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A STEEP DECLINE OF DEATH IN A SHIGELLOSIS EPIDEMIC IN BANGLADESH BY A COMMUNITY - PARTICIPATED INTERVENTION

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Abstract

The outcome of an intervention of a shigellosis epidemic during April - July 1985 at Dimla, northern Bangladesh is reported. People of the epidemic - affected community operated a makeshift hospital to provide early indoor treatment for 1,708 patients of blood dysentery, based on empirically selected antibiotic(s), oral rehydration of the patients and giving them high - protein diets. They raised funds and received technical and logistic assistance from the physicians and officials of the local government health centre and of the International Centre for Diarrhoeal Disease Research, Bangladesh. In comparison with the number of deaths recorded before intervention, there was a 187 - fold reduction of case - fatality ratio from 11.2 to 0.06% ($p < 0.0001$). Probable causes for this precipitious decline of mortality are discussed. It is concluded that such a community action in the intervention of a rural shigellosis epidemic in a developing country may avert death almost totally.

Key words: Dysentery, Bacillary; Disease outbreaks; Epidemiology; Mortality; Community participation; Interventions.

Introduction

Epidemics of shigellosis are reported from Bangladesh, West Bengal, and Burma since 1984 (1 - 3). A major problem in these epidemics is to select a correct treatment and to provide it timely to the patients in the field. The emergence of multiple drug - resistant *Shigella* has worsened the situation (3,4). We report here an intervention of a shigellosis epidemic in northern Bangladesh, in which blood - dysentery patients were treated in a makeshift hospital constructed and operated by the community. The people, of course, sought assistance from the local Health Administration and the physicians of the Epidemic Control Preparedness Programme (ECPP)*, International Centre

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*ECPP, a collaborative programme of the ICDDR,B, Government Health Services, and the Ford Foundation, aims at training government health personnel at the ICDDR,B and providing epidemic control activities in rural areas of Bangladesh.

for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

Materials and methods

The epidemic of shigellosis started in Dimla, a northern subdistrict of Bangladesh, on 2 March and ended on 14 July 1985. The period of intervention which started from 20 April was for the later 85 days of the epidemic.

People of the community, led by school teachers, village leaders, and local government doctors, formed a committee for the intervention. Funds were raised by donations from the community and some pecuniary allocation from the subdistrict administration. The makeshift hospital, which was opened in a primary school building, had a capacity to provide inpatient care to 40–50 patients at a time. Prompt treatment was delivered to the clinically diagnosed blood-dysentery patients mostly in the initial phase of illness. Treatment included rehydration, mainly by the oral route, antibiotics, and protein-rich meals three times daily. Patients and their attendants were given soap to wash hands before meals and after defaecation to avert nosocomial infection. Supplies and logistics were available from the district Civil Surgeon's office.

On a request of the National Health Services, a team of physicians from the Epidemic Control Preparedness Programme of the ICDDR,B provided technical and partial logistic support to the community-operated hospital between 24 April and 2 May 1985.

Criteria for admission were frequent mucoid or bloody-mucoid stool with acute onset. An absence of blood in the stool by naked eye examination and stool frequency of 3 times or less per day were set as the criteria to discharge a patient. A physician assessed each patient twice daily and recorded his findings on a treatment chart. Ampicillin by oral route (100 mg/kg/day) was the first drug of choice. Nalidixic acid (55mg/kg/day) was given to those patients who did not show clinical improvement within 48 hours' treatment with ampicillin. During high patient load, clinically improved patients were discharged with medicine and advice to complete the treatment at home. Discharged patients were visited daily by government health assistants to monitor drug compliance and clinical outcome.

Due to the epidemic situation, prospective planned sampling of either the patients or their materials could not be adopted. However, a group of 108 patients admitted between 24 April and 2 May 1985 were specially studied for clinical and some epidemiological characteristics. Rectal swabs were collected within 3 days from the onset of illness from 65 patients with bloody-mucoid stool, who had no history of prior drug treatment.

The swabs were transported in buffered glycerol saline to the Dhaka Laboratory of the ICDDR,B. They were cultured on Salmonella-Shigella agar (SS) and MacConkey's agar. The suspected isolates were identified by standard methods and tested for antimicrobial sensitivity by disc diffusion method.

The data on blood-dysentery patients and deaths occurring in the community before the intervention was obtained from the subdistrict diarrhoea surveillance records. Information of patients admitted in the makeshift hospital were taken from their treatment charts. The case-fatality ratios (CFR) for the pre-intervention and the intervention phases of the epidemic were calculated respectively from the surveillance and the makeshift hospital data. The effectiveness of the intervention was

Addendum

This figure should be read before Table 1 on page 217.

