AN INVESTGATION OF DIARRHOEAL DISEASE OUTBREAK AT DILATE MILITARY TRAINING CENTRE

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ABSTRACT: This study was conducted to investigate a reported diarrhoeal diseaseboutbreak among higher education students recruits in Bilate Military Training Centre, Sidamo Administrative Region, Out of the total patients of 5,248 who visited at the out-patient department 1,616 (30.1%) were patients with diarrhoea. There were 99 patients admitted to the hospital out of which 27 (27.2 %) were diarrhoeal patients. There ere no deaths reported. A total of 965 (75.6%) were treated with antimicrobial, mainly Tetracyclines, Chloramphenicol, Metronidazole and Chloroquine. Only 114 (8.9%) were treated with Oral Rehydration Salts (ORS) while 86 (7.11 %) with Anti-diarrhoeal (Charcoal) and ORS. There was no proper excreta disposal and the water source was found to be bacteriologically non-potable. Among the 34 stool specimens collected for culture and sensitivity tests, the genus Shigella was isolated in 6 patients; where 4 were higellaflexneri (Group B) and 2 were Shigella dysenteriae (Group A) one type 1 (Shiga's Bacillus) and the other type 2 (Schmittz's Bacillus). Shigella dysenteriae serogroups 1 and 2 showed resistance to eight and seven drugs including Trimethoprim Sulpha-Methoxazole (TSM) respectively. This study highlights the importance of safe water and improvement of general hygiene and environmental sanitation for prevention and control of epidemics and indicates the importance of continuous surveillance of drug resistant Shigella for the control of outbreaks of Shigellosis.

INTRODUCTION

Diarrhoea is a major cause of morbidity and mortality in all age groups in developing countries. Vibrio cholerae, genus Shigella and other entero-pathogens are endemic in tropical and sub-tropical regions. Shigella is capable to cause widespread epidemics distinguished by high case fatality and extreme debility in survivors (1,2). The 1968 Shigella epidemic in Central America affected half a million people and killed
20,000. In India (West Bengal) caused morbidity and mortality in 350,000 and 3,800 people, respectively (1,3,4,5). In Maldives and Burundi it took the lives of 2,000 people in 1981 and 1982 (1,2). Shigella still causes endless human suffering and catastrophes in Bangladesh and other Asian, Latin America and African countries (1,2,6).

Ethiopia, as a tropical and developing country, is frequently subjected to outbreaks of Shigellosis. Hararge in 1978, Omo Region in 1979, Gondar in 1980, Illubabor in 1981 (7,8). Keffa, Wellega, Bale and Sidamo are other regions with high prevalence (7,8,9). The problem of Shigellosis is specially acute where general hygiene and environmental sanitation are poor and where there is inadequate supply of safe water (10, II). High virulence, low infective dose (10-100 bacteria), large load of excreted organisms (106-108/gram of stool) and rapid development of resistance to many antimicrobial are the agent factors that contribute to the widespread of the outbreak and put heavy tasks on the control of Shigellosis (12-15). Lack of laboratory facilities in many health units, wrong diagnosis of bacillary dysentery as amoebiasis, failures in early case detection and incorrect use of antibiotics, not only pose a problem in control activities but also make treatment ineffective (1,2,15).

The aim of this paper is to disclose the reported diarrhoeal disease outbreak which occurred in Bilate Military Training Centre and discuss the control measures which need to be undertaken in order to prevent further epidemics.

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BACKGROUND

Bilate Military Training Centre (BMTC) is located in Sidamo Administrative Region, 90km away from A was sa and 395 km south of Addis Ababa. Previously it was a state farm. It is a low land area found in the great rift valley 1000- 1400 meters above sea level with two distinct seasons: hot and dry in summer, rainy and humid in winter. It is endemic for malaria. Various unpublished data from RHDs suggest that outbreaks of Typhoid fever associated with Shigellosis also occur frequently. The recruits were students of higher education from allover the country. There were about 10,000 trainees in the centre out of whom 1,000 were females. Their age distribution ranged between 18-22 years. They were divided into 6 brigades, and females were in the 3rd brigade. At the time of this study, there was one hospital and six brigade clinics. There were five physicians, six nurses, 47 health assistance and one laboratory technician.

