers represented in this study. There were no deaths reported and none had chronic diarrhoea. Earlier reports from the Asian region have stressed the potential severity and poor outcome of shigellosis.[2] The benign nature of the disease in the 15 patients with shigellosis in the current study may be a reflection of the reduced virulence of the organisms and/or seeking medical care early in the disease. The absence of *S. dysenteriae* which causes severe disease may also be a contributory factor.

The host characteristics of patients with shigellosis indicate that severe malnutrition contributes to high morbidity and mortality.[1] Malnutrition based on the weight for height values was seen in 7 (47%) in the current study but did not have a significant effect on the severity of the disease. The severity of the disease may be low due to low number of cases, lower virulence of the organism, absence of *S. dysenteriae* and early medical treatment at out-patient level.

In Sri Lanka, it has been reported that the incidence is mainly due to *Shigella sonnei* matching industrialised countries.[3] *Shigella flexneri* was isolated in 14 of 15 patients with shigellosis in the current study, which may reflect regional under development compared to the rest of the country. The other possible reason is the underutilisation of the microbiological services by the medical profession. Further improvement of microbiology laboratory facilities are required to obtain reliable data on the aetiology of dysenteric diarrhoea in the district.

The antibiotic resistance pattern of the 15 isolates matches previously reported studies.[7,13,14] Even though gentamicin is not included in the list of drugs recommended for treatment of shigellosis, there was a clinical response in our study. Hence we conclude that gentamicin is still an effective drug for shigellosis for short term use in resource limited settings.[13,14]

Over the counter sale of antibiotics without prescription is one reason for emergence of antibiotic resistance. Antibiotic resistance to ampicillin and co-trimoxazole, two standard drugs used in patients with shigellosis, was reported over 20 years ago in Sri Lanka.[14] WHO stated in their 2004 report to replace the use of nalidixic acid with ciprofloxacin in the treatment of dysentery.[7,15] Our study also demonstrates resistance to ampicillin, co-trimoxazole, furazolidone and nalidixic acid. *S. flexneri* isolated in the current study was sensitive to mecillinam, ciprofloxacin and ceftriaxone. Although gentamicin sensitivity was not tested, it showed clinical effectiveness in eight (53%) patients with a clinical response in 48 hours. All the patients received a cephalosporin at discharge to complete the antibiotic course. None of the patients were readmitted and none had a chronic course showing the benign nature of the disease.

The limitations of this study include the use of retrospective data and the very limited microbiological investigations with a poor isolation rate. Routine culture facilities became available in Jaffna hospital only in the past 3 years. However, publication of the results of the study is helpful to establish the presence of culture confirmed shigellosis in the Jaffna district. A well planned prospective study with adequate microbiological investigations is needed to determine the aetiology of childhood diarrhoea as there is a wide range of potential infective causes with different transmission routes which will require different public health interventions.

## Conclusions

Of the admissions due to diarrhoeal illness in children, 35% had dysentery and 14 patients had a positive stool culture with *S. flexneri* and one patient, *S. sonnei*. A clinical response was seen most often with gentamicin


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