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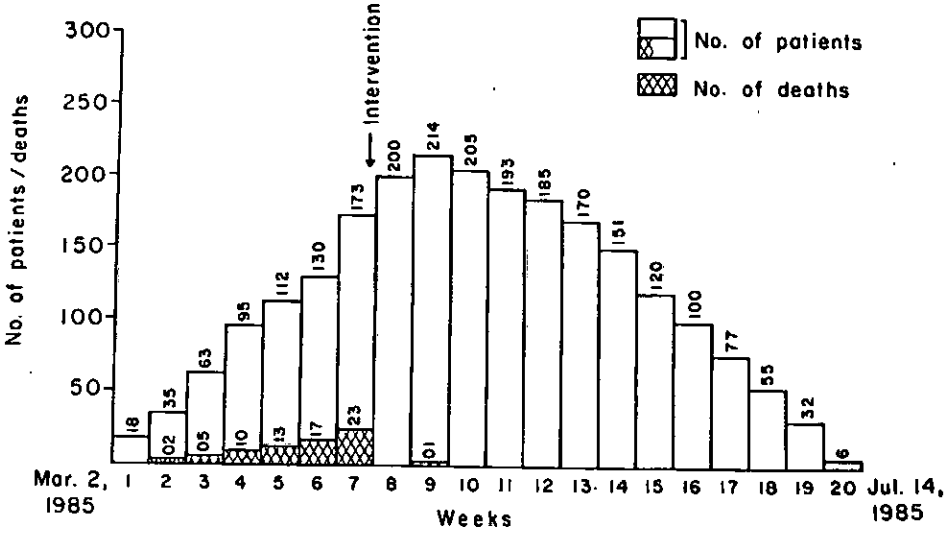
Figure

SHIGELLOSIS EPIDEMIC CURVE, DIMLA SUB-DISTRICT, NORTHERN BANGLADESH 1985



The deaths shown in each week do not necessarily belong to the patients identified in the some week.

assessed by comparing the CFRs using Chi-square statistics. The influence of distance on patients' attendance was determined by the linear regression method.

Results

The figure depicts the epidemic curve. Table I compares the CFR during the pre-intervention and the intervention phases, and shows a 187-fold reduction of the CFR by the intervention ($X^2 = 188.4$; $p < 0.0001$). Only a malnourished one-year old girl with a clinical picture of septicaemia, whose stool culture yielded *Shigella dysenteriae* type 1 died in the makeshift hospital. Since intervention, dysenteric death was reported neither from the community nor from the discharged patients.

Of the 108 patients specially studied, major symptoms and signs were acute onset (86%), fever (56%), frequent bloody-mucoid stools (81%), and abdominal cramps (70%). Dehydration was found, according to WHO classification (5), as severe (5.6%), moderate (14%) and mild to nil (80.4%). Patients came from a mean distance of 3.6 kilometers and attended the hospital on an average of 3.4 days after the onset of illness (76% of the patients attended within 5 days). Mean duration of admission was 3.2 days. The rate of attendance inversely correlated with distance from the hospital ($r = -0.89$, $A = 43.2$, $B = 7.2$).

Table II shows the age and sex distribution of the dysentery cases and dysentery deaths reported from the community and from the makeshift hospital. Analysis of surveillance data revealed that 80% of the deaths that occurred before the intervention died after 5 days of illness.

Of the 65 patients whose rectal swabs were examined, 14 (21.5%) yielded *Shigellae*. Thirteen isolates were *S. dysenteriae* type 1 and 1 was *S. flexneri*. *In vitro*, the isolates were resistant to co-trimoxazole, tetracycline, streptomycin, and chloramphe-

TABLE I - COMPARISON OF CASE-FATALITY RATIOS IN THE PRE-INTERVENTION AND INTERVENTION PHASES OF THE OUTBREAK OF BLOOD DYSENTERY AT DIMLA, NORTHERN BANGLADESH, 1985

Outcome	Pre-intervention (2 Mar-19 Apr 1985) (n=626)	Intervention (20 Apr-14 July 1985) (n=1708)	Total (n=2334)
Recovered	556	1707	2263
Died	70	01	71
CFR	11.2%	0.06%	

$X^2 = 188.4$, DF = 1 $p < .0001$

TABLE II – AGE AND SEX DISTRIBUTION OF BLOOD-DYSENTERY PATIENTS AND DEATHS IN THE COMMUNITY BEFORE THE INTERVENTION AND IN THE COMMUNITY-OPERATED HOSPITAL