PATIENTS AND METHODS

The diarrhoea outbreak started on 5th of March, 1991 and reported to the CDD-MOH office on the 18th of March. Most patients presented with complaints of loss of appetite, weakness, fever, cramp abdominal pain and diarrhoea with blood and mucus. Acutely sick looking appearance with some signs of dehydration were the most frequent findings in the majority of patients. Few had high temperature (up to 4OOC) and very low blood pressure.

Review of the clinical records of patients in each brigade clinics and in the hospital was done. Personal communications with the physicians, and hospital administration staff as well as with those in Sidamo Regional Health Department was performed.

Living quarters, dining halls, recreational places, kitchens, bakery, showering places and latrines were all inspected. Water sources, deep wells, reservoirs and daily use tankers were checked for damage and the pipe lines were inspected for leakage.

Water samples were collected from the main reservoirs and daily use tankers: within the tankers, inlet pipes leading to the tankers, outlet pipes and faucets. Sterile containers in cold ice-box were used to transport the water samples to the National Research Institute of Health (NRIH) for examination.

In the laboratory, each water sample was immediately prepared and incubated at 37°C for 24 to 48 hours and examined for the presumptive coliform counts, by the multiple tube fermentation method using Mackonkey broth tube (16). A Iml amount undiluted and a I: 10 saline diluted portion of each water sample was also pour-plated with molten normal agar for total plate counts.

From a positive Mackonkey broth tube further subculture and identification method was performed to examine the presence of Escherichia Coli type I by incubating it at 44°C for 24 hours. The E. Coli is present and/or presumptive coliform counts is higher than 10 organisms/lOOml of water for unchlorinated piped water or 50 organisms/ 100ml of water for unchlorinated spring water, river or water from deep wells and/or the total plate count is over 106 CFU (colony formation unit) per l00ml of water (16).

Thirty four stool samples were collected from patients and healthy food handlers in small sterile plastic vials. Patients were selected among those with diarrhoea and no antibiotics treatment during the last 14 days prior to collection. Cary- Blair transport media was Used to transport faecal specimen to NRIH. In the laboratory,
swabs were immediately inoculated on Mackonkey agar and Salmonella-Shigella agar and Thiosulfate citrate bile sucrose agar media, as well in to enrichment broth media like Kauffmann and alkaline peptone water. All the plates and broth tubes were incubated at 37°C aerobically for 24 to 48 hours and examined for enteric pathogens like Shigella, Salmonella, EPEC and V. Cholerae.

Biochemical and serological identifications were done according to the standard methods Edwards and Ewing (17). Drug susceptibility test for each Shigella isolated were done according to the standards agar-disk diffusion method (18). Sensitivity disks used included the following drugs: Cephalothin (Ct), Polymixin (Pb),
Tetracyclines (f), Streptomycin (S), Ampicillin (A), Chloramphenicol (C), Carbenicillin (Cb), Kanamycin (K), Gentamicin (Gm), Trimethoprim-sulfamethoxazol (TSM or Sxt), Nalidixic acid (Na), Sulfadiazine (Su).

RESULTS

As Table 1 shows, 5,248 patients visited the six brigade clinics during the outbreak, from March 5th to 22nd 1991, 1,616 (13.8%) were patients with diarrhoea.

Table 1. Total nulber (X) of patients with diar-
rhoea seen at the different brigade clinics fr001
March 5 to 22, 1991 in Bilate Military Training
Centre

Clinics	Total Patients	With diarrhoea No. (X)
Brigade 1	524	72 (13.7)
Brigade2	347	74 (21.3)
Brigade 3	911	117 (12.8)
Brigade 4	1,345	845 (62.8)
Brigade5	1,060	176 (16.6)
Brigade6	1,011	332 (32.8)
Total	248	1,616 (30.8)

Table 2 shows the type of treatment given in the brigade clinics. Among 1,616 patients, 148 (11.6%) were treated with Chloramphenicol and 185 (14.5%) with Chloramphenicol and ORS.

Tetracyclines was given for 198 (15.5%) and 103 (8.1%) were treated with Tetracyclines and ORS. Metronidazole alone was given for 122 (9.7%) and for 107 (8.4%) in combination with ORS. Only 114 (8.9%) were treated with ORS alone. Anti-diarrhoeal drugs particularly charcoal were being used to treat 86 (6.8%) patients while 43 (3.4%) were referred to hospitals for further medical care.

In the hospital medical OPD, among the 817 patients seen during the 17-days outbreak, 113 (13.8%) came with diarrhoeal illness. Laboratory investigations were done for few

Table 2. Type of treatlfent given at Brigade clinics. 1991

Type of treatment	Number (%)
Chloramphenicol	148 (11.6)
Tetracyclines	198 (15.5)
Chloroquine	81 (6.4)
Ampicillin	11 (0.9)
Metronidazole	122 (9.7)
P. Penicillin	10 (0.8)
Chlora~enicol & ORS	185 (14.5)
Tetracyclines & ORS	103 (8.1)
Metronidazole & ORS	107 (8.4)
ORS	114 (8.9)
Charcoal	23 (1.8)
Charcoal & ORS	63 (5.0)
Others	68 (5.3)
Referred to hospital	43 (3.4)
Total	1,276*(100)

*Clinical records of 340 patients were not available

patients. The treatment given was similar to the one in the brigade clinic.

There were 99 patients admitted to the medical ward out of which 27 (27.2%) were diarrhoeal patients with moderate to severe degree of dehydration. They were rehydrated intravenously and one or two types of antibiotics were given. There was no death and the average hospital stay was 3 days. Table 3 shows the results of the laboratory investigations done in the hospital. Direct microscopy was the only laboratory investigation performed. Among the 186 stool specimen examined, Trophozoite of amoeba and giardia were found in 50 (26.9%), many pus cells and RBC were seen in 19 (9.7%) and 76 (40.9%) were negative for ova or parasite.

Bacteriological analysis of the 10 water samples, 3 from reservoirs and 7 from the daily use tankers, showed that all but one sample were bacteriologically non-potable. Out of the thirty four stool specimens, 7 from

Table 3. Laboratory result of faecal specimens at BMTC 1991

Findings	Number(%)
Giardia L. Trophoz.	32 (17.2)
E. Hystolytica Troph.	18 (9.9)
Many pus & RBC cells	19 (9.7)
Others	41 (22.3)
No ova or parasites	76 (40.9)
Total	186 (100)

patients and 2 from kitchen workers, total 9 showed bacterial growth. The genus Shigella was isolated in 6 patients, and Salmonella Para B strains were identified, one from a patient and two from healthy kitchen workers. Further serogrouping and serotyping for species differentiation, identified 2 Shigella dysenteriae (Group A), one type 1 strain and the other type 2 strains and 4 Shigellaflexneri (Group B).

The anti-biogram results indicate that S. dysenteriae type 1 strain was resistant to 8 drugs (TCACbKSSxtSu), and susceptible to Cf, Gm, Na, Pb. S. dysenteriae type 2 strain was resistant to 7 drugs (TCACbSPbSxt) and sensitive to Cf, K, Gm, Na and Su. S. flexneri species showed 3 types of resistance pattern, TCASSu, TCAS, and TCACbS but were all sensitive to Sxt, Cf, K, G. One strain was sensitive to all antibiotics and 3 strains were sensitive to Su.

DISCUSSION

Out of 160 countries worldwide and 58 Afri can countries, 150 & 56 countries, respectively, listed shigellosis as one of the primary causes for morbidity and mortality (19). As many as 25% of all diarrhoeal related deaths can be associated with Shigella (2). Anecdotal evidence showed that shigellosis is a major health problem in Ethiopia. The commonest way of transmission of shigellosis is person to person contact through
contaminated food items, utensils, etc. particularly in over crowded populations with little or no sanitary facilities. In our study, though, contaminated water sources, as possible cause of the outbreak cannot be ruled out. This type of transmission was also found in other studies (10,11).

Since antimicrobial treatment were given prior to laboratory investigations, sufficient numbers of stool specimens could not be collected. This problem was observed in most studies conducted in various developing countries. In Bangladesh during 1979 and 1988, and in Thailand during 1986 and 1991 (2).