Age group (Year)	Community (2 Mar–19 Apr 1985)		Community-operated hospital (24 Apr–2 May 1985)	
	Patients (n=626).	Deaths (n=70)	Patients (n=108)	Deaths (n=01)
0– 2	59(09.4)	22(31.4)	11(10.2)	01(100)
3– 4	120(19.2)	25(35.7)	18(16.7)	00(00)
5–14	273(43.6)	16(22.9)	32(29.6)	00(00)
15–39	137(21.9)	01(01.4)	36(33.3)	00(00)
39+	37(05.9)	01(01.4)	11(10.2)	00(00)
Unknown	–	05(07.2)	–	–

Figures in parentheses indicate percentage.

nicol, but sensitive (100%) to nalidixic acid. Twelve (86%) were resistant to ampicillin. Contrary to apprehensions based on the anti-biograms, 70% (76/108) of the patients clinically improved with ampicillin; only 30% required nalidixic acid.

Discussion

The clinical presentation of patients, the explosive nature of the outbreak, and the results of rectal swab culture suggest that the epidemic was of shigellosis. However, the rectal swabs were not examined for other causal agents of blood dysentery like *Campylobacter*, invasive *Escherichia coli*, and *Entamoeba histolytica*. Bennish *et al.* (3), in an outbreak of dysentery in the adjoining Rangpur district, reported isolation of *Shigellae* in 46.9% of the rectal swabs. Conversely, we could isolate *Shigellae* in 21.5% of the rectal swabs. The low rate of culture positivity (21.5%) of the rectal swabs in our study might be due to the delayed delivery of samples to the laboratory and the use of a transport medium, instead of direct plating in the field. In Bennish *et al.*'s (3) article, however, details of how the rectal swabs were transported from the distant field to the city laboratory are not given.

One important message of this study is that a prior knowledge of bacterial isolates and their antibiotic sensitivity pattern is not imperative for patients' care in a rural epidemic of shigellosis. In developing countries, specially in rural areas, physicians do not have the facilities to identify the bacterial agent of an infection before

treatment is initiated. In this study, an initial effort was made to modify the antibiotic therapy of a particular patient based on the laboratory reports; but the strategy failed due to the long distance (300 km) between the field and the city laboratory. Thus, the physicians had to empirically select ampicillin and nalidixic acid as the first and the second drug of choice, and this regimen indeed proved effective.

It is difficult to explain why the CFR declined so precipitously by the intervention. We think that the cause is multifactorial. The Government health centre, 10 km away from the epidemic area, had only an outdoor dispensary. In Bangladesh, a low use of these health centres, even during epidemics, is reported (6). Therefore, establishment of the makeshift hospital in the centre of the epidemic area, not only provided early inpatient treatment to a large number of patients, also helped in isolating shigellosis patients from the community. The latter event might have helped in the containment of the epidemic. O'connel reported that an early treatment of patients suffering from shigellosis would be more effective than a delayed therapy (7). Moreover, chances of complications, which are rarely amenable to treatment, also increase with the delay in or no treatment (8).

Mathan reported from India (9) that treatment of rehydration proved to be effective in an epidemic caused by *S. dysentariae* type 1. Provision of protein-rich diets also plays an important role in the reparative process of the damaged intestinal mucosa due to ulceration, and to replenish the loss characterised by protein-losing enteropathy (10).

Because of the possibility of fatal complications, such as septicaemia, haemolytic-uraemic syndrome, leukamoid reaction, and necrotizing enterocolitis, especially in malnourished children, the role of antibiotics in shigellosis cannot be overemphasised (11). But it is difficult to pinpoint the reason as to why 70% of the patients clinically responded with ampicillin in the face of *in vitro* resistance of 86% of the isolates to the drug. The Kirby-Bauer disc diffusion technique "provides only qualitative or semi-quantitative information on the susceptibility of a given micro-organism to a given antibiotic" (12). The standard for its sensitivity is based on the concentration of drug that can safely be achieved in plasma (12). On the other hand, "the success of an antibiotic therapy depends on achieving a level of antibacterial activity at the site of infection sufficient to inhibit the bacteria in a manner that tips the balance in favour of the host" (12). "When defenses are maximally effective, the anti-bacterial effect required may be minimal" (12).

Last but not the least, the key social event, namely a massive participation of the people of the affected community, was responsible to add up all the above-mentioned factors and concurrently propelled them to a positive beneficial direction. It may be extrapolated that another 191 (1708 x 11.2%) patients would have died in the absence of the service rendered by the community-operated hospital, and that an installation of the hospital from the beginning of the epidemic could have averted almost all the reported deaths.

We conclude that a community-operated makeshift hospital, providing treatment based on an empirically selected antibiotic(s), rehydration of patients mainly by the oral route and giving them protein-rich diets, may avert deaths almost totally in rural epidemics of shigellosis.

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