The genus Shigella is the most probable cause for the outbreak. Shigella group A and B were the only serogroups isolated in this study. Predominance of these species were observed in two studies done previously on the prevalence of shigellosis in Ethiopia (7,8,20).
Out of the 4 Shigellajlexneri isolated only one was found to be sensitive to the commonly used antibiotics: Tetracyclines, Chloramphenicol and Ampicillin. The others showed 3 types of resistance patterns (TCACbS), (TCAS), (TCACbSSu). Multiple drug resistance to as many as 6 drugs (TCACbSSu) was reported in Ethiopia (20,21) and in other countries (22,23). Few TSM resistant Shigella jlexneri strains were isolated in Ethiopia (21,24) but, in this study, these species were uniformly sensitive to TSM.

Shigella dysenteriae type 1 (Shiga bacillus) showed resistance to 8 drugs (TCACbKSSxtSu) in this study. Similarly resistance to 6 (TCACbSSu) and, one strain, to 7 (TCACbKSSu) drugs was observed in Ethiopia (20,25,26). One TSM resistant strain (Gimira strain) was recovered in Gimira Awraja, Keffa Administrative region in the 1984 outbreak of Shigellosis (9,27). In other countries like Bangladesh, TSM resistant type 1 exceeds 25% (2). In Thailand 42-43.8% and in the USA 7% TSM resistant Shigella dysenteriae type 1 were recovered (28-31).

It was reported previously that Shigella dysenteriae type 2 was sensitive to the commonly used antibiotics (20,26). But, unlike the previous reports, the strain isolated in this outbreak showed resistance to 7 drugs (TCACbSPbSxt) including TSM. Perhaps this is an unusual finding in this study. Nevertheless, it should be
supported by subsequent studies in the future.

The appearance of multiple drug resistant Shigella dysenteriae in the outbreak of Shigellosis will be an immense health hazard in Ethiopia.

Regarding the treatment given to these patients, 3 problems were observed.
a) Anti-diarrhoeal drugs were used: 83 (6.7%) patients were treated with charcoal.
b) Bacillary dysentery was wrongly diagnosed as amoebic dysentery and 229 (18.0%) patients were given Metronidazole.
c) 840 (65.8%) patients were treated with Tetracyclines, Chloramphenicol and Ampicillin. The antibiotics used are not recommended for the treatment of Shigellosis, in fact, all isolated Shigella species were found to be resistant to all of them.

Although antibiotic treatment can be initiated solely on clinical grounds, it is recommended to collect 5-10 stool specimens to be sent to the laboratory for sensitivity tests (I). Enactment of essential drug policies might curb the indiscriminate use of antibiotics and anti-diarrhoeal.

1) Anti-diarrhoeal drugs: Hydroxy diphenoxylate Atropine Sulphate, Loperamide and'activated charcoal should be omitted from the national drug list (32).
2) Shigellosis outbreaks usually occur in rural areas (7,8). Health centres and health stations are the main health units found in the rural part of Ethiopia (33). Since TSM is the only common antibiotic effective against Shigella it should be available at least in health centres and should be strictly used either for proved cases or for severe cases of bacillary dysentery .
3) Drugs sale policy should be defined. TSM should be handled by pharmacists in pharmacies only (not in drug shops or vendors) and must be sold on prescription only.

Early case detection in the control of Shigellosis is crucial. Proper case registration and efficient reporting system is mandatory. It calls for immediate interventions, arrangements for stool examinations and other appropriate control measures can be taken at the right time. Early case detection in outbreaks highly minimizes the bias of treatment given based on clinical grounds only.

Continuous surveillance of drug resistance of Shigella dysenteriae is recommended. If labora.tory support is not readily available, cases can be managed on the basis of the sensitivity results of recently isolated organisms in the country or of organisms isolated in nearby regions (2).

Finally, antibiotic treatment per se is not a solution in the control of Shigellosis. Public Health measures, such as improved personal and domestic hygiene (hand washing and avoiding house flies), availability of proper sewage and excretal disposal, provision of clean and safe water should be implemented.

On national level, the Diarrhoeal Diseases Control Programme needs to study pattern of antibiotic use, investigate resistance of Shigella strains to drugs in different regions, develop treatment schemes appropriate to local conditions and train health workers in correct case management of dysentery.

Usually, reports concerning investigation of outbreaks do not appear in journals or any medical publication and remain in the files of Departments archives. Instead, they should be published to improve control activities and contribute baseline data for epidemiological research purposes.

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